



AGENDA

N.C. WILDLIFE RESOURCES COMMISSION WEBINAR MEETING December 10, 2020 9:00 am

CALL TO ORDER - *Chairman David Hoyle, Jr.*

This electronic meeting is being streamed live and recorded as a public record. The recording of the meeting will be available at www.newwildlife.org.

ROLL CALL OF COMMISSIONERS PRESENT – *Betsy Haywood, Commission Liaison*

INVOCATION – *Commissioner John Coley*

MANDATORY ETHICS INQUIRY – North Carolina General Statute §138A-15 mandates that the Commission Chair shall remind all Commissioners of their duty to avoid conflicts of interest and appearances of conflict under this Chapter, and that the chair also inquires as to whether there is any known conflict of interest or appearance of conflict with respect to any matters coming before the Commission at this time. It is the duty of each Commissioner who is aware of such personal conflict of interest or of an appearance of a conflict to notify the Chair of the same. *Chairman David Hoyle*

APPROVAL OF OCTOBER 22, 2020 MEETING MINUTES – Take action on the October 22, 2020 Wildlife Resources Commission meeting minutes as written in the exhibit **(EXHIBIT A)**

FINANCIAL STATUS REPORT – Receive a financial status report on the Wildlife Operating Fund and Wildlife Endowment Fund – *Dr. DP Singla, Chief Financial Officer (EXHIBIT B)*

COMMITTEE MEETING REPORTS

Ad Hoc Education Centers Committee Report – November 16, 2020 – Kelly Davis, Chair

Finance Committee Report – December 9, 2020 – Landon Zimmer, Chair

Land Acquisitions and Property Committee Report, 2020 – Tom Berry, Chair

Boating Safety Committee Report – December 9, 2020 – Mark Craig

Habitat, Nongame, and Endangered Species Report – December 9, 2020 - Mark Craig, Chair

Committee of the Whole Report – December 9, 2020 – David Hoyle, Jr., Chair

AWARD RECOGNITIONS – Cameron Ingram, Executive Director

Master Officer Darby Enoch, District 6 -Shikar-Safari Club International Officer of the Year for NC

Captain Steve Bullins, District 7 Captain - NC Governor’s Award for Safety and Heroism

Jeff Evans, Superintendent Watha State Fish Hatchery - Southeastern Association of Fish and Wildlife Agencies’ Fisheries Biologist of the Year

Gordon Myers, former Executive Director - Association of Fish and Wildlife Agencies’ Seth Gordon Award

AGENCY SPOTLIGHT – **Pollinator Initiatives and Partnerships** – Cindy Simpson, *Wildlife Action Plan Coordinator*, and Gabriela Garrison, *Eastern Piedmont Habitat Conservation Coordinator*

CONSERVATION PLANS - Consider staff recommendations for final adoption of four Species Conservation Plans – Todd Ewing, *Aquatic Wildlife Diversity Program Manager*, and Dr. Sara Schweitzer, *Wildlife Diversity Program Coordinator*

- Brook Floater (**EXHIBIT C-1**)
- Five Rare Aquatic Species Restricted to Neuse and Tar - Pamlico River Basins (**EXHIBIT C-2**)
- Gopher Frog (**EXHIBIT C-3**)
- Robust Redhorse (**EXHIBIT C-4**)

LAND AND WATER ACCESS DIVISION

Land Acquisitions and Property Matters

Phase II Land Acquisitions

Consider final approval to proceed with acquisition of the following property – Jessie Birckhead, *Land Acquisition and Grants Manager* (**EXHIBITS D-1, D-2**)

- King’s Bridge Tract – Henderson County (D-1)
- Hall Tract – Bladen County (D-2)

Other Property Matter

Consider a naming request from the Three Rivers Land Trust for the Hannah’s Ferry/Pump Station Boating Access Area in Rowan County – Jessie Birckhead (**EXHIBIT E**)

WATER SAFETY RULEMAKING

Final Adoptions

Clay County, Lake Chatuge – Gibson Cove - Consider Public Comments and final adoption of an amendment to 15A NCAC 10F .0308 for a no-wake zone in Gibson Cove on Lake Chatuge – Betsy Haywood, *No-Wake Zone Coordinator* (**EXHIBITS F-1, F-2**)

Clay County, Lake Chatuge – Clay County Recreational Park – Consider public comments and final adoption of an amendment to 15A NCAC 10F .0308 for a no-wake zone at the peninsula around Clay County Recreational Park – Betsy Haywood (**EXHIBITS G-1, G-2**)

Clay County, Lake Chatuge – Dayton Cove – Consider public comments and final adoption of an amendment to 15A NCAC 10F .0308 for a no-wake zone in Dayton Cove – Betsy Haywood (**EXHIBITS H-1, H-2**)

Stanly County, Lake Tillery – Consider public comments and final adoption of an amendment to 15A NCAC 10F .0317, for no-wake zone at the Boathouse and Marina in Norwood – Betsy Haywood (**EXHIBITS I-1, I-2**)

Burke County, Lake James – Consider public comments and final adoption of an amendment to 15A NCAC 10F .0323 to extend the no-wake zone from northeast of the Highway 126 Bridge shore to shore, southward shore to shore to 50 yards south of the Canal Bridge Boating Access Area – Betsy Haywood (**EXHIBITS J-1, J-2**)

Temporary Rulemaking Final Adoption

Burke County, Lake James – Consider public comments and final adoption of an amendment to 15A NCAC 10F .0323 for a temporary no-wake zone and safety zone where vessel entry not authorized by the WRC is prohibited, in Mill Creek on Lake James during construction of a pedestrian bridge at Lake James State Park – Betsy Haywood (**EXHIBITS K-1, K-2**)

PERMANENT RULEMAKING

Controlled Fox Hunting Preserves – 15A NCAC 10H .1200 – Review public comments and consider adoption of proposed amendments to rules for licensing and regulation of controlled fox hunting preserves – Carrie Ruhlman, *Rulemaking Coordinator* (**EXHIBITS L-1, L-2**)

Sale of Live Foxes and Coyotes to Controlled Fox Hunting Preserves – 15A NCAC 10B .0409 – Review public comments and consider adoption of proposed amendments to the rule for trapping and live sale of foxes and coyotes to controlled fox hunting preserves – Carrie Ruhlman (**EXHIBITS M-1, M-2**)

PETITION FOR RULEMAKING

Consider a public request for rulemaking to amend rules 15A NCAC 10H .1201, .1202, .1203 and .1204 regulating controlled fox hunting preserves – Carrie Ruhlman (**EXHIBIT N**)

2021 PUBLIC HEARING SCHEDULE – Consider modification of the 2021 Public Hearing schedule to remove the in-person public hearings due to the ongoing pandemic – Cameron Ingram, *Executive Director* (**EXHIBIT O**)

COMMENTS BY THE CHAIRMAN – *Chairman Hoyle*

COMMENTS BY THE EXECUTIVE DIRECTOR – *Executive Director Ingram*

ADJOURN

EXHIBIT A
December 10, 2020



MINUTES
October 22, 2020
N.C. Wildlife Resources Commission Webinar Meeting
Raleigh, North Carolina

Pursuant to North Carolina General Statute (NCGS) §166A-19.20 (Public Bodies/Remote Meetings During Declared Emergencies) the October 22, 2020 N.C. Wildlife Resources Commission (NCWRC) webinar meeting was called to order by Commission Chairman David Hoyle, Jr. at 9:00 a.m.

Chairman Hoyle announced that the webinar meeting audio is being streamed live and will be available on the NCWRC's website. He reminded Commissioners to speak their names before making motions or comments and to mute their devices when not speaking. Hoyle announced that by the statutory requirement, the roll will be called for attendance and for each vote.

MANDATORY ETHICS INQUIRY

Chairman Hoyle advised the Commission of the mandatory ethics inquiry as mandated in NCGS §138A-15.

ROLL CALL

Betsy Haywood, *Commission Liaison*, called the roll. Nat Harris, Mike Johnson, Richard Edwards, and Jim Cogdell were absent.

COMMISSIONER ATTENDANCE

David Hoyle, Jr.
John Stone
Monty Crump
Brad Stanback
Tom Berry
Landon Zimmer
Hayden Rogers
Wes Seegars

Kelly Davis
John Coley
Steve Windham
Ray Clifton
Tommy Fonville
Jim Ruffin
Mark Craig

MINUTES OF AUGUST 27, 2020 MEETING AND SEPTEMBER 10, 2020 MEEING

On a motion by Monty Crump and second by Steve Windham, the Commission approved the August 27, 2020 NCWRC minutes as presented in **Exhibit A**, and the September 10, 2020 NCWRC minutes as presented in **Exhibit B**. **Exhibits A and B** are incorporated into the official record of this meeting.

ADMINISTRATION

Dr. DP Singla, *Chief Financial Officer*, presented a status report in **Exhibit C** on the Wildlife Operating Fund, Capital Improvement Funds, and the Wildlife Endowment Fund.

Wildlife Operating Fund - As of August 31, 2020, the revenues were \$27,127,292.15, and the expenditures were \$24,410,487.81. The excess of revenues and other sources over expenditures and other uses was \$2,716,804.34. The Fund Balance as of August 31, 2020 was \$19,253,441.57.

Wildlife Capital Improvement Fund - As of August 31, 2020, the revenues were \$1,573,286.95, and the expenditures were \$1,564,303.51. The excess of revenues and other sources over expenditures and other uses was \$8,983.44 The Fund Balance as of August 31, 2020 was \$3,324,153.86.

Wildlife Endowment Fund - Balances in the Endowment Fund as of August 31, 2020 were: \$91,505,226.30 in the Bond Index Fund, \$57,069,996.61 in the Equity Index Fund, and \$4,107,546.90 in the Short-Term Index Fund, for a total of \$152,682,769.81. Expendable interest is \$31,447,974.39. Non-expendable interest is \$13,979,827.77 and expendable interest transferred to operations fiscal year to date is \$270,000.00.

Exhibit C is incorporated into the official record of this meeting.

COMMITTEE MEETING REPORTS

Small Game and Wild Turkey Committee Report – September 29, 2020 – John Stone, *Chair*, reported that the Small Game and Wild Turkey Committee met on September 29, 2020. Chris Kreh gave updates on grouse issues and management and on turkey research. Brian McRae gave an update on possibilities for quail management areas on public lands. Brad Howard gave an update about wild quail management area rules.

Fisheries Committee Report – October 12, 2020 – Tommy Fonville, *Chair*, reported that the Fisheries Committee met on October 12, 2020. Jeremy McCargo gave a report on Albemarle Sound/Roanoke River striped bass management. The striped bass stock is overfished. As a result, for the Roanoke in 2021-2022 there will be reduced season of two weeks, with no change in size or creel limits. Doug Besler discussed a potential statutory change where veterans could fish without a license required in Mountain Heritage Trout Waters. Mark Fowlkes reviewed an initiative for reservoir habitat enhancement using artificial structures and native vegetation. Amanda Bushon gave an overview of habitat work conducted on the French Broad River to benefit Muskellunge. Finally, Lawrence Dorsey presented on staff's research on hybrid Northern and Florida largemouth bass, potential management implications, and a pilot project on Lake Norman.

Habitat, Nongame and Endangered Species (HNGES) Committee Report – October 12, 2020 – Mark Craig, *Chair*, reported that the HNGES Committee met on October 12, 2020. Sara Schweitzer reviewed eleven nominations for members of the Nongame Wildlife Advisory Committee (NWAC). Later in this meeting the WRC will vote on five members from the slate of nominations. Todd Ewing gave a presentation about the State Listing Process for endangered, threatened, and species of special concern for conservation and the purpose of the State Listing Process. John Carpenter and Scott Anderson gave a presentation about a proposed North Carolina Bird Atlas project.

Motion from HNGES Committee – on a motion by Mark Craig and second by Landon Zimmer the Commission approved a motion from the HNGES Committee for Allen Boynton to receive the 2020 Thomas L. Quay Award.

Elk and Alligator Committee Report – October 13, 2020 – Steve Windham, *Chair*, reported that the Elk and Alligator Committee met on October 13, 2020. Alicia Davis reported about alligator fieldwork, which has been hampered by the restrictions associated with the Covid-19 pandemic, including alligator spotlight surveys that could not be accomplished. The Committee will continue to explore funding for the study of alligators. Brad Howard reviewed the concept of private lands management of alligators. The Committee unanimously supports proceeding with caution and according to science to protect the species. Chairman Windham tasked staff with creating an outline and timetable for management options and reporting back to the WRC at the next Committee meeting.

Finance Committee Report – October 13, 2020 – Landon Zimmer, *Chair*, reported that the Finance Committee met on October 13, 2020. D.P. Singla reviewed revenues and expenditures in the operating funds for presentation at the meeting today. He stated that revenues from vessel registrations and license sales are up. Dr. Singla reviewed the lifetime license pricing analysis from the Southwick Associates study. Chairman Zimmer requested a cost comparison between Southwick Associates and other companies for the remainder of the pricing analysis. The Committee discussed the Endowment portfolio.

Motion from Finance Committee – on a motion by Tommy Fonville and second by Brad Stanback, the Commission approved a motion from the Finance Committee to approve the transfer from the Bond Index Fund to the Equity Index Fund in the amount of three million dollars, that was processed in July and August of 2020, and approved fund transfers from the Bond Index Fund to Equity Index Fund of \$1.5 million each month for twelve months, beginning in November 2020 and ending in October 2021.

Lands Acquisition and Property (LAP) Committee Meeting Report – October 19, 2020 - Tom Berry, *Chair*, reported that the LAP Committee met on October 19, 2020. Jessie Birkhead provided an update on land acquisition projects and the Alcoa-Tuckertown Acquisition Project status. The Committee gave approval for staff to develop acquisition plans for two properties and endorsed three Phase II projects for approval at the meeting today. The Committee reviewed an endorsed approval to demolish a damaged pole shed at the Elizabethtown Depot. The Committee expressed interest in the formation of an *ad hoc* committee to develop statewide land acquisitions. Jessie Birkhead will report back to the Committee about interest from Commissioners.

Boating Safety Committee Report – October 19, 2020 – *Commissioner* Mark Craig reported that the Boating Safety Committee met on October 19, 2020. Betsy Haywood reviewed proposed emergency rulemaking and temporary rulemaking for a no-wake zone and safety zone, where unauthorized vessel entry is prohibited, on Lake James in Burke County during a bridge construction project. She reviewed a Fiscal Note and application for rulemaking from the Town of Ocean Isle Beach for a no-wake zone in the ICW at the Highway 904 bridge. Major Ben Meyer gave an update of assessment criteria that the Enforcement Division uses in assessing statutory safety hazards that may be mitigated by placement of no-wake zones in the waters of the State. He reviewed a manual that he has prepared to provide the District Enforcement officers across the state with uniform policies and procedures as they evaluate safety concerns. Major Meyer presented a revised assessment matrix that will provide consistent assessments of allowable criteria for establishing no-wake zones, and a revised D-1 application form for submission from the counties or municipalities, that provides more complete information for the Commission to use. Meyer briefly touched on the Abandoned and Derelict Vessel program, and staff is working on a MOA with the Department of Environmental Quality. The WRC is in a 30-day window to begin removing derelict boats. He estimated there are approximately 150 vessels to remove.

Education, Shooting, and Archery Committee Report – October 20, 2020 – Kelly Davis, *Chair*, reported that the Education, Shooting, and Archery Committee met on October 20, 2020. Gary Gardner provided updates on the John Lentz Hunter Education Shooting Complex, McDowell Shooting Range, and Wake County Firearm Education and Training Center. Kris Smith provided an update about the Hunter Education Program. Staff was asked to provide feedback on what other states do online with Hunter Education programs. Smith provided a review of operations and challenges at the Outer Banks Center for Wildlife Education, John E. Pechmann Fishing Education Center, and Pisgah Center for Wildlife Education. He then reviewed business planning for the *Wildlife in North Carolina* Magazine and how to increase revenues.

Big Game Committee Report – October 21, 2020 – John Coley, *Chair*, reported that the Big Game Committee met on October 21, 2020. The Committee received presentations from Colleen Olfenbuttel, Black Bear/Furbearer Biologist and Dr. Jon Shaw, Deer Biologist. Olfenbuttel updated the Committee on the results of the Western North Carolina bear population estimation work using genetic mark-recapture and outlined future opportunities to expand this technique to the Coastal Bear Management Unit. She explained how that work would assist ongoing efforts to monitor our bear population, including the use of the Bear Cooperator Program and population reconstruction modeling. Dr. Shaw presented a white-tailed deer research idea that would examine North Carolina's multiple aspects of deer ecology and management along the urban/suburban interface. Results of the study's findings would guide deer management and the agency technical guidance provided on deer management well into the future. The project would involve GPS collaring of adult deer and would track their movements, home range and susceptibility of harvest as well as other mortality types. Staff will continue to update the Commission as plans for the project develop including ideas for study areas and an estimated budget. The Committee discussed a variety of Big Game related topics and received an update on deer and bear harvest trends thus far in the 2020 seasons. Harvest of bears was 503 in the mountain bear unit and is consistent with the three-year average. Deer harvest remains steady thus far across all hunting zones.

Planned Giving Committee Report – October 21, 2020 – Wes Seegars, *Chair*, reported that the Planned Giving Committee had its inaugural meeting on October 21, 2020. Seegars discussed a planned giving concept that will expand the Commission’s ability to offer constituents additional opportunities to use Wildlife lands for non-traditional uses. The Committee will assess challenges and solutions for the planned giving program and report back to the Commission.

Committee of the Whole Report – October 21, 2020 – David Hoyle, Jr., *Chair*, reported that the Committee of the Whole met on October 21, 2020. Christian Waters, Brad Howard, and Brian McRae reviewed fiscal notes and proposed rules for fisheries, wildlife management, and lands management to present at public hearings in January 2021. Daron Barnes reviewed proposals to begin rulemaking for adoption of rules licensing and regulating wildlife and alligator control agents, and amendments to the rule for wildlife taken for depredations. Executive Director Cam Ingram presented a draft schedule of 2021 statewide public hearings for proposed rules. Ingram also reviewed a proposed schedule of WRC meetings in 2021. Chairman Hoyle briefed the Committee on the NC Wildlife Federation’s One Mission, One Commission Initiative.

AGENCY SPOTLIGHT – 2020 BOATING SAFETY LAW ENFORCEMENT UPDATE

Lieutenant Brad Stoop, *District 1 Law Enforcement Division*, gave a spotlight about law enforcement field activities and methods to gain compliance with state laws and public safety. Lt. Stoop teaches field sobriety testing and firearms safety. Lt. Stoop stated that law enforcement education and outreach to the boating public is pro-active. During 2020 Law Enforcement has conducted 144 media interviews, produced safety videos, news releases, and social media posts promoting safely managing boat wakes and wearing personal flotation devices while boating. Pre-launch safety checks are done at the boat ramps, to educate the public and prevent violations. In 2019 pre-launch safety checks prevented 519 violations and \$25,950.00 in fines. Education campaigns such as “Preserve Your Life” and “Wake Responsibly” were conducted. Signs have been placed at Boating Access Areas and kiosks and 750,000 boating safety mailers were sent out. Over the 2020 Memorial Day weekend the On the Road On the Water campaign was conducted in collaboration with the NC Highway Patrol. One hundred seventy-four officers checked 2400 boaters. Twenty-seven Boating While Intoxicated (BWI) arrests were made with the highest blood alcohol concentration (BAC) at .32%. Ten boating incidents were reported. On the Labor Day weekend 146 officers checked 884 boaters. There were 13 BWI arrests with the highest BAC .23%. There were seven boating incidents. Operation Dry Water, a national campaign, was conducted over the July 4th weekend. Outdoor breathalyzers were used. One hundred sixty-five officers checked 3000 boaters. There were 59 arrests for BWI with the highest BAC .20%. There were 14 boating incidents. Lt. Stoop mentioned tools that Law Enforcement uses in enforcing boating safety laws, included a port security boat purchased through a Public Safety grant, a 24-foot Regulator in District 1 that has been used for rescue calls and to take supplies to Ocracoke and Hatteras after storms, and two hovercrafts used for rescues. There have been 20 boating fatalities this year. Five of 20 deaths were alcohol related. Fifteen of 20 deaths involved drowning by people not wearing personal flotation devices.

NONGAME WILDLIFE ADVISORY COMMITTEE (NWAC) APPOINTMENTS

On a motion by Mark Craig and second by Monty Crump, the Commission approved appointments, presented in **Exhibit D**, of Sarah McRae, Judith Ratcliffe, Marquette Crockett, Dr. David Webster, and Dr. Liz Rutledge to the NWAC. **Exhibit D** is incorporated into the official record of this meeting.

INLAND FISHERIES RULEMAKING

Christian Waters, *Inland Fisheries Division Chief*, presented 17 fisheries proposals for 2021-2022 to be presented at statewide public hearings, in **Exhibit E-1**:

Trout

Combine the two-existing Public Mountain Trout Waters (PMTW) catch-and-release classifications (Catch and Release/Artificial Flies Only Trout Waters and Catch and Release/Artificial Lures Only Trout Waters) into a single classification (Catch and Release/Artificial Flies and Lures Only Trout Waters).

15A NCAC 10C .0205 Public Mountain Trout Waters

15A NCAC 10C .0316 Trout

Remove Franks Creek in Graham County from Wild Trout Natural Bait Waters. This proposal will remove 4.1 miles from Public Mountain Trout Waters and 0.4 miles of Franks Creek on game lands will be reclassified to Wild Trout Waters.

15A NCAC 10C .0205 Public Mountain Trout Waters

Remove Hemphill Creek in Haywood County from Wild Trout Natural Bait Waters. This proposal will remove 3.7 miles of Public Mountain Trout Waters.

15A NCAC 10C .0205 Public Mountain Trout Waters

Remove Buff Creek in Jackson County from Wild Trout Natural Bait Waters. This proposal will remove 2.8 miles of Public Mountain Trout Waters and 1.0 mile of Buff Creek on game lands will be reclassified to Wild Trout Waters.

15A NCAC 10C .0205 Public Mountain Trout Waters

Modify the upper boundary of Hatchery Supported Trout Waters on Big Pine Creek in Alleghany County removing approximately 4.5 miles of Public Mountain Trout Waters. The designated reach will be from the S.R. 1464 bridge to the confluence with Brush Creek.

15A NCAC 10C .0205 Public Mountain Trout Waters

Remove Meadow Fork in Alleghany County from Hatchery Supported Trout Waters. This proposal will remove 5.0 miles of Public Mountain Trout Waters.

15A NCAC 10C .0205 Public Mountain Trout Waters

Remove Mill Creek in McDowell County from Hatchery Supported Trout Waters. This proposal will remove 6.0 miles of Public Mountain Trout Waters.

15A NCAC 10C .0205 Public Mountain Trout Waters

Clarify that there is no closed season for harvest in undesignated trout waters.

15A NCAC 10C .0205 Public Mountain Trout Waters

Clarify the boundaries for the Delayed Harvest Trout Waters reaches of the Watauga River in Watauga County. The designated reaches are S.R. 1114 bridge to Valle Crucis Community Park lower boundary (upper reach) and S.R. 1103 bridge to confluence with Laurel Creek (lower reach). This proposal will not add or remove any Public Mountain Trout Waters.

15A NCAC 10C .0205 Public Mountain Trout Waters

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Clarify that Boundary Line Pond in Wilkes County is designated as Public Mountain Trout Waters and further classified as Hatchery Supported Trout Waters.

15A NCAC 10C .0205 Public Mountain Trout Waters

Clarify that the lower Hatchery Supported Trout Waters boundary on the Middle Prong Roaring River in Wilkes County is the second bridge on S.R. 1736.

15A NCAC 10C .0205 Public Mountain Trout Waters

Largemouth Bass, Smallmouth Bass, and Spotted Bass

Clarify that the daily creel limit for Largemouth Bass, Smallmouth Bass, and Spotted Bass in the Alleghany County portion of the New River downstream of Fields Dam (Grayson County, Virginia) is five fish in combination.

15A NCAC 10C .0305 Largemouth Bass

15A NCAC 10C .0321 Smallmouth Bass

15A NCAC 10C .0322 Alabama and Spotted Bass

Prohibit harvest of Largemouth Bass from three ponds associated with Martin-Marietta Park, City of New Bern, Craven County.

15A NCAC 10C .0305 Largemouth Bass

Striped Bass

Prohibit harvest of Striped Bass from three ponds associated with Martin-Marietta Park, City of New Bern, Craven County.

15A NCAC 10C .0314 Striped Bass

Blue Catfish

Establish an exception to the general statewide regulation for Blue Catfish in the North Carolina portion of the Dan River (Caswell Co.), downstream of Danville, Va. by allowing only one fish greater than 32 inches to be possessed in the daily creel.

15A NCAC 10C .0401 Manner of Taking Nongame Fishes

American Eel

Allow American Eel greater than the 9-inch minimum length limit to be used for cut bait provided the body depth of the eel is at least ½ inch.

15A NCAC 10C .0401 Manner of Taking Nongame Fishes

15A NCAC 10C .0402 Taking Nongame Fishes for Bait or Personal Consumption

Prohibited Species

Add the African Longfin Eel, Creole Painted Crayfish, Bigclaw Crayfish, Marbled Crayfish or Marmorokrebs, Applesnail, Olive Mysterysnail, European Eel, Oriental Weatherfish, Brown Hoplo, Yellow Bass, Shortfin Eel, Crucian Carp, Prussian Carp, European Perch, European Minnow, and Amur Sleeper to the list of species for which it is unlawful to transport, purchase, possess, sell or stock in the public or private waters of North Carolina. The proposed change also includes taxonomic clarifications and corrections.

15A NCAC 10C .0211 Possession of Certain Fishes

Waters presented the Fiscal Note for Inland Fisheries Rules in **Exhibit E-2**. On a motion by Wes Seegars and second by Steve Windham the Commission approved **Exhibits E-1 and E-2**, which are incorporated into the official record of this meeting.

WILDLIFE MANAGEMENT RULEMAKING

Brad Howard, *Wildlife Management Division Chief*, presented five proposed changes in the 2021-2022 wildlife management rules to be presented at statewide public hearings, in **Exhibit F-1**:

Deer

This proposal modifies the definition of a muzzleloading firearm to allow for the use of pre-loaded powder capsules in muzzleloader during blackpowder season.

15A NCAC 10B .0203 Deer (White-tailed)

Archery Equipment

This proposal modifies the permitted archery equipment to allow for the use of sling bow for taking white-tailed deer.

15A NCAC 10B .0116 Permitted Archery Equipment

Quail

This proposal will create a NCWRC private land program called “Wild Quail Management Areas” and will allow dedicated property managers enrolled in the Program to implement specific additional management actions.

15A NCAC 10B .0227 Wild Quail Management Areas

Trapping

This proposed rule amendment will allow the use of remote trap checking systems in lieu of a physical trap check under specified conditions.

15A NCAC 10B .0110 Attendance of Traps

Bear

This proposed rule amendment corrects the open season for the take of bear in Camden, Chowan, and Pasquotank counties.

15A NCAC 10B .0202 Bear

Howard presented the Fiscal Note for Wildlife Management Rules in **Exhibit F-2**. On a motion by Wes Seegars and second by Steve Windham, the Commission approved **Exhibits F-1 and F-2**, which are incorporated into the official record of this meeting.

LAND AND WATER ACCESS DIVISION

Rulemaking

Brian McRae, Land and Water Access Division Chief, presented in **Exhibit G-1** proposed changes in the 2021-2022 game land rule proposals to be presented at statewide public hearings:

Property

Codify the Commission’s authority to manage public access and use of Commission property and/or waive any non-statutorily required rules in Chapter 10 to protect public health, public safety, wildlife resources, and Commission property.

15A NCAC 10A .1102 Emergency Closures and Waivers

Game Lands and Wildlife Conservation Areas

This proposal will redefine the description of a Temporary Restricted Zone.

15A NCAC 10D .0102 General Regulations Regarding Use

Remove the Laurinburg Fox Trial facility from the NCAC.

15A NCAC 10D .0102 General Regulations Regarding Use

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Clarify that coyotes, armadillos, and groundhogs are authorized to be taken on game lands by trapping during the regulated trapping season (November 1 through end of February). This rule also clarifies that foxes can be trapped on game lands during the regulated trapping season in counties with a session law that authorizes fox trapping in that county. This proposal also establishes a closed trapping season on game lands from April 1 through October 31.

15A NCAC 10D .0102 General Regulations Regarding Use

Clarify that licensed trappers can use bait on game lands while trapping.

15A NCAC 10D .0102 General Regulations Regarding Use

Clarify NCAC rule text that identifies where game lands designated in the disabled access program are listed.

15A NCAC 10D .0102 General Regulations Regarding Use

Amend NCAC rule text by removing Brunswick County Game Land.

15A NCAC 10D .0103 Hunting on Game Lands

Clarify NCAC rule text that establishes the December segment of the bear season for Alligator River, Buckridge, Chowan Swamp, Gull Rock, and Van Swamp game lands.

15A NCAC 10D .0103 Hunting on Game Lands

Clarify that horseback riding is allowed seven days per week from May 16 – August 31, and on Sundays only September 1 – May 15 on R. Wayne Bailey-Caswell, Chatham, Jordan, and Pee Dee River game lands. This proposal will also allow equestrian riding on gated roads and trails posted for equestrian use at Pee Dee River Game Land. This proposal will also clarify that a Game Land License is not needed to ride horses on the American Tobacco Trail at Jordan Game Land.

15A NCAC 10D .0103 Hunting on Game Lands

Prohibit the pursuing or chasing of deer and bear with dogs for the purposes of training or hunting on the Beaufort County portion of Goose Creek Game Land north of NC 33.

15A NCAC 10D .0103 Hunting on Game Lands

Implement permanent rule text to replace a temporary rule that corrected a clerical error in the NCAC regarding the primitive weapons seasons for deer on Nicholson Creek Game Land.

15A NCAC 10D .0103 Hunting on Game Lands

Change Perkins Game Land from an Introductory Either-Sex Gun Season to a Conservative Either-Sex Gun Season.

15A NCAC 10D .0103 Hunting on Game Lands

Clarify the times and places where horseback riding will be permitted and not allowed on the Sandhills Game Land.

15A NCAC 10D .0103 Hunting on Game Lands

Amend NCAC rule text to remove references to impoundments on Stones Creek Game Land.

15A NCAC 10D .0103 Hunting on Game Lands

Prohibit horseback riding at William H. Silver Game Land.

15A NCAC 10D .0103 Hunting on Game Lands

Clarify NCAC rule text regarding restrictions on Wildlife Conservation Areas.

15A NCAC 10J .0103 Hunting on Game Lands

Add the definition of a “Seven Days per Week Game Land” and indicate that hunting is allowed Monday through Sunday during open seasons. Also add the definition for a “Four Days per Week Game Land” and indicate that hunting is allowed Tuesday, Thursday, Saturday, and Sunday. Further, as per G.S. 103-2, this rule will indicate that on Sundays, hunting between 9:30 AM and 12:30 PM is prohibited, the use of a firearm to take deer that are run or chased by dogs is prohibited, and hunting within 500 yards of a place of religious worship, as defined by G.S. 14-54.1(b), or any accessory structure thereof, is prohibited.

15A NCAC 10D .0103 Hunting on Game Lands

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Change the following six game lands to “Four Days per Week Game Lands”:

Bullard and Branch Hunting Preserve
Columbus County
Mitchell River
Perkins
Robeson
Sampson

15A NCAC 10D .0103 Hunting on Game Lands

Change the following 45 game lands to “Seven Days per Week Game Lands”:

Alcoa
Alligator River
Angola Bay
Bachelor Bay
Brinkleyville
Buffalo Cove
Cape Fear River Wetlands
Carteret County
Chatham
Chowan
Cold Mountain
Croatan
Currituck Banks
Dare
Elk Knob
Embro
Goose Creek
Gull Rock
Harris
Hyco
Juniper Creek
Lee
Light Ground Pocosin
Linwood
Lower Fishing Creek
Mayo
Nantahala
Needmore
New Lake
North River
Northwest River Marsh
Pee Dee River

NCWRC Webinar Meeting

October 22, 2020

Minutes

Pisgah
Pond Mountain
Sandy Creek
Shocco Creek
South Mountains
Sutton Lake
Three Top Mountain
Thurmond Chatham
Tillery
Toxaway
Uwharrie
Van Swamp
William H. Silver

15A NCAC 10D .0103 Hunting on Game Lands

Prohibit the harvest of bear on Sunday on the following game lands in the Coastal Bear Management Unit:

Alligator River
Angola Bay
Bullard and Branch Hunting Preserve
Cape Fear River Wetlands
Carteret County
Chowan
Croatan
Currituck Banks
Goose Creek
Gull Rock
Juniper Creek
Light Ground Pocosin
New Lake
North River
Northwest River Marsh
Robeson
Sampson
Sutton Lake
Van Swamp

15A NCAC 10D .0103 Hunting on Game Lands

Brian McRae presented the Fiscal Note for game land rule proposals in **Exhibit G-2**. On a motion by Wes Seegars and second by Steve Windham, the Commission approved **Exhibits G-1 and G-2**, which are incorporated into the official record of this meeting.

Land Acquisitions and Property Matters

Phase II Land Acquisitions – on a motion by Tom Berry and second by Brad Stanback, the Commission approved the acquisition of three properties, presented by Jessie Birckhead, *Land Acquisition and Grants Manager*, in **Exhibits H-1, H-2, and H-3** Riverstone Jenerette Tract, Columbus County (H-1)

- Pitzer Road PFA Tract, Stokes County (H-2)
- North Fork Catawba Tract, McDowell County (H-3)

Elizabethtown Shed Demolition - by the same motion, the Commission approved the demolition of a damaged pole shed at Elizabethtown Depot presented in **Exhibit I. Exhibits H-1, H-2, H-3, and I** are incorporated into the official record of this meeting.

WATER SAFETY RULEMAKING

Emergency Rulemaking – 15A NCAC 10F .0323 Burke County, Lake James – on a motion by Mark Craig and second by Wes Seegars, the Commission approved a request presented in **Exhibit J-1** by Betsy Haywood, *No-Wake Zone Coordinator*, to propose text to the Office of Administrative Hearings for emergency rulemaking in the waters of Mill Creek on Lake James, for a no-wake zone shore to shore, contiguous with a safety zone in the remainder of Mill Creek north of the no-wake zone, to mitigate boater safety hazards during a pedestrian bridge construction project.

Temporary Rulemaking – 15A NCAC 10F .0323 Burke County, Lake James – on a motion by Mark Craig and second by Wes Seegars, the Commission approved a request presented in **Exhibit J-2** to propose text to the Office of Administrative Hearings for temporary rulemaking for a no-wake zone in the waters of Mill Creek on Lake James shore to shore, contiguous with a safety zone in the remainder of Mill Creek north of the no-wake zone, where vessel entry not authorized by the WRC is prohibited, to mitigate hazards to boater safety during a pedestrian bridge construction project. Simultaneous commencement of temporary rulemaking is required when an agency adopts an emergency rule.

Fiscal Note and Notice of Text – 15A NCAC 10F .0305 Brunswick County – on a motion by Mark Craig and second by Wes Seegars the Commission approved a Fiscal Note required for the application for water safety rulemaking by the Town of Ocean Isle Beach in the waters of the ICW shore to shore on both sides of the Highway 904 bridge, presented in **Exhibit K-1**. The Commission approved the request to publish Notice of Text in the *NC Register* with one public hearing and an open comment period, for a no-wake zone in the waters of the ICW shore to shore on both sides of the Highway 904 bridge, presented in **Exhibit K-2**.

Exhibits J-1, J-2, and K-1, K-2 are incorporated into the official record of this meeting.

PERMANENT RULEMAKING

Notice of Text – 15A NCAC 10H .1500 Wildlife and Alligator Control Agents – on a motion by Steve Windham and second by Kelly Davis, the Commission approved **Exhibit L**, presented by Daron Barnes, *Program Manager, Office of Wildlife Interaction, Regulated Activities and Permits*, to publish Notice of Text in the *NC Register* with an open comment period and one virtual public hearing for proposed adoption of rules for licensing and regulating wildlife and alligator control agents.

Notice of Text – 15A NCAC 10B .0106 Wildlife Taken for Depredations – on a motion by Steve Windham and second by Kelly Davis, the Commission approved **Exhibit M**, presented by Daron Barnes, to publish Notice of Text in the *NC Register* with an open comment period and virtual public hearing, for proposed amendments to the Wildlife Taken for Depredation Rule.

Exhibits L and M are incorporated into the official record of this meeting.

2021 STATEWIDE PUBLIC HEARING SCHEDULE

The Commission approved holding regional public hearings for rules proposals as presented in **Exhibit N** – January 12, 2021 at Craven County Courthouse, 302 Broad Street, New Bern; January 14 at AVS Catering and Banquet Center, 2045 N. Fayetteville Street, Asheboro, NC; and January 19, 2021 at McDowell Technical Community College, 54 College Drive, Marion, NC; and one virtual public hearing January 21, 2021. **Exhibit N** is incorporated into the official record of this meeting.

2021 WILDLIFE RESOURCES COMMISSION MEETING SCHEDULE

The Commission adopted the 2021 Wildlife Resources Commission Meetings schedule, presented in **Exhibit O**:

THURSDAY, FEBRUARY 25, 2021

THURSDAY, APRIL 22, 2021

THURSDAY, JULY 29, 2021

THURSDAY, AUGUST 26, 2021

THURSDAY, OCTOBER 28, 2021

THURSDAY, DECEMBER 10, 2021

COMMENTS FROM THE CHAIRMAN

Chairman Hoyle thanked Commissioners and Staff for their attendance and planning for the multiple committee meetings that have been held in September and October. He thanked staff for the tours of the fish hatcheries recently.

COMMENTS FROM THE EXECUTIVE DIRECTOR

Executive Director Ingram thanked the Commission for the approval to hold fewer public hearings in January 2021 in the interest of public safety during the pandemic. He also stated his appreciation for the efforts to conduct eleven out of cycle committee meetings over the past month, noting that there were 19 ½ hours of committee meetings. He thanked Commissioners for their involvement and participation in recent field trips to the Wake County Range, fish hatcheries, and Wildlife and Fishing Education Centers. He thanked Lieutenant Brad Stoop for the spotlight at today’s meeting and asked everyone for prayers for Law Enforcement Officers during the hunting season. He recognized Kyle Briggs and Betsy Haywood for their efforts in putting together the meeting materials and agenda package, and thanked staff for their involvement in getting exhibits and presentations prepared.

ADJOURNMENT

There being no further business, the WRC webinar meeting was adjourned at 10:22 a.m.
All exhibits are incorporated into the official record of this meeting by reference and are filed with the minutes.

David Hoyle, Jr., Chairman

Date

Cameron Ingram, Executive Director

Date

NORTH CAROLINA WILDLIFE RESOURCES COMMISSION
CAFR 52G - STATEMENT OF REVENUES, EXPENDITURES and CHANGES in FUND BALANCES
GOVERNMENTAL FUNDS
AS OF OCTOBER 31, 2020

	FY 2021 General	FY 2021 Capital Improvement	FY 2021 Endowment
REVENUES			
Federal funds	\$ 10,545,421.08	\$ 1,330,997.00	\$ -
Local funds	\$ 552.87	\$ -	\$ -
Investment earnings	\$ 41,098.65	\$ -	\$ 734,307.73
Sales and services	\$ 3,808,186.85	\$ -	\$ -
Rental and lease of property	\$ 19,947.40	\$ -	\$ -
Fees, licenses and fines	\$ 16,119,230.44	\$ -	\$ 1,974,631.50
Contributions, gifts and grants	\$ 796,779.32	\$ 392,632.72	\$ 12,699.00
Miscellaneous	\$ 7,789.82	\$ -	\$ -
Unclassified/invalid accounts	\$ -	\$ 1,161.85	\$ -
OTHER FINANCING SOURCES			
Sale of capital assets	\$ 255,613.26	\$ -	\$ -
Transfers in	\$ 19,142,785.60	\$ 664,650.00	\$ 1,560,194.00
Appropriations	\$ 5,872,267.25	\$ -	\$ -
TOTAL REVENUES	\$ 56,609,672.54	\$ 2,389,441.57	\$ 4,281,832.23
EXPENDITURES			
Personal services	\$ 11,859,394.72	\$ -	\$ -
Employee benefits	\$ 5,265,403.35	\$ -	\$ -
Contracted personal services	\$ 2,754,637.60	\$ 41,442.61	\$ -
Supplies and materials	\$ 2,173,062.65	\$ -	\$ -
Travel	\$ 55,245.02	\$ -	\$ -
Communication	\$ 215,537.02	\$ -	\$ -
Utilities	\$ 230,347.31	\$ -	\$ -
Data processing services	\$ 517,276.88	\$ -	\$ -
Other services	\$ 1,452,638.97	\$ 10,862.02	\$ -
Claims and benefits	\$ 490,390.26	\$ -	\$ -
Other fixed charges	\$ 113,416.19	\$ -	\$ -
Capital outlay	\$ 1,424,235.86	\$ 2,406,626.97	\$ -
Grants, state aid and subsidies	\$ 2,002,930.64	\$ -	\$ -
Insurance and bonding	\$ 15,232.60	\$ -	\$ -
Other expenditures	\$ 408,152.79	\$ -	\$ -
Reimbursements	\$ (247,024.79)	\$ -	\$ -
Unclassified/invalid accounts	\$ 106,348.75	\$ -	\$ -
OTHER FINANCING USES			
Transfers out	\$ 22,388,555.93	\$ 350,000.00	\$ 270,000.00
TOTAL EXPENDITURES	\$ 51,225,781.75	\$ 2,808,931.60	\$ 270,000.00
EXCESS OF REVENUES OVER (UNDER) EXPENDITURES	\$ 5,383,890.79	\$ (419,490.03)	\$ 4,011,832.23
EXCESS OF REVENUES AND OTHER SOURCES OVER (UNDER) EXPENDITURES AND OTHER USES			
	\$ 5,383,890.79	\$ (419,490.03)	\$ 4,011,832.23
FUND BALANCE - JULY 1, As previously stated	\$ 16,536,637.23	\$ 3,315,170.42	\$ 138,879,798.61
FUND BALANCE - OCTOBER 31, 2020	\$ 21,920,528.02	\$ 2,895,680.39	\$ 142,891,630.84

EXHIBIT C-1

December 10, 2020



Brook Floater Conservation Plan for North Carolina



BROOK FLOATER CONSERVATION PLAN for NORTH CAROLINA

Dec. 10, 2020



NORTH CAROLINA WILDLIFE RESOURCES COMMISSION



Brook Floater found in the Linville River



Brook Floaters from the Roaring River



Collecting tissue from a brook floater for genetic analysis



N.C. Wildlife Resources Commission
1701 Mail Service Center
Raleigh, N.C. 27599-1700
ncwildlife.org

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Executive Summary

The Brook Floater (*Alasmodonta varicosa*) is a small mussel that is typically found in well oxygenated, free-flowing rivers and streams in gravel riffles along the Blue Ridge Escarpment and into the upper Piedmont. It is sporadically distributed in streams and rivers of the Atlantic coastal region, from Georgia north to Nova Scotia and New Brunswick (Canada). In North Carolina it is found in three river basins: the Catawba, Yadkin-Pee Dee, and Cape Fear. The most viable populations exist in the Upper Catawba and Upper Yadkin river basins, including the Linville River, Mulberry Creek, Johns River, Roaring River, Mitchell River, and the mainstem Yadkin River. Habitat loss and impaired water quality resulting from sedimentation (agricultural and urban runoff), nutrient loading, loss of riparian forests, sewage and industrial discharges, development and increased impervious surfaces, and watershed development all threaten the Brook Floater. To maintain Brook Floater populations, the N.C. Wildlife Resources Commission will support and contribute to permit reviews, current regulations, habitat protection and habitat management. The primary conservation strategy moving forward is to maintain the Brook Floater in the Catawba, Yadkin-Pee Dee, and Cape Fear river basins and reestablish populations where once extirpated. Currently in North Carolina there are 14 known populations, with varying degrees of viability. Within the next decade, the Wildlife Commission plans to reestablish six populations — three in each of the upper Catawba and Yadkin River basins. The ultimate goal in North Carolina is to maintain 20 viable populations, where a viable population is defined as one where multiple individuals and recruitment are observed over multiple years.



Biological Information

Description and Taxonomic Classification

The Brook Floater (*Alasmidonta varicosa*) is a small mussel, usually less than 70 mm in length. The shell is thinner towards the posterior margin and the mussel has a subovate or subtrapezoidal shape (Strayer and Jirka 1997). In North Carolina it is found in the three river basins: the Catawba, Yadkin-Pee Dee, and Cape Fear. It can be distinguished from other mussel species in the state by the raised (varicose) ridges on the posterior slope, a rayed (black or green) periostracum, and a bright orange foot.

Life History and Habitat

The Brook Floater is typically found in well oxygenated free-flowing rivers and streams in gravel riffles along the Blue Ridge Escarpment and into the upper Piedmont. It is predominantly a filter feeder consuming bacteria, algae, and plant and animal debris. Like almost all mussels, the Brook Floater requires a fish host to complete its life cycle. Identified fish hosts for the Brook Floater include: Blacknose Dace, Longnose Dace, Golden Shiner, Pumpkinseed, Slimy Sculpin, Yellow Perch, and Margined Madtom (Bogan 2002; Nedeau et al 2000; <https://www.ncwildlife.org/Learning/Species/Mollusks/Brook-Floater#3029857-life-history>). The species typically releases glochidia in February-April in North Carolina.



To complete its life cycle, the Brook Floater requires a fish host, such as this Pumpkinseed Sunfish.

Distribution and Population Status

The Brook Floater is sporadically distributed in streams and rivers of the Atlantic coastal region, from Georgia north to Nova Scotia and New Brunswick (Canada). In some states the Brook Floater appears to have experienced significant declines in population size. In North Carolina, Brook Floaters have been extirpated from several streams but are still found in three river basins: the Catawba, Yadkin-Pee Dee, and Cape Fear (Figure 1). The most viable populations exist in the Upper Catawba and Upper Yadkin river basins, including the Linville River, Mulberry Creek, Johns River, Roaring River, Mitchell River and the mainstem Yadkin River. Several populations have been discovered within the last seven years including the Catawba River upstream of Lake James in McDowell County, Roaring River in Wilkes County, and Mulberry and Buffalo creeks in Caldwell County. Roaring River and Mulberry Creek currently have the highest densities in each of the river basins. The populations of Brook Floater in the Uwharrie Mountains region may represent an undescribed species (Arthur Bogan, personal communication 2017). However, no definitive work on this population has been published so this population is still considered to be Brook Floater.

Until recently, surveys for the Brook Floater in North Carolina have been sporadic at best. Some initial mussel surveys by E.P. Keferl in the late 1980s found the mussel in six streams — four in the Catawba River Basin and two

in the Yadkin-Pee Dee. Throughout the 1990s, surveys primarily by the NC Department of Transportation and the Wildlife Commission determined the range of the Brook Floater to be much larger than initially thought. In 1990, the first population was discovered in the Rocky River in the Cape Fear River Basin, but only one individual was observed. Throughout the 1990s the Brook Floater was still only known from 12 streams in North Carolina. In 1993, populations in Upper Creek and the Linville River in the Catawba River Basin were considered the best in the state (catch per unit effort [CPUE] 20.7 and 25.3 individuals per person-hour, respectively). Yet, regardless of river basin, the majority of observations in the 1990s were between one and three individuals and the average CPUE was 1.0. The highest density in any population was observed in 1998, in the Linville River (CPUE 31.5).

From 2000-2017 mussel surveys throughout North Carolina increased and more Brook Floater populations were discovered. By the end of 2009, 21 streams had known Brook Floater populations. Still, CPUE was highly variable. The majority of sites ranged from one to three individuals and CPUE was usually less than one mussel per hour. The highest population numbers were observed in the Roaring, Yadkin and Mitchell rivers (CPUE 25.5, 14, and 13.8, respectively) in the Yadkin River Basin. From 2010-2017, more focused monitoring surveys were conducted for Brook Floaters. Over the past seven years, 16 streams have had recorded Brook Floaters in North Carolina. However, recent surveys have revealed new populations and larger distributions. Some streams have been found to have much higher densities than originally thought. The highest density population in North Carolina was discovered in 2015 in Mulberry Creek in the upper Johns River basin with CPUEs ranging



Conducting mussel surveys

from 38.3 to 48.0 at various sites. In 2011, a population was discovered in the Catawba River, extending upstream of Lake James for ~14 river miles. The population in the Linville River was considered to be small and only inhabited a two-mile reach upstream of Lake James, yet now the known range is extended 3 additional miles into the Linville River gorge. Prior to 2010, the population in the Roaring River was only known from one locality. Following surveys in 2014-2017, the population currently occupies ~24 river miles in the Roaring River watershed, and has consistently high CPUEs in the mainstem Roaring River and at various sites (CPUE=10.3, 11.7, 14.8 and 32.0).

Recent surveys (2015-2017) have provided sufficient data to generate population estimates for Brook Floaters throughout their known range in the Upper Catawba and Upper Yadkin-Pee Dee river basins (Table 1, page 7). Population estimates were calculated using the following formula: $E = (n/A_s)A_o$ where E = the population estimate; n = the number of animals recovered; A_s = a function of the number of sites surveyed, the mean length of surveyed sites, and the mean width of surveyed sites; and A_o = a function of the total segment length between sites with detected animals and the mean width of the segment (COSEWIC, 2009). Lower and upper estimates

Table 1. Population estimates of the Brook Floater (*Alasmidonta varicosa*) in the Catawba and Yadkin River basins in North Carolina. Values have been rounded to the nearest hundred.

Population	Estimated N
<i>Catawba River Basin</i>	
Catawba River (upstream of Lake James)	500-800
Linville River	600-1,100
Mulberry Creek	2,200-2,900
Upper Creek	200-300
Wilson Creek	900-2,300
	<i>Total</i> 4,400-7,400
<i>Upper Yadkin-Pee Dee River Basin</i>	
Mitchell River	900-1,400
Roaring River	3,400-5,500
Yadkin River (downstream of Kerr Scott)	<i>Total</i> 5,800-9,500
	13,600-21,800
	Cumulative Total 18,000-29,000

were determined by substituting total number of sites surveyed (lower estimate) and total number of sites where the species was detected (upper estimate). It is important to note that these estimates assume the area of occupied habitat is homogenous and thus the animals are uniformly distributed. The true Brook Floater population size is likely smaller. These numbers are most useful for providing possible comparative estimated values between surveyed populations.

The Wildlife Commission currently classifies the Brook Floater as Endangered. The NC Natural Heritage Program (NCNHP) categorizes the Brook Floater as S2, G3 – Imperiled. NCNHP defines “Imperiled” as, “Imperiled in North Carolina due to rarity or some factor(s) making it very vulnerable to extirpation from the state. Typically, 6 to 20 occurrences or few remaining individuals (1,000 to 3,000).” The NC Natural Heritage Program currently recognizes 17 confirmed occurrences in the state (Judy Ratcliffe pers. comm.). In 2010 the Center for Biological Diversity filed a petition with the US Fish and Wildlife Service (USFWS) to federally designate the Brook Floater as either Threatened or Endangered (US District Court for Washington, D.C. 2011). This resulted in a positive 90-day finding. The USFWS is now conducting a 12-month review for this species to determine if it merits listing as a candidate species. This review should conclude in 2019 (USFWS 2011).

NCWRC *A. varicosa* records (1987 - 2017)

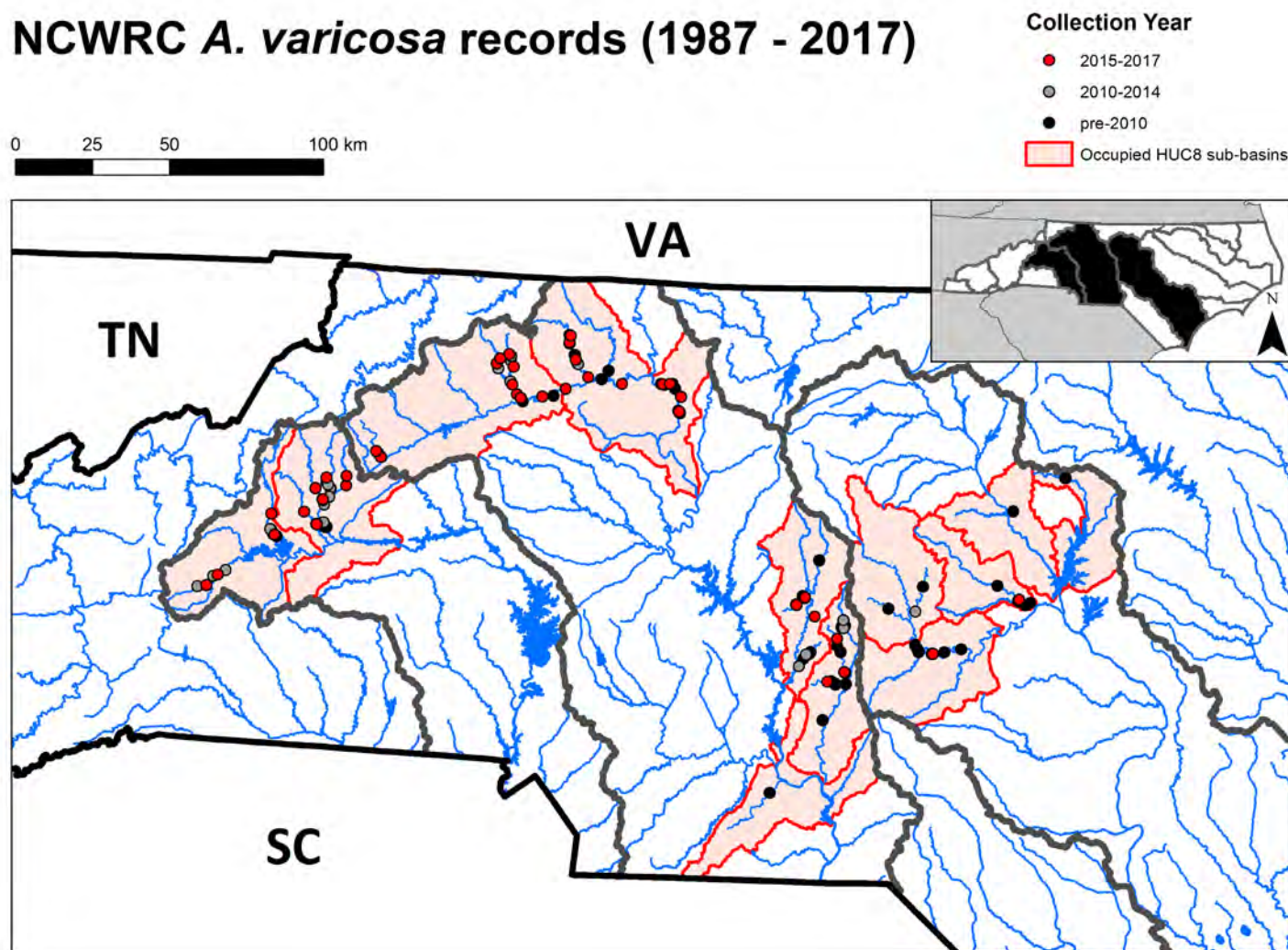


Figure 1. Distribution and collections of Brook Floaters in North Carolina

Historic and Ongoing Conservation Efforts

Historic efforts to conserve Brook Floaters have resulted, tangentially, through the Clean Water Act (1972), which limited pollution from point-source effluents, and from the creation of Pisgah National Forest, which provided water quality protection in the headwaters of the Catawba River Basin. Recent water quality protection in the Upper Catawba and Yadkin river basins have resulted from the purchase and/or expansion of Johns River Game Land, Stone Mountain State Park, Thurmond-Chatham Game Land, Mitchell River Game Land, and Pilot Mountain State Park. In addition, the following streams are either considered a High Quality Water or Outstanding Resource Water (HQW/ORW): Linville River, Warrior Fork, Wilson Creek, Mulberry Creek and Mitchell River. This designation is the highest level the state of North Carolina provides for water quality protection (NCDENR 2011). These designations confer stringent erosion and sediment controls, buffer widths, dictate the use of best management practices, and restrict new wastewater discharges.

Recently, researchers completed a host fish study for Brook Floater and found Margined Madtoms (*Noturus insignis*) to be the most suitable host in North Carolina (Eads 2008). This information provided the propagation tools to support ongoing efforts to conserve Brook Floaters via translocation and augmentation of extirpated populations such as the Catawba River downstream of Lake James, Upper South Fork Catawba River (Henry and Jacob Forks), and the Upper Yadkin River upstream of Kerr Scott Reservoir. Other recent efforts have focused on limiting vehicular traffic in streams occupied by Brook Floaters, biological assistance focusing on new HQW/ORW water quality classification in occupied rivers such as the Roaring River, technical guidance to land-protection organizations purchasing tracts of land adjacent to occupied streams, and initiation of a mark-recapture study in core populations in order to track temporal changes.



Researchers recently completed a host fish study for Brook Floater and found Margined Madtoms to be the most suitable host in North Carolina.

Threat Assessment

Reason for Listing

Brook Floater was originally listed in North Carolina in 1977 as a Special Concern species. It was elevated to Threatened status in 1990 and listed as Endangered in 2001. These listings were believed to be based primarily on the increased trajectory of threats to recently discovered populations and recently extirpated populations (Judy Ratcliffe pers. comm.)

Present and Anticipated Threats

Habitat loss and impaired water quality resulting from sedimentation (agricultural and urban runoff), nutrient loading, loss of riparian forests, sewage and industrial discharges, development and increased impervious surfaces, and watershed development all threaten the Brook Floater (NCWAP 2015, COSEWIC 2009). In addition, existing populations are highly fragmented by impoundments, hydro-power facilities, and stream crossings in all three currently occupied river basins (Nedeau 2008). Some of these threats have been abated or halted to some degree. There are no new large impoundments currently planned and point-source pollution of conventionally considered contaminants is reasonably regulated in North Carolina. However, it is anticipated that non-point source problems will continue in the future, and enforcement and compliance actions are

The Brook Floater was originally listed in North Carolina in 1977 as a Special Concern species. It was elevated to Threatened status in 1990 and listed as Endangered in 2001.



Wildlife Commission biologists are working to ensure the long-term viability of the Brook Floater.

critical to maintenance or improvement of water quality. A class of emerging contaminants — including pharmaceutical, agricultural, and industrial byproducts that pass through wastewater facilities largely untreated and are often unregulated — pose a threat to many aquatic species. Some compounds act as endocrine disruptors. Others have poorly understood effects on aquatic life. These can reduce juvenile development or survival, and limit adult reproductive success, among other detrimental impacts (Adamson et al. 2017, Lee Pow 2016, Hinck et al. 2009, Gagné 2004). These pollutants may negatively affect both Brook Floater and host fish populations through multiple pathways.

Given the uncertainty in most models investigating the dynamics of aquatic ecosystems, it

is difficult to predict with confidence the extent of effects of climate change on the Brook Floater. NCDENR (2010) states that climate change is likely to have a synergistic effect with other, more impending threats to these systems, such as development and removal of riparian vegetation. Additional system stressors may include increased magnitude and intensity of droughts, increased storm water runoff and resuspension of sediments during more frequent storms, and increased evaporation rates with increased temperatures, which also concentrate nutrients and slow their pathways through aquatic systems. These factors threaten both mussel and native host fish populations (Lynch et al. 2016). Very few specific climate change impact mechanisms have been identified, primarily due to the lack of focused study and standardized data sets. Further work is needed to understand the magnitude of potential effects.

CONSERVATION GOAL AND OBJECTIVES

Conservation Goal

Wildlife Commission biologists are working to prevent the extinction of the Brook Floater and ensure its long-term viability as a member of the fauna of North Carolina for the next 100 years. A viable population will be indicated by multiple individuals, numerous size-classes, a stable or increasing population, and recruitment over multiple years.

Conservation Objectives

Wildlife Commission biologists have developed a conservation strategy to maintain the populations of Brook Floater in the Catawba, Yadkin-Pee Dee, and Cape Fear river basins and reestablish populations where once extirpated.

Objectives include:

1. Maintain viable populations in at least seven locations in the Catawba River Basin. Four current populations include: Upper Catawba River, Linville River, Warrior Fork, Johns River (Wilson's Creek and Mulberry Creek). Reestablish three populations: Upper South Fork Catawba River (Henry and Jacobs Fork), Catawba River downstream of Lake James, and North Fork Catawba River (Armstrong Creek).
2. Maintain viable populations in at least 10 locations in the Yadkin-Pee Dee River Basin. Seven current populations include: Buffalo Creek, Roaring River, Mitchell River, Fisher River, mainstem Yadkin River, Uwharrie River (Barnes Creek and other small tributaries), Little River (Densons Creek), West Fork Little River (Uwharrie River and Little River populations may represent a currently undescribed species). Reestablish three populations: Upper Yadkin River mainstem, Elk Creek, and Reddies River.
3. Maintain viable populations in at least three locations in the Cape Fear River Basin: Deep River, Rocky River, and New Hope Creek.

CONSERVATION ACTIONS

Habitat Protection and Habitat Management

The N.C. Wildlife Resources Commission conserves Brook Floaters by protecting wide forested riparian corridors, minimizing construction and fill in the 100-year floodplain, using effective sediment and erosion control, and adequately managing storm water quality and quantity in development areas — actions that are essential to protect water quality and aquatic habitat for Brook Floaters. Staff will utilize the permit review process to minimize the effects of development on this and other aquatic species, generally following guidance provided in the Wildlife Commission's Guidance Memorandum to Address and Mitigate Secondary and Cumulative Impacts to Aquatic and Terrestrial Wildlife Resources and Water Quality (NCWRC 2002). Forestry activities should incorporate forest practice guidelines (FPGs) or best management practices (BMPs) as required by certifying organizations such as those of the Sustainable Forestry Initiative/Forest Stewardship Council/American Tree Farm System certification standards. This can help retain adequate conditions for aquatic ecosystems.



Wildlife Commission biologists conserve Brook Floaters by protecting wide, forested riparian corridors, which should be at least 100 feet for perennial streams.

Riparian buffers of at least 100 feet for perennial streams and 50 feet for intermittent streams will be recommended for most project settings. Where federally listed species are present, larger buffers and more stringent protection measures may be recommended. Where instream work is proposed, recommendations will focus on minimizing streambed

disturbance, such as working outside of live flows. Staff may also recommend that projects incorporate more stringent sediment and erosion control measures than are ordinarily required, such as stabilizing soils within five working days or seven calendar days, whichever is shorter, and using advanced settling devices. The Commission will evaluate recommending flow improvements in reaches where flow is regulated by upstream reservoirs such as the reach downstream of Kerr Scott Reservoir as the opportunity arises. The NC Division of Water Resources and several nongovernmental organizations are working toward resolving some water quality issues on the Rocky River. The Commission will support these efforts as necessary and appropriate.

The Commission will also support the addition of conservation lands in the Upper South Fork Catawba River sub-basin along the mainstem Catawba River downstream of Lake James, along Wilson Creek and the Johns River, in the Roaring River sub-basin, along the mainstem Yadkin River near Pilot Mountain State Park, and along the Rocky River in the Cape Fear basin. The Commission will also support expansion of the Mitchell River and Buffalo Cove Game Lands as appropriate.

The Commission should support dam removal as opportunities allow to reconnect populations or reestablish new ones. Examples of some of the highest priorities are provided: Patterson Dam on Buffalo Creek, Wilkesboro Dam on Reddies River, Rocky River Hydropower Dam on the Rocky River and Henry River Dam.

Population Management

Augmenting existing populations or establishing new populations in suitable areas can be a powerful tool for conservation. However, establishing new populations of a species that may become federally listed can be problematic because it can introduce regulations inherent in the Endangered Species Act. All management actions described below must be approved individually and separately from endorsement of this management plan by the Habitat,

Captive propagation — growing mussels in tanks before releasing them in the wild — will be one of the tools Wildlife Commission biologists use to conserve Brook Floaters in North Carolina.



Nongame, and Endangered Species (HNGES) Committee of the N.C. Wildlife Resources Commission. Before these actions take place, the HNGES may require tools that minimize regulatory burden such as Candidate Conservation Agreement with Assurances or Safe Harbor Agreement.

Utilize captive propagation and/or translocations to establish and augment populations of Brook Floater in the Catawba River downstream of Lake James, the Upper South Fork Catawba River (Henry and Jacob Fork), North Fork Catawba River, Upper Yadkin River upstream of Kerr Scott Reservoir, Elk Creek, Reddies River, and Fisher River. Establish connectivity and gene flow between existing and established populations by either translocating individuals or dam removal. Meta-populations can be reconnected to currently extirpated populations. All four populations in the Catawba River are isolated due to Lake James and its hypolimnetic discharge. These populations may need genetic augmentation to prevent inbreeding and boost outbreeding. The upper Reddies River is cut off from the Roaring and Yadkin River population by a dam. The water quality and habitat upstream of the dam has recovered, but Brook Floaters cannot reestablish naturally at that site. The only population upstream of W Kerr Scott Reservoir is isolated in Buffalo Creek. In addition, this population is bisected by the Patterson Dam which is currently breached and acts as a sediment release valve during random events. Populations in the Deep and (if extant) Haw River are also fragmented by dams. The Haw River is isolated from the rest of the Cape Fear River Basin by Jordan Lake, a large reservoir managed for hydropower generation and recreation by the US Army Corps of Engineers at B. Everett Jordan Dam. If suitable habitat and water quality are located, this could be a receiving system for reintroduction material. The Deep River has a chain of dams extending from Lockville Dam near Jordan Lake up to the headwaters at Oak Hollow Lake in the City of High Point. Opportunities to restore connectivity, particularly in the middle reach between Lockville Dam and Coleridge Dam, should be evaluated and pursued where appropriate.

Catawba River Basin

In 2018 Brook Floater propagation began at the Commission's Conservation Aquaculture Center. Pending approval by the HNGES, individuals from this cohort will be stocked in 2020 in the Upper South Fork Catawba River (Henry and Jacobs Fork) and/or in the Catawba River downstream of Lake James. We estimate initial stocking numbers at ~1,000 individuals per stream. These stockings should continue at a minimum of five years. In addition, translocated adults may be stocked in each target stream to increase the genetic viability of the reestablished populations. Selected stocking sites will be monitored yearly for success. By 2030, success or failure will be confirmed. These projects will be considered successful if multiple individuals are collected and there is evidence of recruitment into the population.

Depending on propagation success, excess individuals may be used to augment the Upper Catawba River Basin at selected, high quality sites. Additional individuals may be stocked in Armstrong Creek though reestablishing this population is currently the lowest priority.

Yadkin River Basin

In 2018, Brook Floater populations in the Upper Yadkin River, including Elk Creek, and the Fisher River will be augmented by individuals from the populations in Roaring and Mitchell rivers. We estimate translocating ~100 mussels per year for five years into high quality sites in the Upper Yadkin River, Elk Creek and Fisher River. Brook Floater propagation may also be implemented to augment these populations. However, this will follow propagation

efforts in the Catawba River Basin. Augmentation sites will be monitored for 10 years. In 2028, success or failure of augmented sites will be confirmed. These projects will be considered successful if multiple individuals are collected and there is evidence of recruitment into the population.

Following propagation in the Catawba River Basin and augmentation efforts in the Yadkin River Basin, Brook Floater propagation for the Reddies River may begin. We anticipate this occurring in 2028-2030.

Cape Fear Basin

More surveys and monitoring are needed within the Cape Fear River Basin to understand population levels, where suitable habitat exists, and where restoration could occur in the future.

Incentives (Tax break)

Wildlife Commission biologists will encourage private landowners in Brook Floater habitat to participate in the Wildlife Conservation Lands program. This program allows qualifying landowners whose property contains state listed species to get a property tax credit for implementing conservation actions.

Monitoring and Research

Mark-recapture studies in the Catawba and Yadkin river basins were completed in 2018 to establish baseline population levels. These surveys should be replicated on a defined schedule, along with general distribution surveys to track the range within specific streams. Particular attention should be paid to the Catawba River upstream of Lake James to determine if the population is starting to decline in that basin. In addition, the populations in the Fisher and Ararat rivers appear to have declined recently and have perhaps been extirpated. More distribution surveys are needed in these watersheds.

Population surveys in the Piedmont regions of the Cape Fear and lower Yadkin-Pee Dee should continue to identify better the extent of occupied reaches and abundance in these systems. The lower Rocky and Deep rivers in the Cape Fear basin both have large areas of potentially suitable habitat that lack survey coverage. The West Fork Little River should be investigated to document whether there are declines in the both habitat quality and mussel populations.

Conduct propagation research for long-term fish holding and mussel rearing at the Marion Conservation Aquaculture Center (MCAC).

Education and Outreach

Wildlife Commission biologists will work with Wildlife Education staff to promote education and awareness of the Brook Floater and efforts to conserve the species and its habitat. As part of this process, staff will develop and share outreach materials to help increase public awareness.

Regulations

Provisions of the Clean Water Act are often enough to protect Brook Floater populations. However, there may be instances where designation of Brook Floater Habitat as either High Quality Waters (HQW) or Outstanding Resource Waters (ORW) may be necessary. These designations will afford additional protection to the Brook Floater. In instances where this is necessary, the Wildlife Commission will support the NC Division of Water Resources in its assessments to determine if HQW or ORW designations are necessary and appropriate.

N.C. General Statute § 113 337 makes it unlawful to take, possess, transport, sell, barter, trade, exchange, export, or offer for sale, barter, trade, exchange or export, or give away for any purpose including advertising or other promotional purpose any animal on a protected wild animal list, except as authorized without a valid permit is currently prohibited under NC law and administrative code (15A NCAC 10I .0102). These restrictions are enforced by the N.C. Wildlife Resources Commission and violations are considered Class 1 misdemeanor (§ 113 337b).

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EXHIBIT C-2

December 10, 2020



Five Rare Aquatic Species Conservation Plan for North Carolina



Tar River Spiny mussel



Yellow Lance



Dwarf Wedgemussel



Carolina Madtom

CONSERVATION PLAN

for Five Rare Aquatic Species
Restricted to the Neuse and
Tar-Pamlico River Basins
in **NORTH CAROLINA**

Dec. 10, 2020

Neuse River Waterdog





Neuse River Waterdog



Dwarf Wedgemussel



Carolina Madtom



Yellow Lance



Tar River Spiny mussels



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Recommended citation:

N.C. Wildlife Resources Commission. 2018. Conservation Plan for Five Rare Aquatic Species Restricted to the Neuse and Tar-Pamlico River Basins in North Carolina. Raleigh, North Carolina

Executive Summary

The N.C. Wildlife Resources Commission developed this conservation plan to direct management activities for three freshwater mussel species [Dwarf Wedgemussel (*Alasmidonta heterodon*), Yellow Lance (*Elliptio lanceolata*), and Tar River Spiny mussel (*Parvaspina steinstansana*)], one freshwater fish species [Carolina Madtom (*Noturus furiosus*)], and one aquatic salamander species [Neuse River Waterdog (*Necturus lewisi*)] known in North Carolina from the Neuse and Tar-Pamlico river basins. Historically, these species inhabited waterways from the headwaters to lower reaches of both river basins. Each species requires slightly different habitat requirements; however, they all require high-quality waterways containing cool, well oxygenated and unpolluted water. Waterways must contain adequate suitable habitat, including constant flow, natural flow regime, unembedded substrate, and stable instream habitat. Direct threats to these species include pollution (chemical and thermal), unnatural flow conditions, dams, sedimentation, unstable or fragmented habitat, invasive species, and diseases.

The Dwarf Wedgemussel and Tar River Spiny mussel were listed as state endangered in 1977 and listed as federally endangered in 1990 and 1985, respectively. The Yellow Lance was listed as state endangered in 1977, downlisted to state threatened in 1990, and uplisted to state endangered in 2001. It was listed as federally threatened in 2018. The Carolina Madtom was state listed as special concern in 1977, modified to state special concern (Neuse River basin only), and uplisted to state threatened in 2006. The Neuse River Waterdog was state listed as a Species of Special Concern in 1990.



Dwarf Wedgemussel



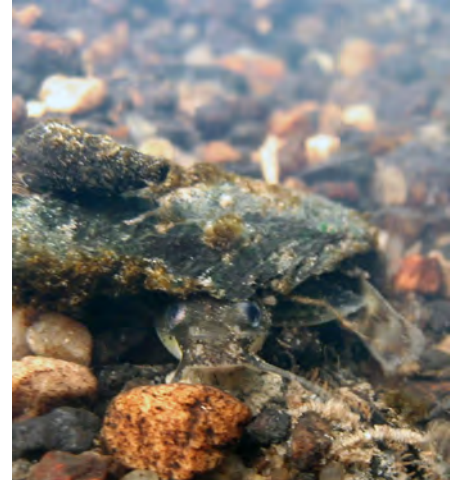
Yellow Lance



Tar River Spiny mussel

In 2010, Yellow Lance, Carolina Madtom, and Neuse River Waterdog were petitioned for federal listing under the Endangered Species Act of 1973.

This conservation plan seeks to prevent the extinction of these species and promote population viability within North Carolina for the next 100 years. Within this goal, species-specific conservation objectives and research needs are outlined for respective species. The general, unifying theme for these species focuses on identifying and reducing threats, promoting population viability, habitat protection, population monitoring, research, and partnerships. N.C. Wildlife Resources Commission staff will establish and maintain partnerships between the Commission and other state agencies, federal agencies, universities, non-profit organizations, companies, local governments, and citizens to implement this conservation plan. Management of these species will require collaborative stakeholder efforts to protect sensitive habitats and maintain high-quality water resources throughout the Neuse and Tar-Pamlico river basins.



Carolina Madtom



Neuse River Waterdog

Introduction

This conservation plan outlines recovery action needs of five aquatic species within the Neuse and Tar-Pamlico river basins in North Carolina. The species covered in this conservation plan include three freshwater mussels — Dwarf Wedgemussel (*Alasmidonta heterodon*), Yellow Lance (*Elliptio lanceolata*), Tar River Spiny mussel (*Parvaspina steinstansana*); one freshwater fish — Carolina Madtom (*Noturus furiosus*); and an aquatic salamander — Neuse River Waterdog (*Necturus lewisi*). The Dwarf Wedgemussel and Tar River Spiny mussel are listed as state and federally endangered. The Yellow Lance is listed as state endangered and federally threatened. The Carolina Madtom is listed as state threatened, and the Neuse River Waterdog is listed as Special Concern. However, the latter two species were petitioned in 2010 for federal listing under the Endangered Species Act of 1973 and are being evaluated to determine their federal conservation status.

Species Accounts

Dwarf Wedgemussel (*Alasmidonta heterodon*)

Biological Information

Description and Taxonomic Classification

The Dwarf Wedgemussel (*Alasmidonta heterodon* Lea 1830) is a state and federally endangered freshwater mussel that historically inhabited numerous waterways along the Atlantic Slope. The Dwarf Wedgemussel is a member of the genus *Alasmidonta*, which includes 12 species that typically have a thin shell, a well-developed posterior ridge, weak to moderate pseudocardinal teeth, and weak to absent lateral teeth (Turgeon et al. 1998; Williams et al. 2008). The Dwarf Wedgemussel is easily distinguished from the other *Alasmidonta* species by the presence of two weak lateral teeth on the right valve. The external surface of the shell (periostracum) is often green to olive with variable rays, and the inside of the shell (nacre) is white to bluish white. Adults are sexually dimorphic and reach a maximum length of < 60 mm. Females have a shell that is laterally inflated, which results in a steep posterior slope and truncated appearance. In comparison, males have a shell that is compressed, lacking a steep posterior slope, and an elongate oval shell outline. **Etymology:** *heterodon*, referring to the fact that Dwarf Wedgemussel is the only North American freshwater mussel that typically has two lateral teeth on the right valve and one on the left (Fuller 1977).

Taxonomic Hierarchy (Integrated Taxonomic Information System 2017):

Kingdom:	Animalia
Phylum:	Mollusca
Class:	Bivalvia
Order:	Unionoida
Family:	Unionidae
Genus:	<i>Alasmidonta</i>
Species:	<i>Alasmidonta heterodon</i>

Distribution and Population Status

The historical distribution of Dwarf Wedgemussel ranged from North Carolina to New Brunswick, Canada (USFWS 1993). Currently, the population in Canada is considered extirpated, and the remaining populations occur in isolated locations between New Hampshire and North Carolina. Despite this species' apparently large range, Dwarf Wedgemussel has a very disjunct distribution consisting of small, relict populations. In North Carolina, Dwarf Wedgemussel is restricted to the Piedmont and western edge of the Coastal Plain within the Neuse and

Tar-Pamlico river basins (Figure 1, page 16). Neuse River basin occurrence records exist for Buffalo Creek, Eno River, Little Creek, Little River, Middle Creek, Moccasin Creek, Neuse River, Swift Creek, Turkey Creek, and White Oak Creek. The Neuse River basin population of Dwarf Wedgemussel is highly fragmented, extremely small, and at-risk of extirpation. In the Tar-Pamlico River basin, it historically occurred in Bens Creek, Cedar Creek, Crooked Creek, Cub Creek, Fox Creek, Isinglass Creek, Little Shocco Creek, Long Branch, Maple Branch, Norris Creek, North Fork Tar River, Red Bud Creek, Rocky Swamp, Ruin Creek, Shelton Creek, Shocco Creek, Stony Creek, Tabbs Creek, Tar River, an unnamed tributary to Cub Creek, and an unnamed tributary to Little Fishing Creek. The Tar-Pamlico River basin population is also fragmented; however, the watershed remains a stronghold for the species within North Carolina.

Surveys focused specifically on Dwarf Wedgemussel in North Carolina are somewhat limited because many freshwater mussel surveys assess freshwater mussel diversity rather than the status of a single species. As such, numerous freshwater mussel surveys have been conducted throughout the Neuse and Tar-Pamlico river basins (Figure 1, page 16). To date, Dwarf Wedgemussel has been collected within 18 watersheds (i.e., 10-digit hydrologic units) in North Carolina. Within the past decade (2008 – 2017), Dwarf Wedgemussel has been collected from only one of eight watersheds (13%) and six of 10 watersheds (60%) within the Neuse and Tar-Pamlico river basins, respectively.



Dwarf Wedgemussel

The status of Dwarf Wedgemussel was listed as “Endangered” by Fuller (1977) due to dwindling populations and rarity. In 1986, Master submitted the results of a global status survey and strongly recommended that Dwarf Wedgemussel be listed as “Endangered.” Subsequently, on March 14, 1990, the U.S. Fish and Wildlife Service made a final ruling that the Dwarf Wedgemussel be listed as a threatened species with protection provided by the Endangered Species Act of 1973 (USFWS 1993). The findings of the U.S. Fish and Wildlife Service 5-year reviews continue to recommend that the Dwarf Wedgemussel remain listed as “Endangered” (USFWS 2007, 2013).

Habitat and Life History

Habitat Use of Dwarf Wedgemussel

Within North Carolina, Dwarf Wedgemussel typically inhabits small to medium streams with moderate flow and stable sand, gravel, and cobble substrates. The species is sometimes found in clay or under rootwads (Kendig 2014).

Diet of Dwarf Wedgemussel

The Dwarf Wedgemussel is a filter feeder that feeds on a variety of particulate matter suspended in the water column including algae, phytoplankton, zooplankton, bacteria, detritus, and dissolved organic matter (Haag 2012). Juveniles pedal feed by using the cilia on their foot to gather particulate matter from the substrate.

Reproduction of Dwarf Wedgemussel

Similar to most freshwater mussels, Dwarf Wedgemussel has a complex life cycle that requires the use of a fish host to reproduce successfully. Freshwater mussels are dioecious, and sexually mature males release large quantities of sperm into the water column to begin the reproductive life cycle. For fertilization to occur, sperm must pass into the incurrent apertures of sexually mature females. The sperm travel through the aperture while the mussel is filter feeding and fertilize eggs in the suprabranchial chamber. The fertilized eggs are then transferred into the gill chambers, which form a modified brood pouch called the marsupium. While in the marsupium, the fertilized eggs quickly mature into the larval form known as glochidia. This process usually requires 2-6 weeks for maturation (Haag 2012). Dwarf Wedgemussel is considered to be a long-term brooder (bradytictic), which means that individuals spawn in late summer, females become gravid in September, and release glochidia in April (Michaelson and Neves 1995). Glochidia are released into the water column to attach onto the gills of a suitable fish host, where the glochidia metamorphose from larvae to free-living mussel. Glochidia remain on the host fish for a period of 10-38 days. During this time, they receive nutrients from the fish blood and develop internal organs such as a foot, digestive tract, and gills, as well as form two adductor muscles (Michaelson and Neves 1995, Haag 2012). After glochidia complete their metamorphosis, they excyst from the gills of the host fish and settle into the substrate to live as a juvenile freshwater mussel.

Fish Host Trials for Dwarf Wedgemussel

To date, 46 fish species across 11 families have been exposed to Dwarf Wedgemussel glochidia (Michaelson and Neves 1995, St. John White 2007, Levine et al. 2011, St. John White et al. 2017, NCSU unpublished data).

Effective Hosts: *Aphredoderus sayanus* (Pirate Perch), *Cottus bairdii* (Mottled Sculpin), *Cottus cognatus* (Slimy Sculpin), *Etheostoma flabellare* (Fantail Darter), *Etheostoma nigrum* (Johnny Darter), *Etheostoma olmstedi* (Tessellated Darter), *Morone saxatilis* (Striped Bass), *Percina nevisense* (Chainback Darter), *Salmo salar* (Atlantic Salmon)

Poor Hosts: *Etheostoma collis* (Carolina Darter), *Etheostoma vitreum* (Glassy Darter), *Fundulus diaphanous* (Banded Killifish), *Lepomis auritus* (Redbreast Sunfish), *Lepomis cyanellus* (Green Sunfish), *Notropis altipinnis* (Highfin Shiner), *Percina peltata* (Shield Darter), *Salmo trutta* (Brown Trout)

Ineffective Hosts: *Ambloplites rupestris* (Rock Bass), *Anguilla rostrata* (American Eel), *Campostoma anomalum* (Central Stoneroller), *Catostomus commersoni* (White Sucker), *Cyprinella analostana* (Satinfin Shiner), *Cyprinella*

spiloptera (Spotfin Shiner), *Etheostoma zonale* (Banded Darter), *Exoglossum maxillingua* (Cutlips Minnow), *Hypentelium nigricans* (Northern Hog Sucker), *Ictalurus punctatus* (Channel Catfish), *Lepomis gibbosus* (Pumpkinseed), *Lepomis macrochirus* (Bluegill Sunfish), *Luxilus albeolus* (White Shiner), *Luxilus cornutus* (Common Shiner), *Lythrurus matutinus* (Pinewoods Shiner), *Micropterus dolomieu* (Smallmouth Bass), *Micropterus salmoides* (Large-mouth Bass), *Nocomis leptocephalus* (Bluehead Chub), *Notemigonus crysoleucas* (Golden Shiner), *Notropis procnus* (Swallowtail Shiner), *Noturus insignis* (Margined Madtom), *Oncorhynchus mykiss* (Rainbow Trout), *Perca flavescens* (Yellow Perch), *Percina roanoka* (Roanoke Darter), *Pimephales notatus* (Bluntnose Minnow), *Pomoxis annularis* (White Crappie), *Rhinichthys atratulus* (Blacknose Dace), *Rhinichthys cataractae* (Longnose Dace), *Salvelinus fontinalis* (Brook Trout)

Glochidia of Dwarf Wedgemussel

Dwarf Wedgemussel glochidia are roughly triangular, with hooks, and are relatively large, measuring 325 µm in length and 255 µm in height (Clarke 1981). Glochidia are heavy and typically sink to the bottom of an aquarium. The hooks on the glochidia allow them to attach to the fins of fish and remain there during transformation, which suggests the use of a benthic host fish in the wild.

Conservation Management

Historical Conservation Efforts

N.C. Wildlife Resources Commission and US Fish and Wildlife Service (USFWS) biologists conduct 5-10 targeted surveys for Dwarf Wedgemussel on a yearly basis and search for suitable locations for future augmentation efforts. In 2009, the Wildlife Commission, USFWS and N.C. Department of Transportation partnered with N.C. State University to identify the host fish and refine captive propagation techniques for Dwarf Wedgemussel. The Commission in 2008 established the Marion Conservation Aquaculture Center (MCAC), located at the Marion State Fish Hatchery in McDowell County, N.C. The objective of the MCAC is to preclude listing, promote delisting, and prevent the extinction of aquatic species when appropriate by using captive propagation and "arking" — the act of holding a captive population of a species in the event of extirpation. The MCAC began to "ark" the Neuse River basin Dwarf Wedgemussel population in 2015 and began propagation efforts to augment remaining populations in the future. In 2015, the Commission initiated beaver management activities on Brinkleyville



The Marion Conservation Aquaculture Center

and Shocco Creek Game Lands so that flowing conditions could be restored to three waterways (Maple Branch, Shocco Creek, and Rocky Swamp) within the Tar-Pamlico River basin. The three focal reaches historically harbored Dwarf Wedgemussel and quality mussel habitat; however, beaver activity severely impacted flow regimes and riparian canopy cover as well as substantially reduced mussel abundance. In addition, the USFWS partnered with species experts to develop a structured decision-making conservation strategy for Dwarf Wedgemussel in 2015. This collaborative effort identified the optimal conservation strategy for Dwarf Wedgemussel in North Carolina (Smith et al. 2015) — a strategy to protect the best by protecting Tar-Pamlico River basin populations, or a hybrid strategy to protect Tar-Pamlico River basin populations with additional attempts to expand the distribution in the Neuse River basin.

Threats

As with all aquatic species, there are many natural and anthropogenic factors that threaten the long-term viability of Dwarf Wedgemussel (USFWS 1993). Extinction and decline of North American unionid bivalves can be traced to impoundment and inundation of riffle habitat throughout the United States. The loss of obligate hosts, coupled with increased siltation, and various types of industrial and domestic pollution have resulted in the rapid decline



Hydrilla is an invasive species that can threaten mussel populations.

of the unionid bivalve fauna in North America (Bogan 1993, NCWRC 2015). Dams, both manmade and natural (created by beavers, see Kemp et al. 2012), are a barrier to dispersal of host fish and attached glochidia. Throughout the Neuse and Tar-Pamlico river basins, beavers have continued to build dams and impound an increasing number of river kilometers. Beaver dams not only inundate and alter riffle/run mussel habitat upstream of the dam, but also affect mussel populations downstream of the dam by increasing fluctuations in flow regime, decreasing dissolved oxygen levels, and increasing the variability of food quality and quantity (Hoch 2012, Kemp et al. 2012). Contaminants and water pollution are significant threats to all aquatic species, especially mussels. Point-source

discharges from municipal wastewater that contains monochloramine and unionized ammonia compounds are acutely toxic to freshwater mussels and may be responsible for glochidial mortality that results in local extirpation of mussels (Goudreau et al. 1993, Gangloff et al. 2009, NCWRC 2015). Impervious areas in urbanized watersheds contribute to high water levels, even during short rainfall events, which can result in flash flooding. These high or flashy flow events contribute to increased sediment loads, turbidity throughout the water column, and stream bed movements that stress mussel populations (Gangloff et al. 2009, NCWRC 2015). Development and climate change will likely bring additional stressors that need to be evaluated for mussels. Furthermore, specific pollutants that may be introduced into the aquatic environment, the interactions of pollutants and temperature (from climate change), salinity (related to sea level rise), and lower dilution (from altered flows) will need to be considered (NCWRC 2015).

In addition, invasive species such as the Asian Clam (*Corbicula fluminea*), the Flathead Catfish (*Pylodictis olivaris*), and Hydrilla (*Hydrilla verticillata*) can create competitive pressures on food resources and habitat availability. These invasive species can decrease oxygen availability, cause ammonia spikes, alter benthic substrates, impact host fish communities, reduce stream flow, and increase sediment buildup (Belanger et al. 1991, Scheller 1997, NCANSMPC 2015, NCWRC 2015).

Conservation Goal

The N.C. Wildlife Resources Commission is working to prevent the extinction of Dwarf Wedgemussel and promote population viability (i.e., multiple age classes and wild recruitment) within North Carolina for the next 100 years.

Conservation Objectives

The overarching conservation strategy is to promote habitat protection and maintain the best populations of Dwarf Wedgemussel in the Tar-Pamlico river basin and focus efforts within the Neuse River basin on Swift Creek, Little River, and consider options to expand the distribution. Restoration of habitat should be promoted for hydrologic units listed under Objective 1 and should focus primarily on beaver management and protection of riparian habitat and associated uplands.

1. Promote habitat protection and maintain two viable populations of Dwarf Wedgemussel in the Neuse River basin and three populations in the Tar-Pamlico River basin (Figure 2, page 17). Management Units (MUs) will be defined based on hydrologic units (i.e., HUC10s).
 - a. **Neuse River Basin**
 - i. Swift Creek MU (0302020110)
 - ii. Little River MU (0302020115, 0302020116)
 - b. **Tar Pamlico**
 - i. Fishing Creek MU (0302010201, 0302010202, 0302010203, 0302010205)
 - ii. Swift Creek MU (0302010107)
 - iii. Tar River MU (0302010101, 0302010102, 0302010103, 0302010104)
2. Maintain an ark population of Dwarf Wedgemussel from Neuse and Tar-Pamlico river basin broodstock.
3. Utilize captive propagation and/or translocations to augment or establish subpopulations of Dwarf Wedgemussel where appropriate habitat exists (pending approval from the Habitat, Nongame and Endangered Species Committee). To reduce the potential of regulatory burden associated with the federal Endangered Species Act, a tool such as Safe Harbor will be established prior to reintroduction into an unoccupied area.
 - a. All Neuse and Tar-Pamlico river basin MU hydrologic units listed above.
 - b. Additional augmentation areas within the known range of Dwarf Wedgemussel (Figure 2, page 17), if propagation efforts exceed MU needs.
 - i. **Neuse River Basin**
 1. Contentnea Creek (0302020301)
 2. Eno River (0302020103)
 3. Middle Creek (0302020109)
 4. Neuse River (0302020107)

ii. **Tar-Pamlico River Basin**

1. Stony Creek (0302010105)

b. Potential reintroduction or introduction of Dwarf Wedgemussel (Figure 2, page 17) into areas within the presumed historical range, if propagation efforts exceed MU needs. Ideally located in areas with reduced likelihood of anthropogenic threats.

i. **Neuse River Basin**

1. Black Creek (0302020112)
2. Contentnea Creek (0302020302, 0302020303, 0302020304, 0302020305, 0302020306, 0302020307)
3. Falling Creek (0302020114)
4. Falls Lake (0302020104, 0302020105, 0302020106)
5. Flat River (0302020101)
6. Little River (0302020102)
7. Mill Creek (0302020113)
8. Neuse River (0302020111, 0302020117, 0302020201, 0302020202, 0302020203)
9. Swift Creek (0302020204)

ii. **Tar-Pamlico River Basin**

1. Beech Swamp (0302010204)
2. Conetoe Creek (0302010303)
3. Fishing Creek (0302010206)
4. Swift Creek (0302010108)
5. Tar River (0302010106, 0302010109, 0302010302, 0302010304, 0302010306)
6. Town Creek (0302010301)
7. Tranters Creek (0302010305)

4. Establish connectivity and gene flow between existing and established populations by either translocating individuals or removal of barriers.
5. Re-establish historical populations of Dwarf Wedgemussel after habitat threats have been reduced.

Research Needs

1. Monitor Dwarf Wedgemussel populations every 2-5 years to assess survival, abundance, population structure, recruitment, and genetic diversity.
2. Develop captive propagation techniques to maximize yield, genetic diversity, and post-release survival.
3. Determine locations for establishing Dwarf Wedgemussel populations and monitor the success of population establishment.
4. Determine the genetic diversity and number of genetically distinct populations of Dwarf Wedgemussel throughout its range.
5. Develop microsatellite markers or similar genetic tagging techniques to determine age structure, parentage, and hatchery contribution to wild stock.
6. Monitor host fish abundance, population structure, and recruitment.
7. Develop techniques to reduce the abundance of Asian Clam.

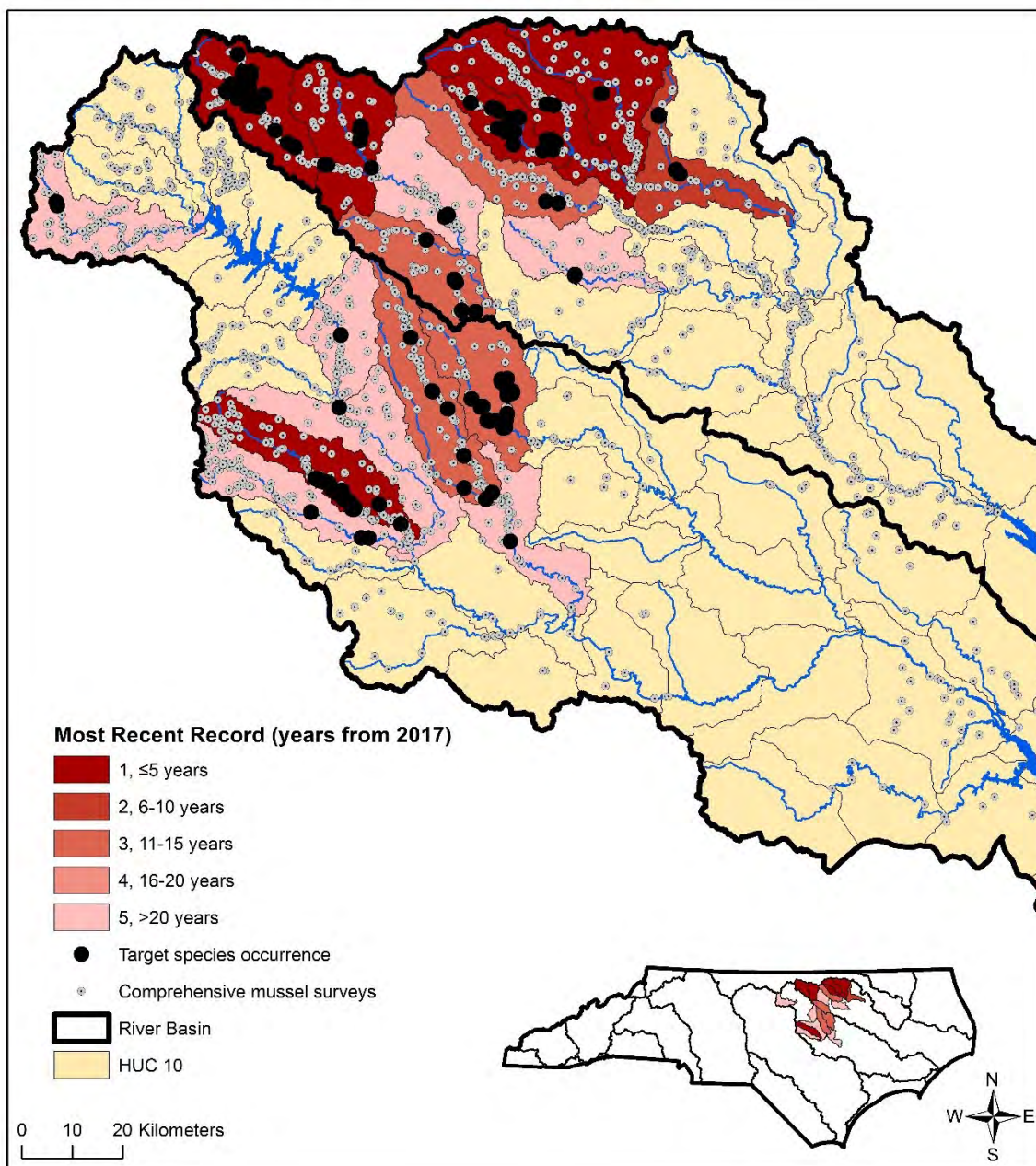
8. Determine the known historical range of Dwarf Wedgemussel by verifying the identification of specimens held in museum collections.
9. Determine the impact of Flathead Catfish on Dwarf Wedgemussel host fish populations.

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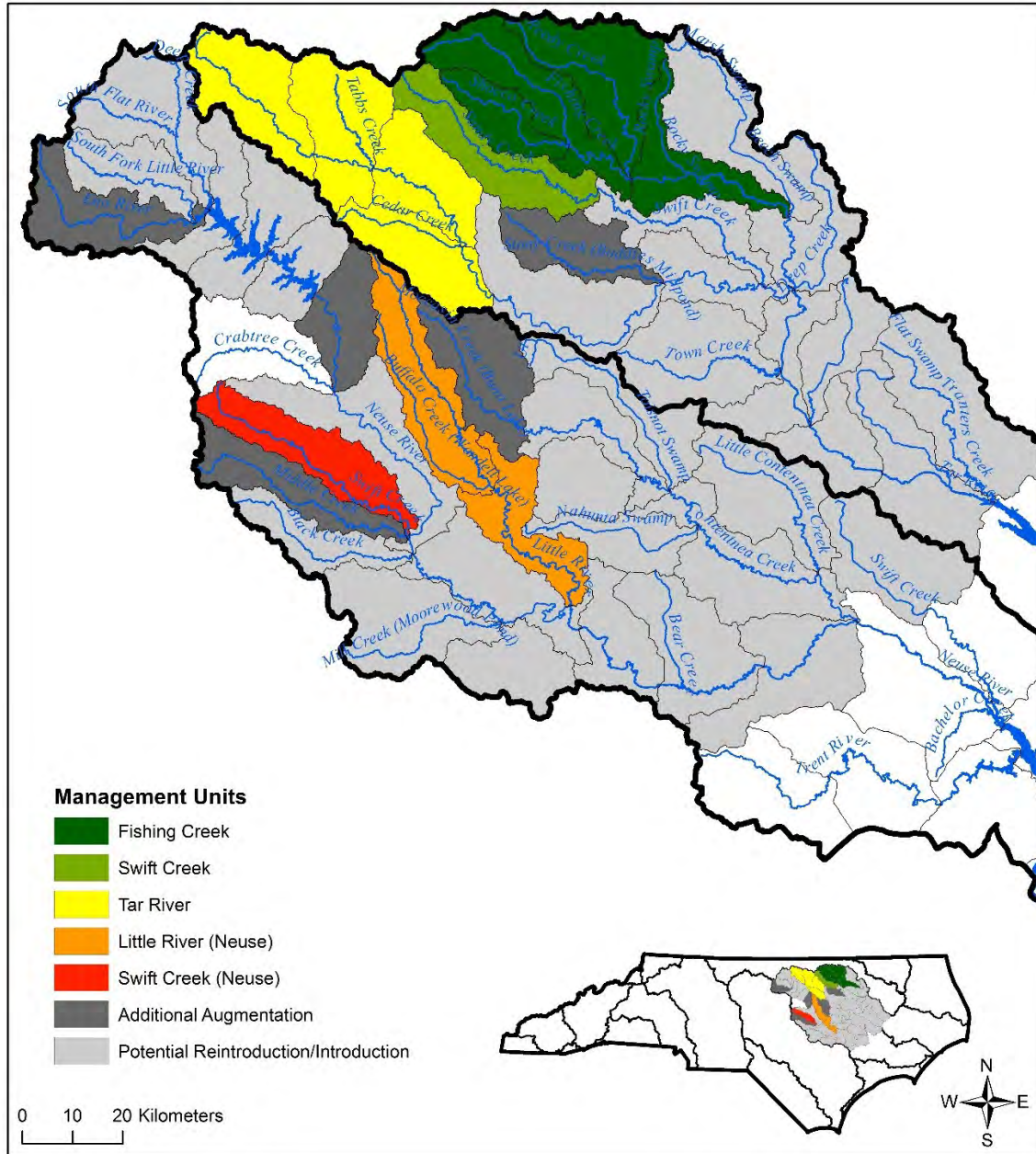
Occurrences by HUC 10 Watershed of the Dwarf Wedgemussel (*Alasmidonta heterodon*) and Survey Locations



Map created by Tyler Black Ph.D. 9/5/2017 Data Sources: NC Wildlife Resources Commission

Figure 1. Distribution map of Dwarf Wedgemussel (*Alasmidonta heterodon*) within the Neuse and Tar-Pamlico river basins depicting 10-digit hydrologic units (colored and categorized based on year of observation), collection locations (black dots), and survey locations (gray dots).

Dwarf Wedgemussel (*Alasmidonta heterodon*) Management Units



Map created by Tyler Black Ph.D. 9/5/2017 Data Sources: NC Wildlife Resources Commission

Figure 2. Management units of Dwarf Wedgemussel (*Alasmidonta heterodon*) within the Neuse and Tar-Pamlico river basins depicting 10-digit hydrologic units (colored based management units and future management scenarios).

Yellow Lance (*Elliptio lanceolata*)

Biological Information

Description and Taxonomic Classification

The Yellow Lance (*Elliptio lanceolata* (Lea 1828)) is a state endangered and federally threatened freshwater mussel that is restricted to the Neuse and Tar-Pamlico river basins in North Carolina. It has a bright yellow elongate shell that is more than twice as long as it is tall and usually not more than 86 mm in length (Bogan 2017). Its periostracum has a smooth and waxy appearance with brownish growth rests, and it rarely has rays (Alderman 2003). The posterior ridge is distinctly rounded and curves dorsally toward the posterior end (Lea 1828, Bogan 2017). The lateral teeth are long and thin, with two in the left valve and one in the right valve. Each valve has two pseudocardinal teeth with the posterior one on the left valve and the anterior one on the right valve being vestigial (Lea 1828, Kendig 2014). The Yellow Lance was originally described as *Unio lanceolatus* in 1828 by Isaac Lea. For many years, the Yellow Lance was recognized as part of the "lanceolate *Elliptio*" species complex that incorporated 25 species (Johnson 1970). However, in 2009, Bogan et al. identified *Elliptio lanceolata* as described by Lea to be a distinct species, but its placement in the genus *Elliptio* remains questionable.

Taxonomic Hierarchy (Integrated Taxonomic Information System 2017):

Kingdom:	Animalia
Phylum:	Mollusca
Class:	Bivalvia
Order:	Unionoida
Family:	Unionidae
Genus:	<i>Alasmidonta</i>
Species:	<i>Alasmidonta lanceolata</i>

Distribution and Population Status

Yellow Lance has a historical range of the Patuxent River basin in Maryland; possibly the Potomac River basin in Maryland and Virginia; the Rappahannock, York, James, and Cowan river basins in Virginia; and the Tar-Pamlico and Neuse river basins in North Carolina (Figure 3, page 26; USFWS 2018). A range-wide Species Status Assessment Report was recently completed by the U.S. Fish and Wildlife Service, providing a comprehensive review of the species (USFWS 2018). Historically, the distribution of Yellow Lance in North Carolina appeared widespread within the two basins. In the Neuse River basin, it historically occurred in Swift Creek, Mill Creek, Middle Creek, and the Little River. In the Tar-Pamlico River basin, occurrence records exist in Swift Creek, Richneck Creek, Fishing Creek, Sandy Creek, Tabbs Creek, Shocco Creek, Crooked Creek, Fox Creek, and the Tar

River proper. Given the distribution of Yellow Lance, it is presumed that it historically occurred within the Roanoke and Chowan river basins in North Carolina; however, there are no verified records from these basins.

To date, Yellow Lance have been collected in 17 watersheds (i.e., 10-digit hydrologic units) in North Carolina (Figure 3, page 26). Within the past decade (2008 – 2017), Yellow Lance have been collected from two of five watersheds (40%) and seven of 12 watersheds (58%) within the Neuse and Tar-Pamlico river basins, respectively. The range and number of sites that Yellow Lance has been found in recent years has been decreasing. However, this species seems to be locally abundant in a few locations, as Wildlife Commission biologists found 53 Yellow Lance in 10 person-hours at a new site in Swift Creek (Tar-Pamlico river basin) in 2016. The Tar-Pamlico river basin holds the best known remaining populations of Yellow Lance, with the Swift Creek sub-basin being the primary stronghold of the species. During recent surveys, two locations in the Tar River proper were documented to harbor Yellow Lance. However, given the cryptic nature of this species, its proclivity for burying deep into the substrate, and the large size and depth of the mainstem Tar River, it is possible that other locations and populations in the Tar River have yet to be discovered. Yellow Lance has been found at only two sites in Fishing Creek in the past 10 years, and it appears that the habitat at one of the sites has degraded in recent years and may no longer be suitable for this mussel to persist. Thus, only one remaining known site is left in Fishing Creek that can serve as a broodstock collection location. The Yellow Lance populations in the Neuse River basin are in worse shape than the populations in the Tar-Pamlico River basin. The Neuse River basin populations lack sufficient numbers from which to collect broodstock. While there have been several Yellow Lance observations in Swift Creek within the past 10 years and as recently as 2015, every observation found only one or two individuals during the survey. There have been recent (2014-2016) intensive surveys in the Swift Creek watershed, and only one Yellow Lance has been observed. Available habitat in Swift Creek has declined continually over the past 10 years. With the impending construction of the I-540 Outer Loop Southeast Extension and continued development and urbanization within the Swift Creek sub-basin, the persistence of Yellow Lance within Swift Creek appears bleak. There appears to be more available habitat in the Little River sub-basin; however, there has not been a Yellow Lance observation in this sub-basin since 2009. Yellow Lance is listed as endangered (soon to be changed to threatened) in the state of North Carolina. On May 3, 2018, the U.S. Fish and Wildlife Service made a final ruling to list the Yellow Lance as a threatened species with protection provided by the Endangered Species Act of 1973.



Yellow Lance

Habitat and Life History

Habitat use of Yellow Lance

Yellow Lance is often found in stable, clean, coarse- to medium-sized sandy substrate, although it has also been found in gravel substrates and migrating with shifty sands (Alderman 2003). This species is highly mobile and has been shown to migrate up to 15 m upstream in sandy substrates (NCWRC unpublished data). Due to its high mobility, Yellow Lance will often be found within a few inches of exposed substrate, migrating toward the thalweg when the water level drops. This mussel can often be found on the downstream end of stable sand and gravel bars, sometimes buried up to six inches in the substrate. Clean flowing water with high dissolved oxygen and minimal nutrient loading is important for the survival of Yellow Lance (USFWS 2018).

Diet of Yellow Lance

Yellow Lance is a filter feeder that feeds on a variety of particulate matter suspended in the water column including algae, phytoplankton, zooplankton, bacteria, detritus, and dissolved organic matter (Haag 2012). Juveniles pedal feed by using the cilia on their foot to gather particulate matter from the substrate.

Reproduction of Yellow Lance

Similar to most freshwater mussels, Yellow Lance has a complex life cycle that requires the use of a fish host to reproduce successfully. Freshwater mussels are dioecious with sexually mature males releasing large quantities of sperm into the water column to begin the reproductive life cycle. For fertilization to occur, sperm must pass into the incurrent apertures of sexually mature females. The sperm travel through the aperture while the mussel is filter feeding and fertilize eggs in the suprabranchial chamber. The fertilized eggs are then transferred into the gill chambers, which form a modified brood pouch called the marsupium. While in the marsupium, the fertilized eggs quickly mature into the larval form known as glochidia — a process usually requiring 2-6 weeks for maturation (Haag 2012). Yellow Lance is a short-term brooder (tachytictic), which means that when the eggs develop into mature glochidia, they are released shortly thereafter into the water column to attach onto the gills of an appropriate fish host where the glochidia metamorphose from larvae to free-living mussels. In a hatchery setting, female Yellow Lance have been observed to become gravid multiple times in one spawning season and release between 2-3 broods from April-July in North Carolina (Eads and Levine 2009). Glochidia remain on the host fish for a period of 7-17 days. During this time, they receive nutrients from fish blood and develop internal organs such as a foot, digestive tract, and gills, as well as forming two adductor muscles (Haag 2012). After the glochidia complete their metamorphosis, they excyst from the gills of the host fish and settle into the substrate to live as a juvenile freshwater mussel.

Fish Host Trials for Yellow Lance

To date, 26 fish species across eight families have been exposed to Yellow Lance glochidia (Eads and Levine 2009).

Effective Hosts: *Luxilus albeolus* (White Shiner), *Lythrurus matutinus* (Pinewoods Shiner)

Poor Hosts: *Anguilla rostrata* (American Eel), *Catostomus commersonii* (White Sucker), *Etheostoma vitreum* (Glassy Darter), *Fundulus rathbuni* (Speckled Killifish), *Lepomis cyanellus* (Green Sunfish), *Lepomis macrochirus* (Bluegill),

Micropterus salmoides (Largemouth Bass), *Nocomis leptocephalus* (Bluehead Chub), *Notropis procne* (Swallow-tail Shiner), *Noturus insignis* (Margined Madtom), *Percina roanoka* (Roanoke Darter), *Semotilus atromaculatus* (Creek Chub)

Ineffective Hosts: *Ambloplites cavifrons* (Roanoke Bass), *Ameiurus platycephalus* (Flat Bullhead), *Aphredoderus sayanus* (Pirate Perch), *Cyprinella analostana* (Satinfin Shiner), *Enneacanthus gloriosus* (Bluespotted Sunfish), *Erimyzon oblongus* (Creek Chubsucker), *Etheostoma nigrum* (Johnny Darter), *Hypentelium nigricans* (Northern Hogsucker), *Lepomis auritus* (Redbreast Sunfish), *Notropis hudsonius* (Spottail Shiner), *Noturus furiosus* (Carolina Madtom), *Percina nevisense* (Chainback Darter)

Glochidia of Yellow Lance

Yellow Lance glochidia are small, rounded, and hookless. They measure approximately 200 µm in length and 190 µm in height (Eads and Levine 2009). Broods are released as clumps of mucus and glochidia that stick to each other and ball up at the bottom of an aquarium in a laboratory setting. However, it is possible that in the wild, the glochidia release is more string-like and floats in the water column, resulting in it being targeted as food by minnows (USFWS 2018, C. Eads personal communication). Fecundity for wild Yellow Lance is typically 4,000-15,000 glochidia; however, when held in a hatchery setting, fecundity is increased to 20,000-56,000 glochidia.

Conservation Management

Historical Conservation Efforts

Prior to 2009, Wildlife Commission biologists conducted general mussel surveys in the Neuse and Tar-Pamlico river basins in North Carolina to document the distribution of Yellow Lance throughout its range. In 2009, the Commission partnered with N.C. State University (NCSU) to conduct targeted surveys, perform fish host trials, and develop captive propagation techniques for Yellow Lance. Refinement of captive propagation techniques continued in subsequent years, including the development of in vitro propagation methods to transform Yellow Lance successfully without using a fish host.

The Marion Conservation Aquaculture Center (MCAC), located at the Commission's Marion State Fish Hatchery in McDowell County, N.C., was established in 2008 to preclude listing, promote delisting, and prevent the extinction of aquatic species when appropriate by using captive propagation and arking. In 2015, Commission biologists conducted an experimental release of 270 propagated Yellow Lance split between two sites in Sandy Creek, a tributary of the Tar River. Biologists evaluated habitat suitability, detection, growth, and survival of the released mussels to gain information to guide future augmentation efforts throughout its range. Biologists conducting annual monitoring surveys of the released mussels recorded good growth, survival and maturation of propagated Yellow Lance in the wild, observing that the propagated mussels became gravid in Sandy Creek. In 2015, the Commission partnered with NCSU again to collect additional broodstock and propagate Yellow Lance from the Tar-Pamlico river basin, identify future augmentation areas, and evaluate the suitability of several ponds to serve as grow-out

locations for Yellow Lance. From 2016-2017, Commission biologists conducted targeted surveys for Yellow Lance, resurveying the locations from 2009 and adding several more survey locations throughout its range to update the current species distribution.

Threats

As with all aquatic species, there are many natural and anthropogenic factors that threaten the long-term viability of Yellow Lance. Extinction and decline of North American unionid bivalves can be traced to impoundment and inundation of riffle habitat throughout the United States. The loss of obligate hosts, coupled with increased siltation, and various types of industrial and domestic pollution have resulted in the rapid decline of the unionid bivalve fauna in North America (Bogan 1993, NCWRC 2015). Dams — both manmade and natural (created by beavers, see Kemp et al. 2012) — are a barrier to dispersal of host fish and attached glochidia. Throughout the Neuse and

Tar-Pamlico river basins, beavers have continued to build dams and impound an increasing number of river kilometers. Beaver dams not only inundate and alter riffle/run mussel habitat upstream of the dam, but also affect mussel populations downstream of the dam by increasing fluctuations in flow regime, decreasing dissolved oxygen levels, and increasing the variability of food quality and quantity (Hoch 2012, Kemp et al. 2012). Contaminants and water pollution are a significant threat to all aquatic species, especially mussels. Point-source discharges from municipal wastewater that contains monochloramine and unionized ammonia compounds are acutely toxic to freshwater mussels and may be responsible for glochidial mortality that results in local extirpation of mussels (Goudreau et al. 1993, Gangloff et al. 2009, NCWRC 2015). Impervious areas in urbanized watersheds contribute to high



Beaver dams can alter mussel habitat upstream of the dam and affect mussel populations downstream of the dam as well.

water levels, even during short rainfall events, which can result in flash flooding. These high or flashy flow events contribute to increased sediment loads, turbidity throughout the water column, and stream bed movements that stress mussel populations (Gangloff et al. 2009, NCWRC 2015). Climate change and development will likely bring additional stressors that need to be evaluated for mussels. Furthermore, specific pollutants that may be introduced into the aquatic environment, the interactions of pollutants and temperature (from climate change), salinity (related to sea level rise), and lower dilution (from altered flows) will need to be considered (NCWRC 2015). In addition, invasive species such as Asian Clam (*Corbicula fluminea*), Flathead Catfish (*Pylodictis olivaris*), and Hydrilla (*Hydrilla verticillata*) can create competitive pressures on food resources and habitat availability. These invasive species can decrease oxygen availability, cause ammonia spikes, alter benthic substrates, impact host fish communities, reduce stream flow, and increase sediment buildup (Belanger et al. 1991, Scheller 1997, NCANSMPC 2015, NCWRC 2015).

Conservation Goal

Wildlife Commission biologists are working to prevent the extinction of Yellow Lance and ensure its long-term viability as a member of the fauna of North Carolina for the next 100 years. A viable population will be indicated by multiple individuals, numerous age-classes, a stable or increasing population, and recruitment in the wild.

Conservation Objectives

Wildlife Commission biologists have developed an overarching conservation strategy to promote habitat protection and maintain the best populations of Yellow Lance in the Tar-Pamlico river basin and focus efforts within the Neuse River basin on Swift Creek and Little River. Restoration of habitat should be promoted for hydrologic units listed under Objective 1 and should focus primarily on the protection of riparian habitat and associated uplands.

1. Promote habitat protection and maintain for two populations of Yellow Lance in the Neuse River basin and three populations in the Tar-Pamlico River basin (Figure 4, page 27). Management Units (MUs) are defined based on hydrologic units (i.e., HUC10s).
 - a. **Neuse River Basin**
 - i. Little River MU (0302020115, 0302020116)
 - ii. Swift Creek MU (0302020110)
 - b. **Tar-Pamlico River Basin**
 - i. Fishing Creek MU (0302010201, 0302010203, 0302010205, 0302010206)
 - ii. Swift Creek MU (0302010107, 0302010108)
 - iii. Tar River MU (0302010102, 0302010103, 0302010104, 0302010106, 0302010109, 0302010302)
2. Maintain an ark population of Yellow Lance from Neuse and Tar-Pamlico river basin broodstock.
3. Utilize captive propagation and/or translocations to augment or establish subpopulations of Yellow Lance where appropriate habitat exists (pending approval from the Habitat, Nongame and Endangered Species Committee). To reduce the potential regulatory burden associated with the federal Endangered Species Act, a tool such as Safe Harbor will be established prior to reintroduction into an unoccupied area.
 - a. All Neuse and Tar-Pamlico river basin MU hydrologic units listed above.
 - b. Additional augmentation areas within the known range of Yellow Lance (Figure 4, page 27), if propagation efforts exceed MU needs.
 - i. **Neuse River Basin**
 1. Middle Creek (0302020109)
 2. Mill Creek (0302020113)
 - ii. **Tar-Pamlico River Basin**
 1. Stony Creek (0302010105)
 2. Tar River (0302010101)
 - c. Potential reintroduction or introduction of Yellow Lance (Figure 4, page 27) into areas within the presumed historical range, if propagation efforts exceed MU needs. Ideally located in areas with reduced likelihood of anthropogenic threats.
 - i. **Neuse River basin**
 1. Black Creek (0302020112)

2. Contentnea Creek (0302020301, 0302020304, 0302020307)
 3. Eno River (0302020103)
 4. Flat River (0302020101)
 5. Little River (0302020102)
 6. Neuse River (0302020107, 0302020111, 0302020117, 0302020201, 0302020202, 0302020203)
- ii. **Tar-Pamlico River basin**
1. Little Fishing Creek (0302010202)
 2. Tar River (0302010304, 0302010306)
 3. Town Creek (0302010301)
4. Establish connectivity and gene flow between existing and established populations by either translocating individuals or removal of barriers.
 5. Reestablish historical populations of Yellow Lance after habitat threats have been reduced.

Research Needs

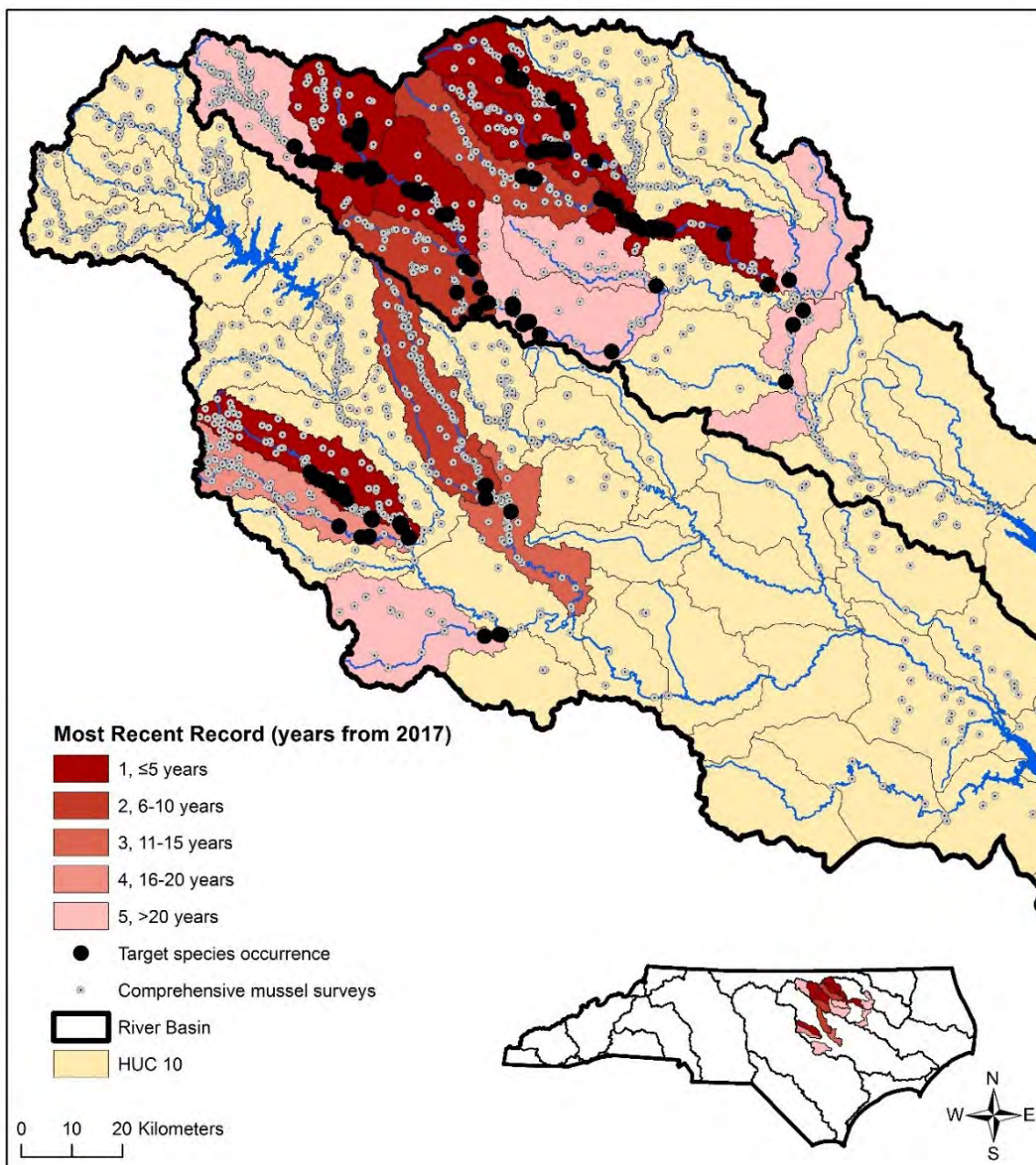
1. Monitor Yellow Lance populations every 2-5 years to assess survival, abundance, population structure, recruitment, and genetic diversity.
2. Conduct Yellow Lance-focused surveys within the Roanoke and Chowan river basins to assess presence or absence of the species.
3. Develop captive propagation techniques to maximize yield, genetic diversity, and post-release survival.
4. Determine locations for establishing Yellow Lance populations and monitor the success of population establishment.
5. Determine the genetic diversity and number of genetically distinct populations of Yellow Lance throughout its range.
6. Develop microsatellite markers or similar genetic tagging techniques to determine age structure, parentage, and hatchery contribution to wild stock.
7. Monitor host fish abundance, population structure, and recruitment.
8. Develop techniques to reduce the abundance of Asian Clam.
9. Determine the known historical range of Yellow Lance by verifying the identification of specimens held in museum collections.
10. Determine the impact of Flathead Catfish on Yellow Lance host fish populations.

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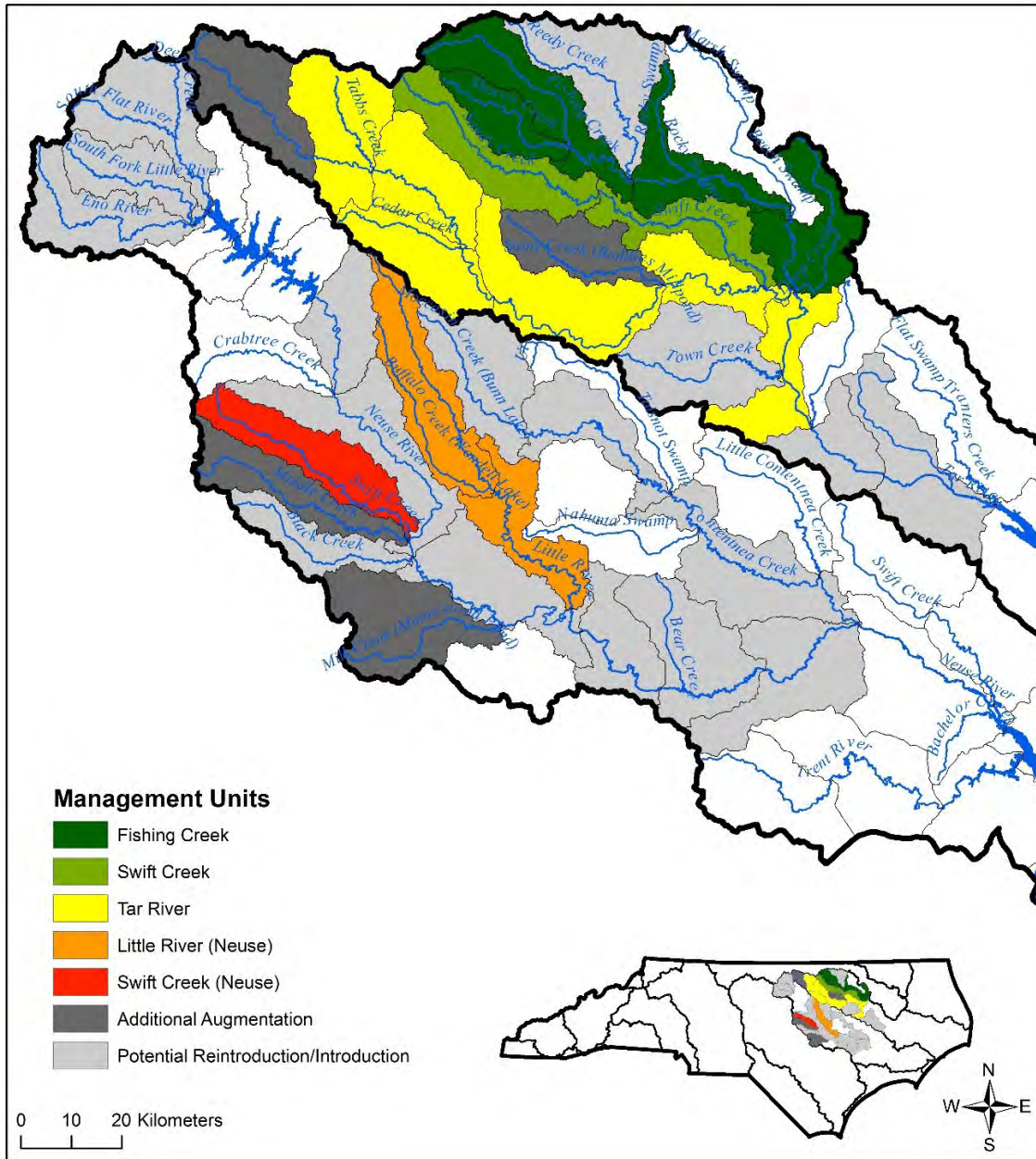
Occurrences by HUC 10 Watershed of the Yellow Lance (*Elliptio lanceolata*) and Survey Locations



Map created by Tyler Black Ph.D. 9/5/2017 Data Sources: NC Wildlife Resources Commission

Figure 3. Distribution map of the Yellow Lance (*Elliptio lanceolata*) within the Neuse and Tar-Pamlico river basins depicting 10-digit hydrologic units (colored and categorized based on year of observation), collection locations (black dots), and survey locations (gray dots).

Yellow Lance (*Elliptio lanceolata*) Management Units



Map created by Tyler Black Ph.D. 9/5/2017 Data Sources: NC Wildlife Resources Commission

Figure 4. Management units of the Yellow Lance (*Elliptio lanceolata*) within the Neuse and Tar-Pamlico river basins depicting 10-digit hydrologic units (colored based management units and future management scenarios).

Tar River Spiny mussel (*Parvaspina steinstansana*)

Biological Information

Description and Taxonomic Classification

The Tar River Spiny mussel (*Parvaspina steinstansana* Johnson and Clarke 1983) is a state and federally endangered freshwater mussel that is restricted to the Neuse and Tar-Pamlico river basins of North Carolina. It is a small to medium-sized mussel with adults typically ranging between 30-50 mm in length; however, individuals reaching up to 60 mm have been documented. The Tar River Spiny mussel is one of three freshwater mussel species in North America that are characterized by the presence of spines. Short spines (up to 5 mm in length) are found on most young specimens (Bogan 2017). As many as 12 spines have been found on juveniles, but adults tend to lose some or all their spines as they mature (Bogan 2017). On the nacre, fine iridescent lines radiate from where the spines originate, helping to identify shells that have lost spines (Kendig 2014). The left valve contains two triangular pseudocardinal teeth. The right valve has two parallel pseudocardinals — one triangular and serrate (posterior) and one low and vestigial (anterior) (Johnson and Clarke 1983). The umbo is slightly elevated above the hinge line and more centrally located than that of *Elliptio* species, which sometimes exhibit a similar shell shape (Kendig 2014). The periostracum is smooth orange-brown and can be covered with greenish rays when young, becoming darker or blackish brown. The rays can become inconspicuous in adult mussels (Johnson and Clarke 1983). These mussels appear to have extensive wear and erosion around the umbo because they are older than their small size would suggest (Kendig 2014).

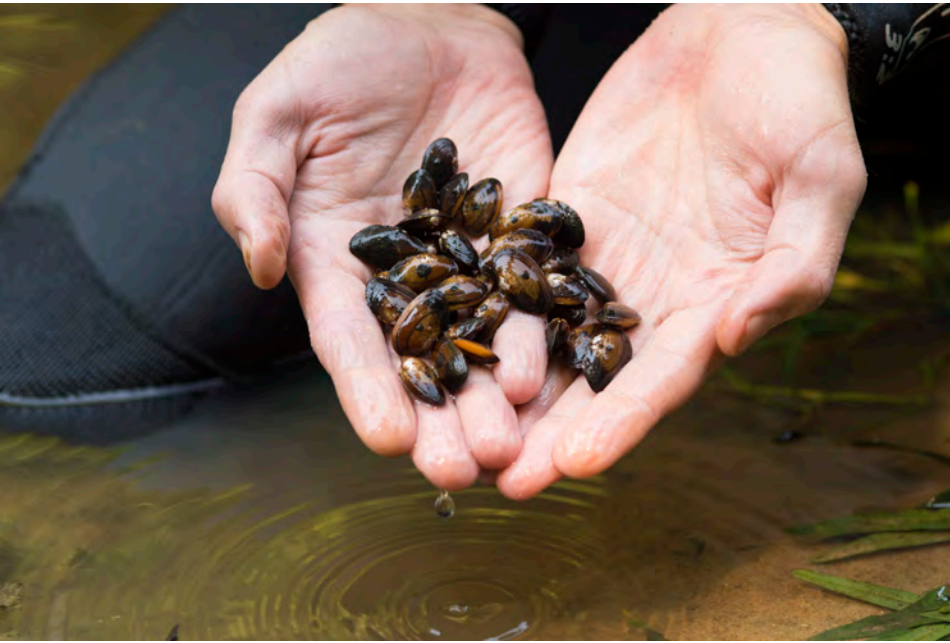
This species has been informally cited as “spiny naiad” by Shelly (1972), “*Canthyria* sp.” by Fuller (1977) and the “Tar River spiny mussel (*Canthyria* sp.)” by Biggins (1982). It was first formally described by Johnson and Clarke (1983) as *Elliptio (Canthyria) steinstansana*. The reasons for placement in the genus *Elliptio*, with *Canthyria* as a subgenus, are described by Clarke (1983; Section 3.4). A recent study examining the molecular systematics of the North American spiny mussels concludes that *Elliptio steinstansana* and *Pleurobema collina* (James Spiny mussel) form a monophyletic clade that is distinct from both *Elliptio* and *Pleurobema*, and a new genus (*Parvaspina* gen. nov.) is described to reflect this relationship (Perkins et al. 2017). **Etymology:** *steinstansana*, referring to the honorary naming of the Tar River Spiny mussel after Dr. Carol B. Stein and Dr. David H. Stansbery, who discovered the species in the Ohio State Museum of Natural History in 1964 and ownership of a specimen that was used in Shelly (1972) figures, respectively (Johnson and Clarke 1983).

Taxonomic Hierarchy (Integrated Taxonomic Information System 2017; Perkins et al. 2017):

Kingdom:	Animalia
Phylum:	Mollusca
Class:	Bivalvia
Order:	Unionoida
Family:	Unionidae
Genus:	<i>Parvaspina</i> (<i>Elliptio</i>)
Species:	<i>Parvaspina</i> (<i>Elliptio</i>) <i>steinstansana</i>

Distribution and Population Status

The Tar River Spiny mussel has a historical range that is restricted to the Neuse and Tar-Pamlico river basins in North Carolina. To date, Tar River Spiny mussel have been collected within 14 watersheds (i.e., 10-digit hydrologic units) in North Carolina (Figure 5, page 37). Within the past decade (2008 – 2017), Tar River Spiny mussel have been collected from two of three watersheds (67%) and three of 11 watersheds (27%) within the Neuse and Tar-Pamlico river basins, respectively. It is probable that the Tar River Spiny mussel may have once occurred throughout much of the Tar-Pamlico river basin prior to settlement of the area during the 1700s (USFWS 1992). In the Tar-Pamlico river basin, occurrence records exist in Chicod Creek, Fishing Creek, Little Fishing Creek,



Tar River Spiny mussel

Sandy Creek, Swift Creek, Shocco Creek, and the Tar River. In the Neuse River basin, it has been collected in the Little and Neuse rivers; however, historically it likely inhabited many waterways throughout the basin. Monitoring and other surveys for Tar River Spiny mussel have documented a continued decline in nearly all the surviving populations of the species. For example, a robust population of Tar River Spiny mussel in Swift Creek (Tar-Pamlico river basin) experienced a substantial mussel kill due to a chemical spill in 1990 (Fleming et al 1995). Although limited levels of reproduction and recruitment may be occurring within the Little Fishing Creek/Fishing Creek and Little River populations, the amount of recruitment

occurring does not appear to be at levels high enough to maintain these populations (USFWS 2014). All surviving populations are small to extremely small in number and restricted in range. Based on the most recent survey data within each river system, each of the surviving populations appears to be isolated from the other populations in the same river system by impoundments and/or extensive unoccupied stream reaches (USFWS 2014).

The Tar River Spiny mussel is listed as endangered in the state of North Carolina. The U.S. Fish and Wildlife Service on July 29, 1985 made a final ruling that the Tar River Spiny mussel be listed as an endangered species with protection provided by the Endangered Species Act of 1973.

Habitat and Life History

Habitat use of Tar River Spiny mussel

Tar River Spiny mussel is often found in relatively fast-flowing, well-oxygenated waters with a circumneutral pH. The substrate is usually composed of silt-free, clean, stable, gravel/coarse sand substrate (Alderman 1988). Many individuals have been found in a small, stable seam of habitat where the substrate transitions from cobble/pebble to sand/gravel.

Diet of Tar River Spiny mussel

The Tar River Spiny mussel is a filter feeder that feeds on a variety of particulate matter suspended in the water column, including algae, phytoplankton, zooplankton, bacteria, detritus, and dissolved organic matter (Haag 2012). Juveniles pedal feed by using the cilia on their foot to gather particulate matter from the substrate.

Reproduction of Tar River Spiny mussel

Similar to most freshwater mussels, the Tar River Spiny mussel has a complex life cycle that requires the use of a fish host to reproduce successfully. Freshwater mussels are dioecious. Sexually mature males release large quantities of sperm into the water column to begin the reproductive life cycle. For fertilization to occur, sperm must pass into the incurrent apertures of sexually mature females. The sperm travel through the aperture while the mussel is filter feeding and fertilize eggs in the suprabranchial chamber. The fertilized eggs are then transferred into the gill chambers, which form a modified brood pouch called the marsupium. While in the marsupium, the fertilized eggs quickly mature into the larval form known as glochidia. This process usually requires 2-6 weeks for maturation (Haag 2012).

The Tar River Spiny mussel is a short-term brooder (tachytictic). When its eggs develop into mature glochidia, they are released shortly thereafter into the water column to attach onto the gills of an appropriate fish host where the glochidia metamorphose from larvae to free-living mussels. In a hatchery setting, female Tar River Spiny mussel have been observed to become gravid multiple times in one spawning season and are known to release up to five broods between late March and early August (Eads and Levine 2009, R. Hoch personal communication). Glochidia remain on the host fish for a period of 27-39 days. During this time, glochidia receive nutrients from the fish blood and develop their internal organs such as a foot, digestive tract, and gills. They also form two adductor muscles (Eads and Levine 2008, Haag 2012). After glochidia complete their metamorphosis, they excyst from the gills of the host fish and settle into the substrate to live as juvenile freshwater mussels.

Fish Host Trials for Tar River Spiny mussel

To date, 18 fish species across seven families have been exposed to Tar River Spiny mussel glochidia (Eads and Levine 2008, Eads and Levine 2009, Levine et al. 2011, Eads and Levine 2015).

Effective Hosts: *Luxilus albeolus* (White Shiner), *Lythrurus matutinus* (Pinewoods Shiner), *Nocomis leptocephalus* (Bluehead Chub)

Poor Host: *Cyprinella analostana* (Satinfin Shiner), *Notemigonus crysoleucas* (Golden Shiner), *Notropis procerus* (Swallowtail Shiner), *Pimephales promelas* (Fathead Minnow), *Semotilus atromaculatus* (Creek Chub)

Ineffective Hosts: *Anguilla rostrata* (American Eel), *Enneacanthus gloriosus* (Bluespotted Sunfish), *Erimyzon oblongus* (Creek Chubsucker), *Esox americanus* (Chain Pickerel), *Etheostoma olmstedi* (Tessellated Darter), *Etheostoma vitreum* (Glassy Darter), *Lepomis auritus* (Redbreast Sunfish), *Moxostoma cervinum* (Blacktip Jumprock), *Noturus furiosus* (Carolina Madtom), *Percina roanoka* (Roanoke Darter)

Glochidia of Tar River Spiny mussel

Tar River Spiny mussel glochidia are very small (170 μm wide), hookless, and relatively spherical, which causes them to naturally lay with their hinge down (Eads and Levine 2008). The glochidia are packaged in a single row along the margin of a ribbon-like, flat conglutinate that is 5-7 mm long (Eads and Levine 2008). The only gravid females found in the wild had a very low percentage of the brood fertilized — less than 8%. However, when held in a hatchery setting, the percent of brood fertilized can regularly exceed 90%, with a typical fecundity of 3,000-10,000 glochidia (Eads and Levine 2014).

Conservation Management

Historical Conservation Efforts

The first targeted surveys for Tar River Spiny mussel were conducted in 1983 when Arthur Clarke surveyed throughout the Neuse, Tar, and Roanoke river basins (Clarke 1983). Since the late 1980s, biologists with the U.S. Fish and Wildlife Service (USFWS) and N.C. Wildlife Resources Commission have conducted both targeted surveys for Tar River Spiny mussel and general mussel surveys throughout its range. The USFWS and Wildlife Commission in 2007 began partnering with N.C. State University to conduct a continuing series of experiments investigating the life history of Tar River Spiny mussel. Research accomplishments include:

- finding gravid females in the wild, collecting individuals for broodstock to begin arking a population at a Wildlife Commission fish hatchery,
- identifying effective fish hosts,
- investigating life history characteristics and spawning periods,



- refining captive propagation and culture techniques,
- evaluating creeks for future augmentation through in situ monitoring of caged juveniles, and
- identifying appropriate habitats for future augmentations (Eads and Levine 2008, Eads and Levine 2009, Levine et al. 2011, Eads and Levine 2014, Eads and Levine 2015).

The Wildlife Commission established the Marion Conservation Aquaculture Center (MCAC) in 2008 at its Marion State Fish Hatchery in McDowell County, N.C., to preclude listing, promote delisting, and prevent the extinction of aquatic species when appropriate by using captive propagation and arking. Between December 2014 and September 2016, the Commission worked with the USFWS and other conservation partners to release more than 9,500 propagated Tar River Spiny mussel at four locations in Fishing Creek and Little Fishing Creek (Tar-Pamlico river basin). To evaluate the success of the initial augmentations, biologists individually tagged and measured 1,310 Tar River Spiny mussel, then released them into an experimental reach of Little Fishing Creek from December 2014 to October of 2015. In August 2015 and August 2016, biologists conducted a two-pass snorkel survey in the experimental stocking reach where they recaptured 35% of the released mussels from 2015 and 20% from 2016. Mean growth of recaptured individuals was 1.04 mm (SD=0.7 mm). Preliminary results suggest that stocking propagated individuals of Tar River Spiny mussel into the best available habitat may bolster dwindling populations and assist in the recovery of this species.

Threats

As with all aquatic species, there are many natural and anthropogenic factors that threaten the long-term viability of Tar River Spiny mussel. Extinction and decline of North American unionid bivalves can be traced to impoundment and inundation of riffle habitat throughout the United States. The loss of obligate hosts, coupled with increased siltation, and various types of industrial and domestic pollution have resulted in the rapid decline of the unionid bivalve fauna in North America (Bogan 1993, NCWRC 2015). Dams — both man-made and natural (created by beavers, see Kemp et al. 2012) — are barriers to dispersal of host fish and attached glochidia. Throughout the Neuse and Tar-Pamlico river basins, beavers have continued to build dams and impound an increasing number of river kilometers. Beaver dams not only inundate and alter riffle/run mussel habitat upstream of the dam, but also affect mussel populations downstream of the dam by increasing fluctuations in flow regime, decreasing dissolved oxygen levels, and increasing the variability of food quality and quantity (Hoch 2012, Kemp et al. 2012). Contaminants and water pollution are significant threats to all aquatic



High flow events contribute to increased sediment loads, turbidity throughout the water column, and stream bed movements that stress mussel populations. (Photo: Wikimedia)

species, especially mussels. Point-source discharges from municipal wastewater that contains monochloramine and unionized ammonia compounds are acutely toxic to freshwater mussels and may be responsible for glochidial mortality that results in local extirpation of mussels (Goudreau et al. 1993, Gangloff et al. 2009, NCWRC 2015). Impervious areas in urbanized watersheds contribute to high water levels, even during short rainfall events, which can result in flash flooding. These high or flashy flow events contribute to increased sediment loads, turbidity throughout the water column, and stream bed movements that stress mussel populations (Gangloff et al. 2009, NCWRC 2015). Climate change and development will likely bring additional stressors that need to be evaluated for mussels. Furthermore, specific pollutants that may be introduced into the aquatic environment, the interactions of pollutants and temperature (from climate change), salinity (related to sea level rise), and lower dilution (from altered flows) will need to be considered (NCWRC 2015). In addition, invasive species such as Asian Clam (*Corbicula fluminea*), Flathead Catfish (*Pylodictis olivaris*), and Hydrilla (*Hydrilla verticillata*) can create competitive pressures on food resources and habitat availability. These factors can decrease oxygen availability, cause ammonia spikes, alter benthic substrates, impact host fish communities, reduce stream flow, and increase sediment buildup (Belanger et al. 1991, Scheller 1997, NCANSMPC 2015, NCWRC 2015).

Conservation Goal

Wildlife Commission biologists are working to prevent the extinction of Tar River Spiny mussel and ensure its long-term viability as a member of the fauna of North Carolina for the next 100 years. A viable population will be indicated by multiple individuals, numerous age-classes, a stable or increasing population, and recruitment over multiple years.

Conservation Objectives

Wildlife Commission biologists have developed an overarching conservation strategy to promote habitat protection and maintain the best populations of Tar River Spiny mussel in the Tar-Pamlico river basin and focus all efforts within the Neuse River basin on the Little River. Restoration of habitat should be promoted for hydrologic units listed under Objective 1 and should focus primarily on the protection of riparian habitat and associated uplands.

1. Promote habitat protection and maintain for one population of Tar River Spiny mussel in the Neuse River basin and three populations in the Tar-Pamlico river basin (Figure 6, page 38). Management Units (MUs) will be defined based on hydrologic units (i.e., HUC10s).
 - a. **Neuse River Basin**
 - i. Little River MU (0302020115, 0302020116)
 - b. **Tar-Pamlico River Basin**
 - i. Fishing creek MU (0302010201, 0302010202, 0302010203, 0302010205, 0302010206)
 - ii. Swift creek MU (0302010107, 0302010108)
 - iii. Tar River MU (0302010103, 0302010104, 0302010106, 0302010109, 0302010302)
2. Maintain an ark population of Tar River Spiny mussel from the Neuse and Tar-Pamlico river basin broodstock.
3. Utilize captive propagation and/or translocations to augment or establish subpopulations of Tar River Spiny mussel where appropriate habitat exists (pending approval from the Habitat, Nongame and Endangered

Species Committee). To reduce the potential regulatory burden associated with the federal Endangered Species Act, a tool such as Safe Harbor will be established prior to reintroduction into an unoccupied area.

- a. All Neuse and Tar-Pamlico river basin MU hydrologic units listed above.
- b. Additional augmentation areas within the known range of Tar River Spiny mussel (Figure 6, page 38), if propagation efforts exceed MU needs.
 - i. **Neuse River Basin**
 1. Neuse River (0302020117)
 - ii. **Tar-Pamlico River Basin**
 1. Chicod Creek (0302010306)
 2. Tar River (0302010304)
- c. Potential reintroduction or introduction of Tar River Spiny mussel (Figure 6) into areas within the presumed historical range, if propagation efforts exceed MU needs. Ideally located in areas with reduced likelihood of anthropogenic threats.
 - i. **Neuse River Basin**
 1. Black Creek (0302020112)
 2. Contentnea Creek (0302020301, 0302020302, 0302020304, 0302020307)
 3. Eno River (0302020103)
 4. Flat River (0302020101)
 5. Little River (0302020102)
 6. Middle Creek (0302020109)
 7. Mill Creek (0302020113)
 8. Neuse River (0302020107, 0302020111, 0302020201, 0302020202, 0302020303)
 9. Swift Creek (0302020110)
 - ii. **Tar-Pamlico River Basin**
 1. Stony Creek (0302010105)
 2. Tar River (0302010101, 0302010102)
 3. Town Creek (0302010301)
4. Establish connectivity and gene flow between existing and established populations by either translocating individuals or removing barriers.
5. Reestablish historical populations of Tar River Spiny mussel after habitat threats have been reduced.

Research Needs

1. Monitor Tar River Spiny mussel populations every 2-5 years to assess survival, abundance, population structure, recruitment, and genetic diversity.
2. Develop captive propagation techniques to maximize yield, genetic diversity, and post release survival.
3. Determine locations for establishing Tar River Spiny mussel populations and monitor the success of population establishment.
4. Determine the genetic diversity and number of genetically distinct populations of Tar River Spiny mussel throughout its range
5. Develop microsatellite markers or similar genetic tagging techniques to determine age structure, parentage, and hatchery contribution to wild stock.

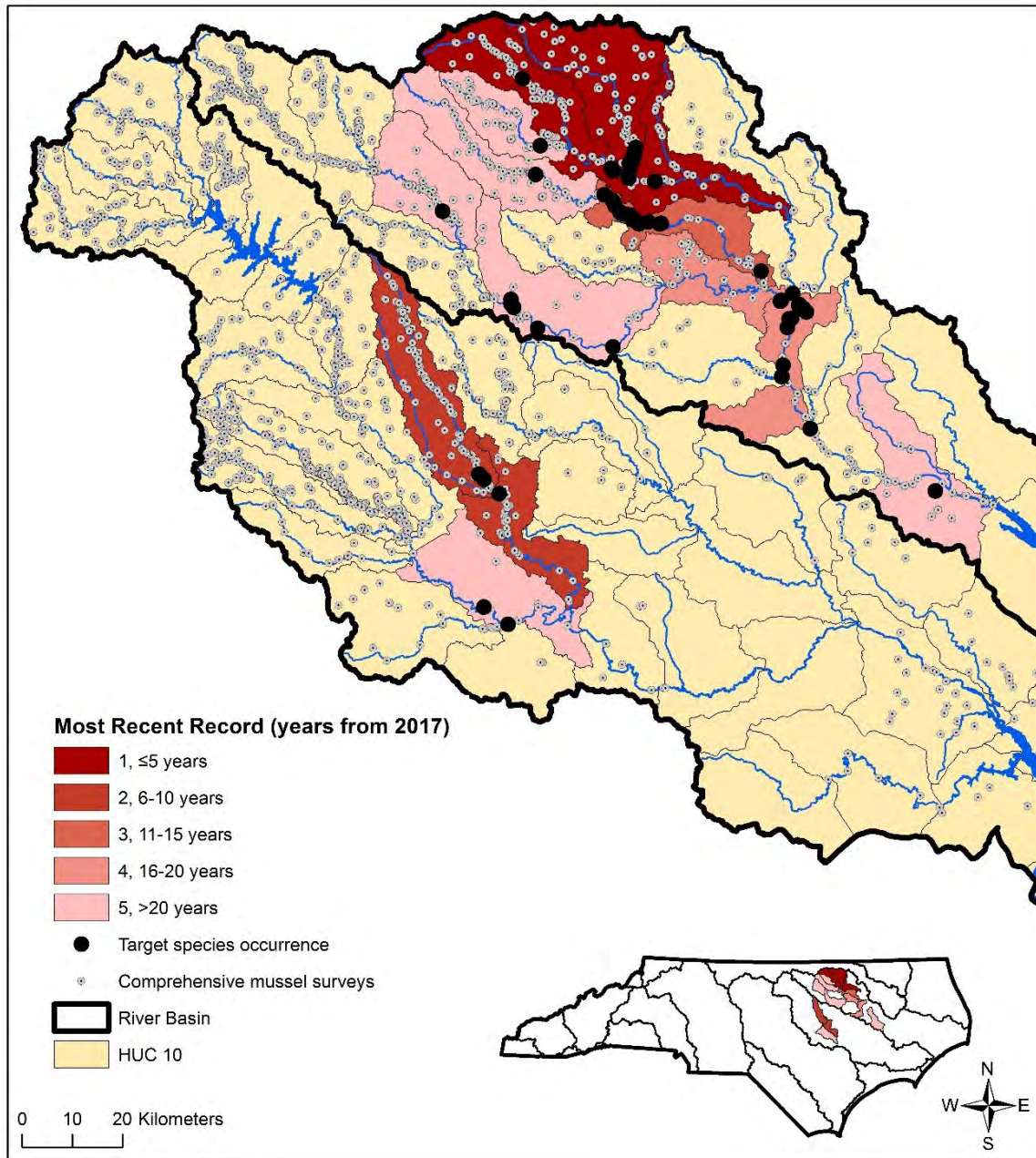
6. Monitor host fish abundance, population structure, and recruitment.
7. Develop techniques to reduce the abundance of Asian Clam.
8. Determine the known historical range of Tar River Spiny mussel by verifying the identification of specimens held in museum collections.
9. Determine the impact of Flathead Catfish on Tar River Spiny mussel host fish populations.

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Occurrences by HUC 10 Watershed of the Tar River Spiny mussel (*Parvaspina steinstansana*) and Survey Locations



Map created by Tyler Black Ph.D. 9/5/2017 Data Sources: NC Wildlife Resources Commission

Figure 5. Distribution map of the Tar River Spiny mussel (*Parvaspina steinstansana*) within the Neuse and Tar-Pamlico river basins depicting 10-digit hydrologic units (colored and categorized based on year of observation), collection locations (black dots), and survey locations (gray dots).

Tar River Spiny mussel (*Parvaspina steinstansana*) Management Units

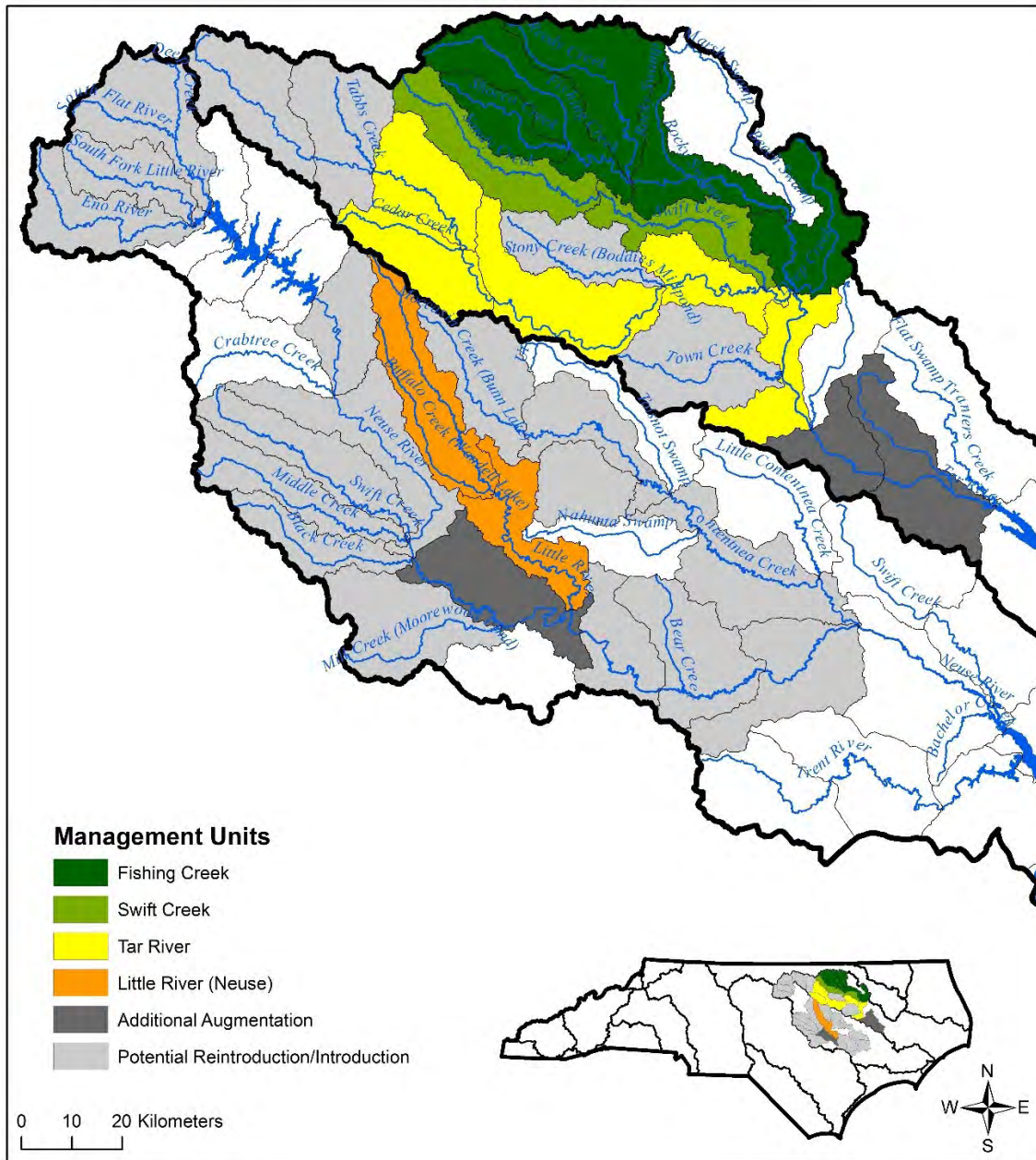


Figure 6. Management units the Tar River Spiny mussel (*Parvaspina steinstansana*) within the Neuse and Tar-Pamlico river basins depicting 10-digit hydrologic units (colored-based management units and future management scenarios).

Carolina Madtom (*Noturus furiosus*)

Biological Information

Description and Taxonomic Classification

The Carolina Madtom (*Noturus furiosus*) (Jordan and Meek 1889), is a small, rare catfish restricted to the Neuse and Tar-Pamlico river basins in North Carolina. Catfishes within the genus *Noturus* are often referred to as “madtoms” and are easily distinguished from other catfishes by an adipose fin that is fused to the body along the entire length. The Carolina Madtom is a member of the subgenus *Rabida*, which includes 15 species that often exhibit boldly marked black and yellow dorsal saddles and curved pectoral spines equipped with prominent, curved serrae. Furthermore, the Carolina Madtom is easily distinguished from other madtom species within the Neuse and Tar-Pamlico river basins because it is the only species to exhibit distinct black saddles (3-4) and curved pectoral spines with large serrae. Adults often range from 36 to 84 mm in length (Burr 1997). Etymology: *furiosus* = “mad” or “raging,” referring to the strongly serrate pectoral spines that are armed with a virulent venom (Jordan 1889).

Taxonomic Hierarchy (Integrated Taxonomic Information System 2017):

Kingdom:	Animalia
Phylum:	Chordata
Class:	Actinopterygii
Order:	Siluriformes
Family:	Ictaluridae
Genus:	<i>Noturus</i>
Species:	<i>Noturus furiosus</i>

Distribution and Population Status

The Carolina Madtom is endemic to the Piedmont and Coastal Plain of the Neuse and Tar-Pamlico river basins in North Carolina (Figure 7, page 46). The historical range of the Carolina Madtom included all major and many minor tributaries to the Neuse and Tar-Pamlico river basins (Burr et al. 1989). Within the Neuse River basin, the Trent River sub-basin represents a disjunct population because it is isolated from the Neuse River by brackish water.

Surveys for Carolina Madtom occurred in the 1960s (Bayless and Smith 1962; Smith and Bayless 1964), the 1980s (Burr et al. 1989), and 2007 (Wood and Nichols 2011). Specifically, the N.C. Wildlife Resources Commission conducted basin-wide rotenone surveys for fishes in the 1960s and collected Carolina Madtom at 26 of 281 sampling stations. In the 1980s, Burr et al. (1989) surveyed 31 localities within the Neuse and Tar-Pamlico river basins, collected Carolina Madtom at 17 localities, and described the species abundance as rare or uncommon. Wood and Nichols’ (2011) surveys at 30 sites throughout the range of the Carolina Madtom detected the species at 11 sites.

In 1977, the status of Carolina Madtom was listed as “special concern” by Bailey, although no rationale for this status was given. In 1987, Menhinick evaluated the Carolina Madtom and determined that it warranted no special conservation status because Carolina Madtom were found at 38 sites from 23 different streams. However, Burr (1997) identified the Carolina Madtom as “special concern.” Due to limited distribution and presumed declines, Carolina Madtom was up-listed from Special Concern to State Threatened in 2006. Wood and Nichols (2011) found strong evidence for a decrease in the occupied range of Carolina Madtom by examining data from the 1960s, 1980s, and 2007 surveys. They noted a decrease in the frequency of occurrence (FOO; no. of sites Carolina Madtom detected/no. of sites surveyed) from 0.70 in the 1960s to 0.37 in 2007. However, this decrease was exclusively due to declines in the Neuse River basin, where FOO dropped from 0.80 in the 1960s to 0.13 in 2007. FOO in the Tar-Pamlico river drainage remained virtually unchanged (Figure 7, page 46; Wood and Nichols 2011). A subset of the sites surveyed in all three studies of the Neuse River basin (Bayless and Smith 1962; Burr et al. 1989;



Carolina Madtom

Wood and Nichols 2011) noted the same pattern. Burr et al. (1989) found Carolina Madtom at only 60% of the sites where they had been found in the Neuse River basin by Bayless and Smith (1962). The 2007 surveys revealed that Carolina Madtom were found at only 13% of the sites in the Neuse River basin where they were found by Bayless and Smith (Wood and Nichols 2011). Within the Neuse River basin, the only remaining populations inhabit Contentnea Creek and Little River (Woods and Nichols 2011). The Tar-Pamlico river basin still contains good populations of Carolina Madtom in Fishing Creek, Swift Creek, and the main stem of the Tar River. As previously noted, there was no change in the Tar-Pamlico river basin populations of Carolina Madtom from the 1960s to 2007, indicating stability in this drainage (Wood and Nichols 2011).

The Wildlife Commission currently classifies Carolina Madtom as threatened. The NC Natural Heritage Program categorizes Carolina Madtom as S2, G2 – Imperiled. The Center for Biological Diversity has filed a petition with the US Fish and Wildlife Service (USFWS) to designate Carolina Madtom as either threatened or endangered (CBD 2010). This resulted in a positive 90-day finding. A range wide Species Status Assessment (SSA) Report was recently completed by the USFWS and provides a comprehensive review of the Carolina Madtom (USFWS 2017). The USFWS is now conducting a 12-month finding for this species to determine if it merits listing under the Endangered Species Act of 1973.

Habitat and Life History

Habitat use of Carolina Madtom

Carolina Madtom typically inhabit medium to large streams with moderate flow and sand, gravel, cobble and detritus substrates (Burr et al. 1989; Burr 1997; Midway et al. 2010). Specifically, Midway et al. (2010) found that Carolina Madtom use water depths of 0.1 to 0.19 m, water velocities of 0.10 – 0.24 m/s, and substrates of sand, gravel, and cobble. Cover objects occupied by Carolina Madtom often include cobble, boulder, woody debris, leaf packs, mussel shells, and beverage cans or bottles (Burr et al. 1989; Midway et al. 2010; Wood and Nichols 2011).

Diet of Carolina Madtom

Adult and young Carolina Madtom are nocturnal, benthic insectivores that feed primarily on immature aquatic insects (Burr et al. 1989). Comparisons between spring and summer diets indicate that Carolina Madtom forage on elmid larvae (riffle beetles) in the spring and shift to simuliid larvae (black flies), ephemeropteran nymphs (mayflies) and trichopteran larvae (caddisflies) in the summer (Burr et al. 1989). In addition, Burr et al. (1989) observed that the presence of chironomid larvae (midges) and odonate nymphs (dragonflies and damselflies) did not change between seasons.

Reproduction of Carolina Madtom

The sex ratio for Carolina Madtom is 1:1. Reproduction has been observed to occur between mid-May and late-July when water temperatures range from 18-25° C (Burr et al. 1989; Wood and Nichols 2011; NCWRC unpublished data). Nesting occurs within or under cover objects (e.g., cobble or boulder, mussel shells, beverage cans or bottles) that are located within runs upstream of riffles or pools with moderate flow (Burr et al. 1989). Parental care of eggs and young is likely provided by the male. Females reach sexual maturity within two years and can produce clutch sizes of approximately 80 to 300 eggs (Burr et al. 1989). The age at which males reach sexual maturity is unknown; however, males guarding nesting sites were 2 to 4 years old (Burr et al. 1989).

Conservation Management

Historical Conservation Efforts

To date, conservation efforts for Carolina Madtom have focused on monitoring surveys and acquisition of conservation lands or conservation easements. Wildlife Commission biologists conducted targeted surveys for Carolina Madtom throughout its range in 2007 to update its current distribution and status. The Commission also partnered with N.C. State University (NCSU) in the same year to examine habitat suitability for Carolina Madtom across its range. The Commission partnered with NCSU again in 2016 to repeat the surveys conducted in 2007, and complete a genetic evaluation of the different Carolina Madtom populations to guide future broodstock collection and augmentation efforts.

Threats

As with all aquatic species, there are many natural and anthropogenic factors that threaten the long-term viability of Carolina Madtom (USFWS 2017). The primary threats to Carolina Madtom include an apparent decline related to invasive species and habitat degradation. It is suspected that Flathead Catfish (*Pylodictis olivaris*) were introduced into the Neuse and Tar-Pamlico river basins in 1980s or 1990s. Since introduction, Flathead Catfish have expanded throughout the Neuse and Tar-Pamlico river basins and currently inhabit a substantial portion of the historical range of Carolina Madtom (Figure 8, page 47). Diet analysis and feeding chronology of Flathead Catfish in North Carolina indicate that the species is an opportunistic generalist that exhibits an ontogenetic dietary shift (300 mm TL) to larger prey items, such as centrarchids, clupeids, and ictalurids (Pine et al. 2005; Baumann and Kwak 2011). Furthermore, Flathead Catfish are known to restructure or suppress native fish communities directly through predation and cause rapid and substantial declines in native catfish populations (Guier et al. 1981; Pine et al. 2005; Dobbins et al. 2012). Currently, there are two known sympatric populations of Carolina Madtom and Flathead Catfish. However, few Carolina Madtom have been observed in these areas, potentially indicating rapid extirpation of Carolina Madtom after Flathead Catfish invades.



Flathead Catfish may be extirpating Carolina Madtom from shared habitats by direct predation, competition for prey and competition for cover habitat.

Suspected mechanisms for Carolina Madtom extirpation related to Flathead Catfish introductions include direct predation, competition for prey, and competition for cover habitat. In addition, invasive species such as Asian Clam (*Corbicula fluminea*) and Hydrilla (*Hydrilla verticillata*) can create competitive pressures on food resources and habitat availability. These factors can decrease oxygen availability, alter benthic substrates, impact fish communities, reduce stream flow, and increase sediment buildup (Belanger et al. 1991, NCANSMPC 2015, NCWRC 2015). Dams — both manmade and natural (created by beavers, see Kemp et al. 2012) — are robust barriers to fish dispersal and alter natural temperature and flow regimes. Contaminants and water pollution are significant threats to all aquatic species. Impervious areas in urbanized watersheds contribute to high water levels, even during short rainfall events, which can result in flash flooding. These high or flashy flow events contribute to increased sediment loads, turbidity throughout the water column, and stream bed movements (NCWRC 2015). Climate change and development will likely bring additional stressors that need to be evaluated for fish. Furthermore, specific pollutants that may be introduced into the aquatic environment, the interactions of pollutants and temperature (from climate change), salinity (related to sea level rise), and lower dilution (from altered flows) will need to be considered (NCWRC 2015).

Conservation Goal

Wildlife Commission biologists are working to prevent the extinction of Carolina Madtom and ensure its long-term viability as a member of the fauna of North Carolina for the next 100 years. A viable population will be indicated by multiple individuals, numerous age-classes, a stable or increasing population, and recruitment in the wild over multiple years.

Conservation Objectives

Wildlife Commission biologists have developed an overarching conservation strategy to promote habitat protection and maintain the best populations of Carolina Madtom in the Tar-Pamlico river basin and focus efforts within the Neuse River basin on Contentnea Creek and Little River. Restoration of habitat should focus on areas that have not been invaded by Flathead Catfish and should focus primarily on the protection of riparian habitat and associated uplands.

1. Promote habitat protection and maintain for two populations of Carolina Madtom in the Neuse River basin and three populations in the Tar-Pamlico river basin (Figure 9, page 48). Management Units (MUs) will be defined based on hydrologic units (i.e., HUC10s).
 - a. **Neuse River Basin**
 - i. Contentnea Creek MU (0302020304)
 - ii. Little River MU (0302020115, 0302020116)
 - b. **Tar-Pamlico River Basin**
 - i. Fishing Creek MU (0302010202, 0302010203, 0302010205)
 - ii. Swift Creek MU (0302010107, 0302010108)
 - iii. Tar River MU (0302010102, 0302010103, 0302010104)
2. Establish and maintain an ark population of Carolina Madtom from Neuse and Tar-Pamlico river basin broodstock.
3. Utilize captive propagation and/or translocations to augment or establish populations of Carolina Madtom where appropriate habitat exists (pending approval from the Habitat, Nongame and Endangered Species Committee). To reduce the potential regulatory burden associated with the federal Endangered Species Act, a tool such as Safe Harbor will be established prior to reintroduction into an unoccupied area.
 - a. All Neuse and Tar-Pamlico river basin MU hydrologic units listed above.
 - b. Additional augmentation areas within the known range of Carolina Madtom (Figure 9, page 48), if propagation efforts exceed MU needs, and threat of Flathead Catfish invasion is low or threats related to Flathead Catfish populations have been reduced.
 - i. **Neuse River Basin**
 1. Eno River (0302020103)
 2. Contentnea Creek (0302020306, 0302020307)
 3. Middle Creek (0302020109)
 4. Mill Creek (0302020113)
 5. Neuse River (0302020107, 0302020111, 0302020117, 0302020201, 0302020202, 0302020203, 0302020206)

6. Swift Creek (0302020110)
7. Trent River (0302020401, 0302020402)
- ii. **Tar-Pamlico River Basin**
 1. Beech Swamp (0302010204)
 2. Fishing Creek (0302010206)
 3. Tar River (0302010106, 0302010109, 0302010302)
 4. Town Creek (0302010301)
- c. Potential reintroduction or introduction of Carolina Madtom (Figure 9, page 48) into areas within the presumed historical range, if propagation efforts exceed MU needs. Ideally located in areas with reduced likelihood of anthropogenic threats and invasion by Flathead Catfish.
 - i. **Neuse River Basin**
 1. Contentnea Creek (0302020301, 0302020303)
 2. Black Creek (0302020112)
 3. Falls Lake (0302020104, 0302020105, 0302020106)
 4. Flat River (0302020101)
 5. Little River (0302020102)
 - ii. **Tar-Pamlico River Basin**
 1. Shocco Creek (0302010201)
 2. Stony Creek (0302010105)
 3. Tar River (0302010101, 0302010304, 0302010306)
4. Establish connectivity and gene flow between existing and established populations by either translocating individuals or removal of barriers.
5. Reestablish historical populations of Carolina Madtom after invasive species or habitat threats have been reduced.

Research Needs

1. Monitor Carolina Madtom populations every 2-5 years with surveys replicating the methods of Wood and Nichols (2011).
2. Develop captive propagation techniques to maximize yield, genetic diversity, and post-release survival.
3. Delineate the distribution of Flathead Catfish and monitor the invasion rate.
4. Develop techniques to reduce the rate of Flathead Catfish invasion and population size.
5. Determine locations for establishing Carolina Madtom populations, and monitor the success of population establishment.
6. Determine the genetic diversity and number of genetically distinct populations of Carolina Madtom throughout its range.
7. Develop microsatellite markers or similar genetic tagging techniques to determine age structure, parentage, and hatchery contribution to wild stock.
8. Monitor the need for additional population or genetic augmentations.

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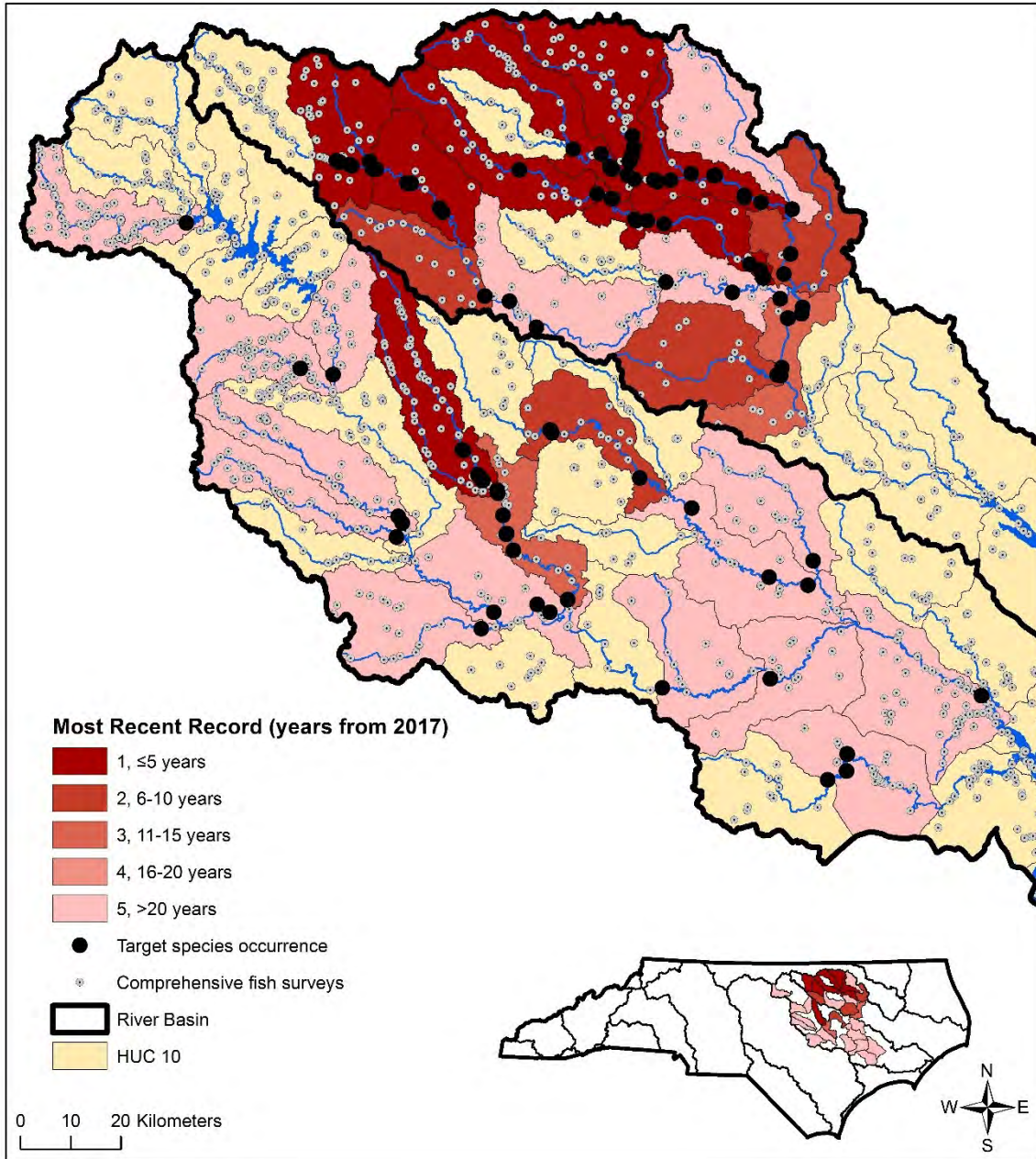
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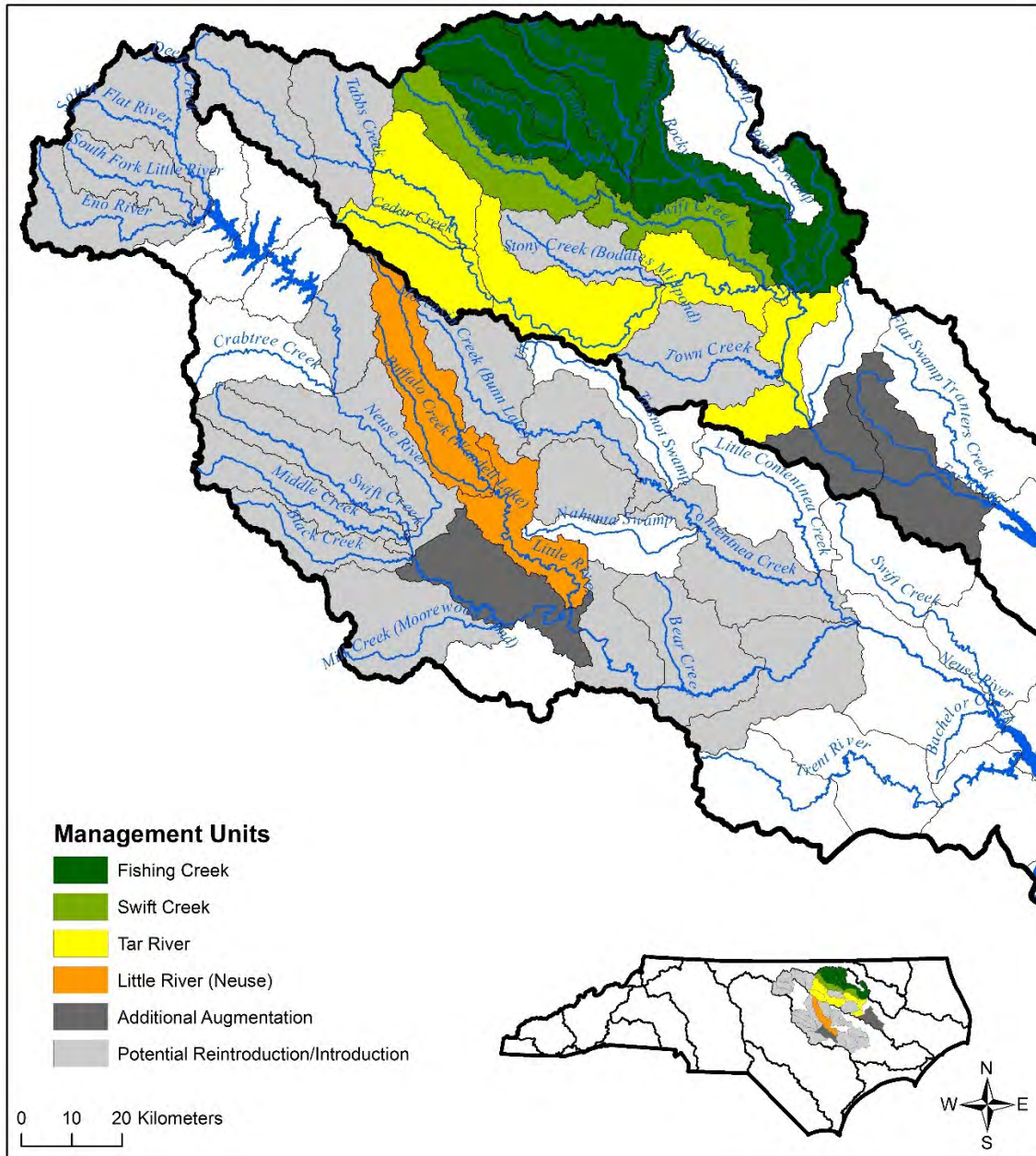
Occurrences by HUC 10 Watershed of the Carolina Madtom (*Noturus furiosus*) and Survey Locations



Map created by Tyler Black Ph.D. 9/5/2017 Data Sources: NC Wildlife Resources Commission

Figure 7. Distribution map of Carolina Madtom (*Noturus furiosus*) within the Neuse and Tar-Pamlico river basins depicting 10-digit hydrologic units (colored and categorized based on year of observation), collection locations (black dots), and survey locations (gray dots).

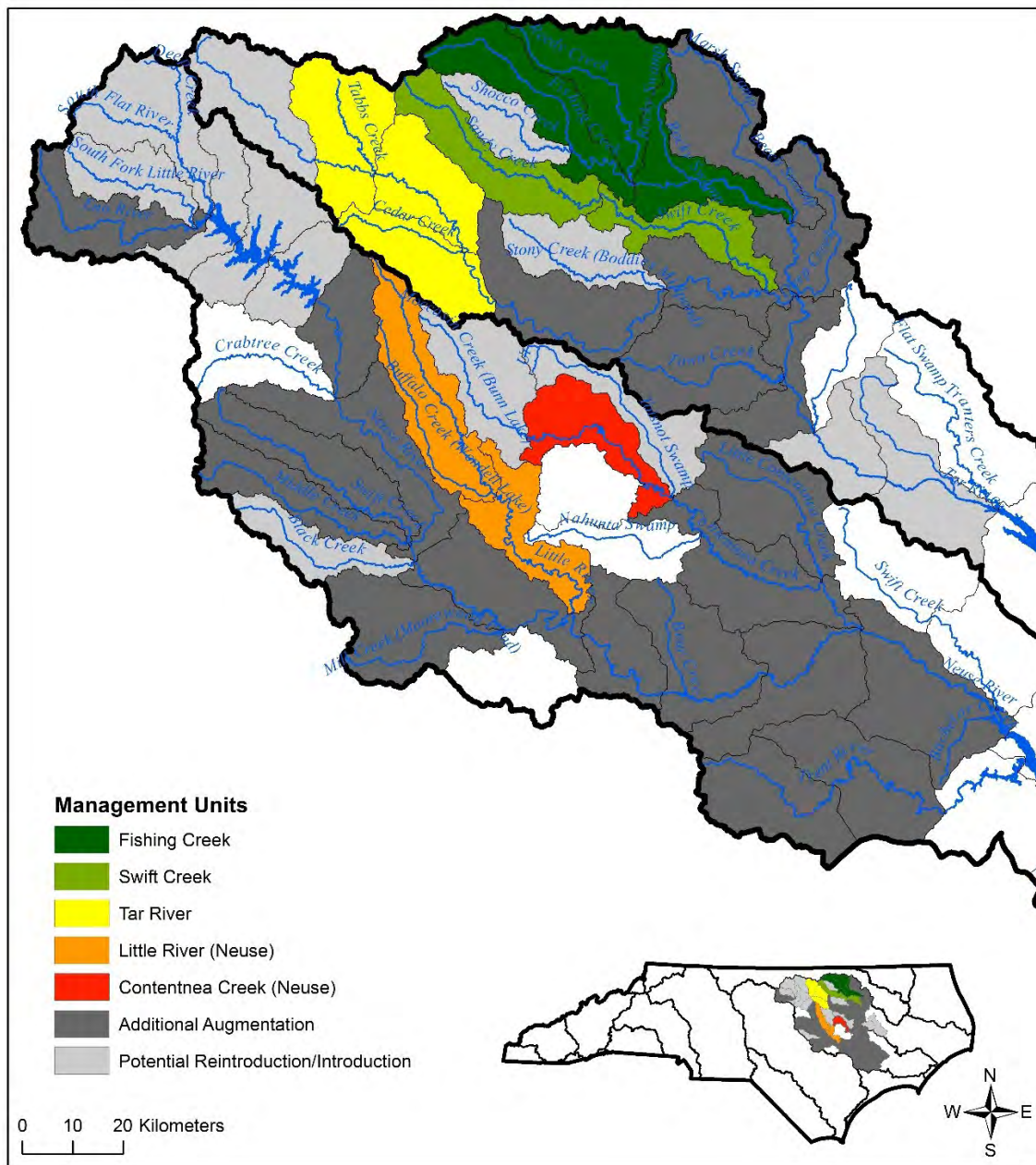
**Carolina Madtom (*Noturus furiosus*) and Invasive Flathead Catfish (*Pylodictis olivaris*)
Distribution Overlay**



Map created by Tyler Black Ph.D. 9/5/2017 Data Sources: NC Wildlife Resources Commission

Figure 8. Distribution map of Carolina Madtom (*Noturus furiosus*) and invasive Flathead Catfish (*Pylodictis olivaris*) within the Neuse and Tar-Pamlico river basins depicting 10-digit hydrologic units (colored-based species occurrence or distribution overlap).

Carolina Madtom (*Noturus furiosus*) Management Units



Map created by Tyler Black Ph.D. 9/5/2017 Data Sources: NC Wildlife Resources Commission

Figure 9. Management units of Carolina Madtom (*Noturus furiosus*) within the Neuse and Tar-Pamlico river basins depicting 10-digit hydrologic units (colored-based management units and future management scenarios).

Neuse River Waterdog (*Necturus lewisi*)

Biological Information

Description and Taxonomic Classification

Neuse River Waterdogs are from an ancient lineage of permanently aquatic salamanders in the genus *Necturus*. Adult Neuse River Waterdogs have been described by Bishop (1943), Brimley (1924), Cahn and Shumway (1926), Viosca (1937), and Hecht (1958), while the first accurate descriptions and illustrations of hatchlings and larvae were documented by Ashton and Braswell (1979).

Hatchlings are light brown in color with dark lines from each nostril through the eye to the gills, with a white patch behind the eye and above the line (Ashton and Braswell 1979). Their heads are round compared to the square, elongated heads of the adults. Hatchlings have melanophores scattered on the gills, upper surfaces of the legs, lower jaw, and parts of the head, with concentrations highest on the tail, making the tail darker than the head and trunk (Ashton and Braswell 1979). Hatchlings have developed forelimbs, with three complete toes and the fourth, inner toe that is only a bud. Its hindlimbs are pressed close to the lower tail fin and not fully developed (Ashton and Braswell 1979).



Adult Neuse River Waterdogs can be up to 9 inches long.

Adults lose the striped pattern, and the side melanophores decrease in intensity while the dorsal melanophores increase in intensity and definition, on top of a reddish-brown skin (Ashton and Braswell 1979). The underside is brown/gray and has dark spots but smaller than those on the back. Adults have a set of external bushy dark red gills. Their tails are laterally compressed, and each foot has four toes. Adults can be up to 9 inches long.

Taxonomic Hierarchy (Integrated Taxonomic Information System 2017):

Kingdom:	Animalia
Phylum:	Chordata
Class:	Amphibia
Order:	Caudata
Family:	Proteidae
Genus:	<i>Necturus</i>
Species:	<i>Necturus lewisi</i>

Distribution and Population Status

The Neuse River Waterdog is endemic to the Neuse and Tar-Pamlico river basins in North Carolina. Its historical distribution includes two physiographic provinces (Piedmont and Coastal Plain) comprising all major tributary systems of the Neuse and Tar-Pamlico, including the Trent River sub-basin (Braswell and Ashton 1985). Because of saltwater influence, the habitats in the Trent River system are isolated from the Neuse River and its tributaries. Therefore, we consider the Trent River system as a separate basin (i.e., population), even though it is technically part of the larger Neuse River basin.



Measuring a Neuse River Waterdog

A concerted effort to survey the range of Neuse River Waterdog was first conducted from 1978-81 (Braswell and Ashton 1985). More than 300 sites throughout the possible range of the species were trapped (Figure 10, page 54). A subset of those exact sites was trapped again from 2011-15 by Wildlife Commission staff and other partners, with 81 individuals captured. A comparison of 170 historical survey sites between time periods showed that 56% (95 of 170 sites) were positive during historical surveys compared to 37% (63 of 170 sites) during recent surveys. Trends in population “loss” or “gain” varied among sub-basins (Figure 11, page 55). Current conditions of the status of the Neuse River Waterdog and possible future scenarios are shown in Figure 12 (page 56).

Habitat and Life History

Habitat use of Neuse River Waterdog

The Neuse River Waterdog is endemic to the Neuse and Tar-Pamlico river basins of North Carolina. They are distributed from larger headwater streams in the Piedmont to coastal streams up to the point of saltwater intrusion. None have been found in lakes or ponds (Braswell and Ashton 1985). Braswell and Ashton (1985) noted that waterdogs are usually found in streams wider than 15 m and deeper than 1 m, and with a main channel flow rate greater than 0.1 m/sec. Further, these stream salamanders need clean, flowing water characterized by high dissolved oxygen concentrations (Brimley 1924, Braswell and Ashton 1985, Ashton 1985). The preferred habitats vary with the season, temperature, dissolved oxygen content, flow rate and precipitation (Ashton 1985). However, the waterdogs maintain home retreat areas under rocks, in burrows, or under substantial cover in backwater or eddy areas.

Diet of Neuse River Waterdog

Neuse River Waterdogs use both olfactory and visual cues to detect prey (Ashton 1985). Both adults and larvae are opportunistic feeders (Braswell and Ashton 1985). Most commonly, waterdogs lie in wait for a small organism to swim or float by (Ashton 1985). However, Neuse River Waterdogs also use other feeding techniques when they are active at night, often leaving their retreats to search actively for food. Larvae eat a variety of small aquatic arthropods (primarily ostracods and copepods), and adults eat larger aquatic arthropods and also any aquatic and terrestrial invertebrates (including hellgrammites, mayflies, caddisflies, crayfish, beetles, caterpillars, snails, spiders, earthworms, centipedes, millipedes, slugs) and some vertebrates (including small fish like darters and pirate perch) (Bury 1980, Braswell and Ashton 1985). All prey are ingested whole. Larger items are sometimes regurgitated and then re-swallowed.

Reproduction of Neuse River Waterdog

Neuse River Waterdogs reach sexual maturity at around 5.5-6.5 years, or at a length of 102 mm SVL (snout-vent length) for males and 100 mm SVL for females (Fedak 1971). The sexes are similar in appearance and can be distinguished only by the shape and structure of the cloacal area. Neuse River Waterdogs breed once per year, with mating in the fall/winter and spawning in the spring (Pudney et al. 1985). After courtship, the male will deposit a packet of sperm that the female places into her vent, thus fertilizing eggs internally (Pudney et al. 1985). During the spring (May-June), females will lay a clutch of ~25-90 eggs in a rudimentary nest, under large rocks in moderate currents (Braswell and Ashton 1985). Ashton (1985) noted that nest sites were often found under large bedrock outcrops or large boulders with sand and gravel beneath them, often placed there by the waterdogs. Females guard the nest (Braswell 2005).

Conservation Management

Historical Conservation Efforts

Conservation efforts to date have mainly consisted of conducting surveys for the Neuse River Waterdog throughout its range, and to monitor populations through repeated surveys. Initial survey efforts for the species were conducted throughout the species' possible range in the late 1970s and early 1980s (Braswell and Ashton 1985). Subsequent surveys were completed by Wildlife Commission staff and partners at a subset of historically surveyed sites from 2011-15. No other direct conservation actions for Neuse River Waterdogs has occurred, except for collecting tissue samples for ongoing genetic analysis.

Threats

As with all aquatic species, there are many natural and anthropogenic factors that threaten the long-term viability of Neuse River Waterdogs. Primary threats to Neuse River Waterdogs include a myriad issues that affect water quality, habitat quality, connectivity of populations, and possibly adverse effects from invasive species.

The USFWS Draft Species Status Assessment (2017) identifies the following general threats to the viability of Neuse River Waterdog populations:

1. Development and pollution
2. Improper agricultural practices
 - a. Nutrient and chemical pollution
 - b. Pumping for irrigation
 - c. Confined animal feeding operations
3. Improper forestry practices
4. Invasive species
5. Dams and other barriers
6. Energy production and mining
7. Climate change

Conservation Goal

Wildlife Commission biologists are working to prevent the extinction of the Neuse River Waterdog and ensure its long-term viability as a member of the fauna of North Carolina for the next 100 years. A viable population will be indicated by multiple individuals, numerous age-classes, a stable or increasing population, and recruitment in the wild over multiple years.

Conservation Objectives

Wildlife Commission biologists have developed an overarching conservation strategy to promote habitat protection and maintain the best populations of *N. lewisi* throughout the Neuse and Tar-Pamlico river basins, as well as the Trent River sub-basin. The Neuse River Waterdog appears to have maintained better populations in the Tar-Pamlico river basin compared to the Neuse River basin, comparing historical to more contemporary survey efforts.

More research is needed to determine why the species appears to have declined drastically in specific watersheds compared to others (e.g., compare land use, water quality, etc. in watersheds with seemingly different levels of population loss). Because the Trent River sub-basin is isolated from the rest of the species' range, concerted effort should be made to maintain that population. Augmentation and/or re-introduction of the species may prove useful in increasing populations. However, reasons for the decline of the species need to be determined and habitat assessments need to be made before these actions are implemented. To reduce the potential regulatory burden associated with the federal Endangered Species Act, a tool such as Safe Harbor will be established prior to re-introduction into an unoccupied area. Specific objectives include:

1. Work collaboratively with landowners adjacent to the species' habitat to protect riparian buffers and limit sediment runoff.
2. Work to remove barriers that limit interactions between Neuse River Waterdog populations.
3. Target point-source pollution issues and work to reduce issues related to water quality downstream of these sources.

4. Continue surveys and studies to increase knowledge about abundance, demography, and life history of Neuse River Waterdogs to manage specific populations better (e.g., the “best” remaining populations).

Research Needs

1. Improve our knowledge of population density, demographics, and land-use effects on populations of waterdogs.
2. Conduct genetic analysis of waterdog tissue samples to determine the effects of population declines on the species, and to determine whether distinct genetic populations exist.
3. Determine the effects of various pollutants on waterdog populations.
4. Monitor the need for additional population or genetic augmentation and possible re-introductions.

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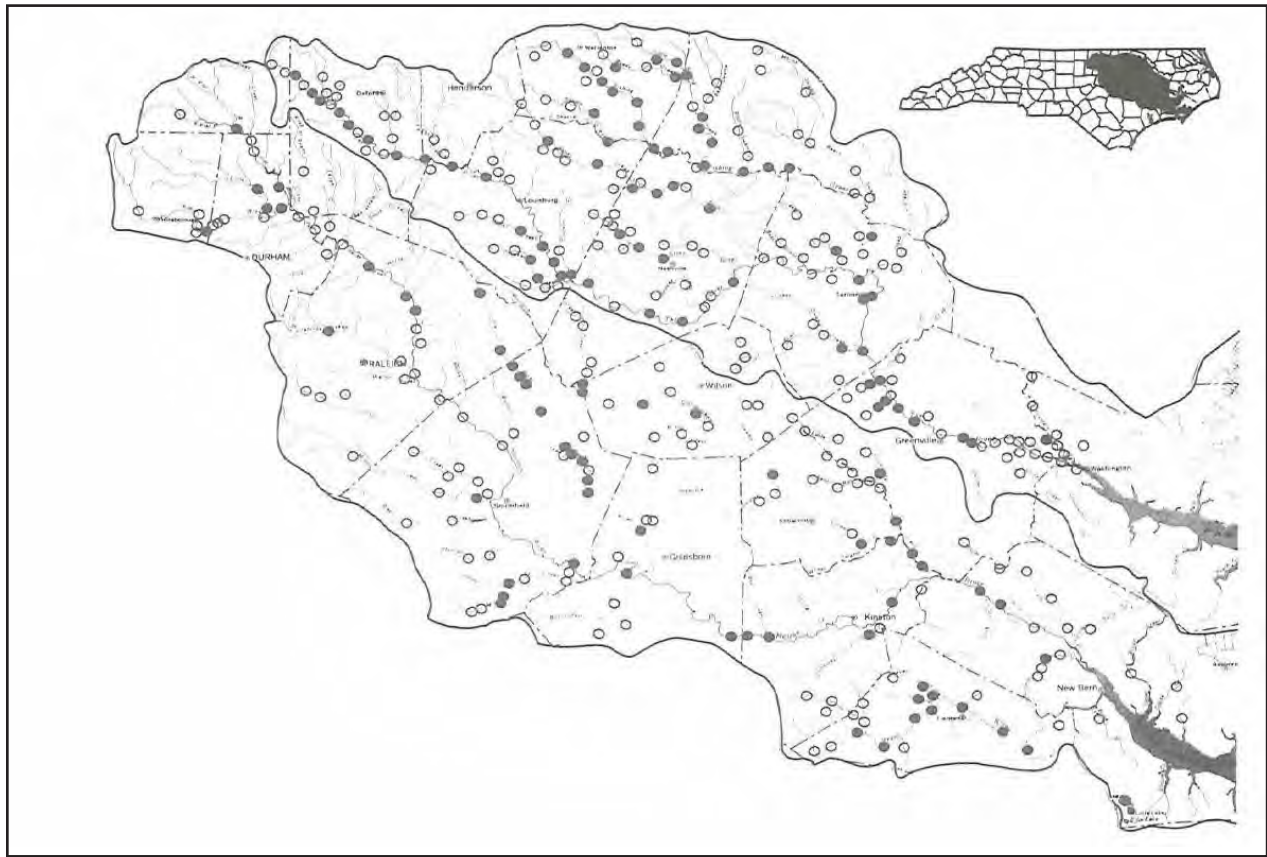
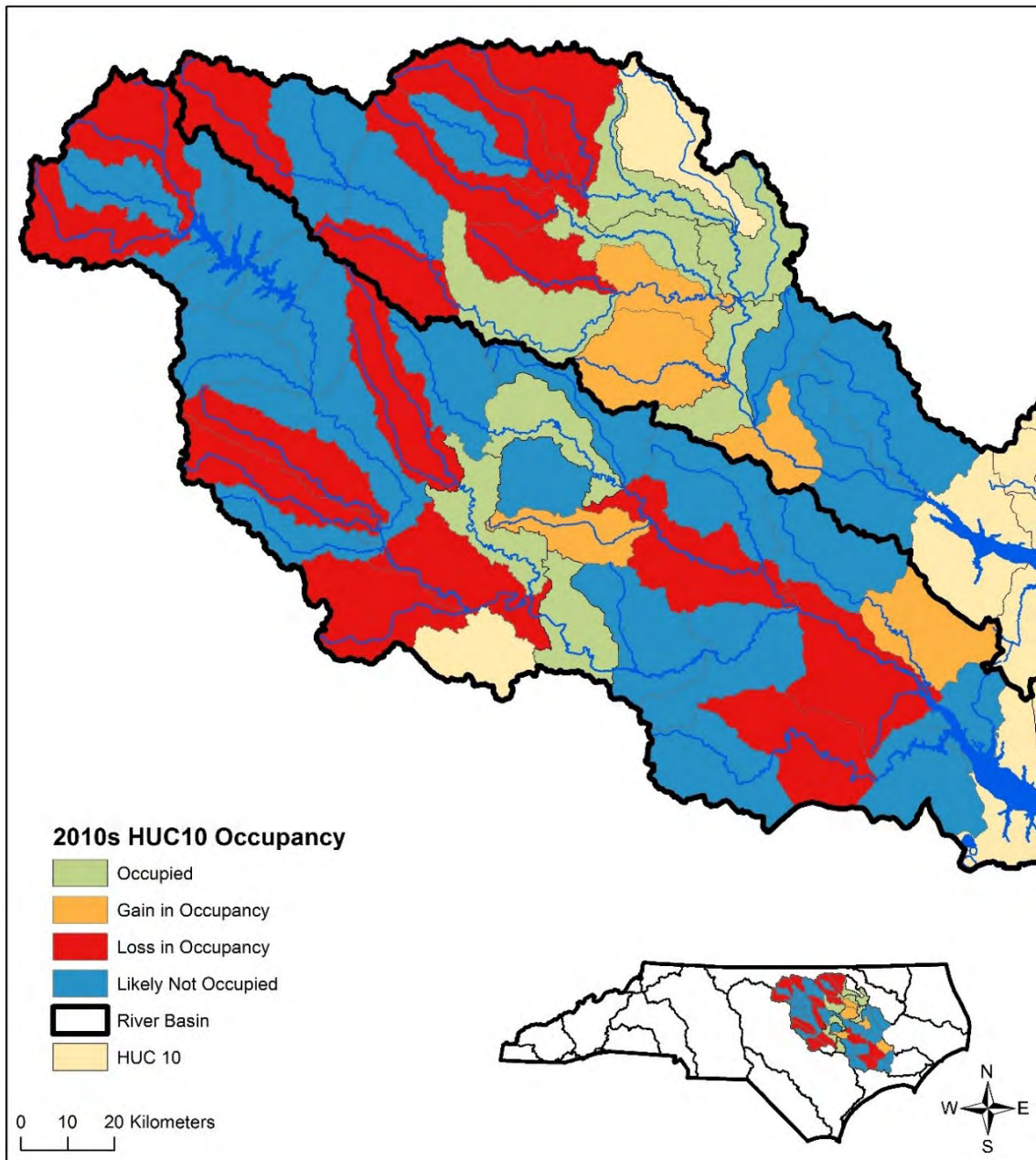


Figure 10. Historical surveys for Neuse River Waterdog (*Neoturus lewisi*) from Braswell and Ashton (1985). Closed circles indicate species presence and open circles indicate species absence.

Occurrences by HUC 10 Watershed of the Neuse River Waterdog (*Necturus lewisi*)



Map created by Tyler Black Ph.D. 9/5/2017 Data Sources: NC Wildlife Resources Commission

Figure 11. Occupancy observations for Neuse River Waterdog (*Necturus lewisi*) within the Neuse and Tar-Pamlico river basins depicting 10-digit hydrologic units.

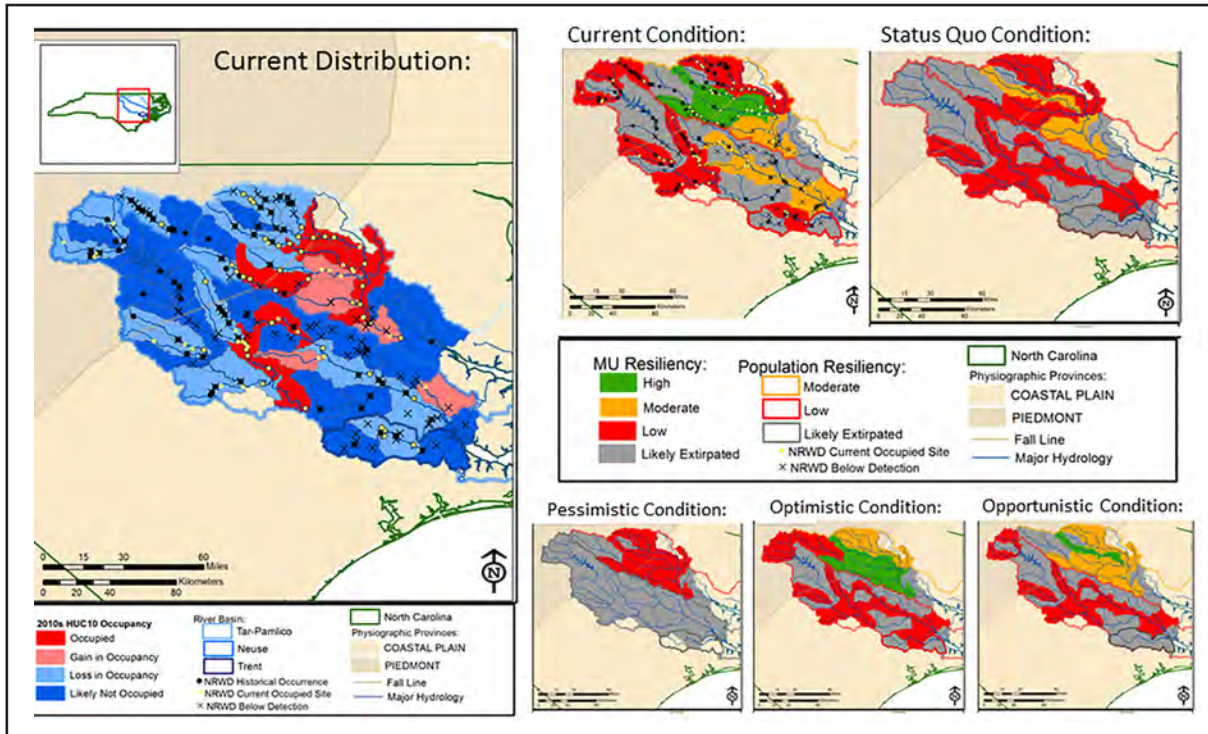


Figure 12. Current distribution and possible future scenarios concerning the status of the Neuse River Waterdog (USFWS 2017).

CONSERVATION ACTIONS

This section outlines conservation actions intended to guide activities needed to achieve conservation objectives. These conservation actions focus on protection and management of habitats, law enforcement, educational outreach, and fostering conservation partnerships.

Habitat Protection and Habitat Management

Federal, state, local, and private organizations own and protect significant habitats within the Neuse and Tar-Pamlico river basin. Publicly owned lands (game lands, national wildlife refuges, national forests, and state parks) include more than 274,000 acres. These lands help promote the viability of Carolina Madtom, Dwarf Wedgemussel, Neuse River Waterdog, Tar River Spynymussel, and Yellow Lance populations by protecting high-quality water resources and associated riparian habitats. However, long-term maintenance of viable populations will require additional habitat protection efforts within the species management units and high priority areas (i.e., 12-digit HUCs and riparian buffers) highlighted within the N.C. Wildlife Action Plan. Land acquisition will require support from a combination of federal, state, local, and private organizations and lands-management strategies should follow “best management practices” that maintain or improve water quality and natural flow regime. In addition, support will be needed to control beaver populations and exotic invasive species such as Asian Clam, Flathead Catfish, and Hydrilla. Forestry activities should incorporate forest practice guidelines (FPGs) or best management practices (BMPs) as required by certifying organizations such as those of the Sustainable Forestry Initiative/Forest

Stewardship Council/American Tree Farm System certification standards. This can help retain adequate conditions for aquatic ecosystems.

Permitting

State and federal biologists will review permit applications for projects that might impact waterways within the ranges of Carolina Madtom, Dwarf Wedgemussel, Neuse River Waterdog, Tar River Spiny mussel, and Yellow Lance.

Protective Laws

Federal

The Tar River Spiny mussel (*Parvaspina steinstansana*) and Dwarf Wedgemussel (*Alasmidonta heterodon*) are listed as Endangered by the U.S. Fish and Wildlife Service (USFWS), while the Yellow Lance (*Elliptio lanceolata*) is proposed to be listed as Threatened. These species are protected by regulations listed in the Code of Federal Regulations (CFR) that implement the Endangered Species Act of 1973, 87 Stat. 884, 16 U.S.C. 1531-1543. The USFWS regulates the import/export, take, possession, sale, and captive breeding of threatened and endangered wildlife under 50 CFR 17.21 and 50 CFR 17.31. Section 404 of the Clean Water Act (CWA) regulates the discharge of dredged or fill material into the waters of the United States, regulating such activities as fill for development, water resource projects (such as dams and levees), infrastructure development (such as highways and airports) and mining projects. Section 404 requires a permit that is reviewed by the U.S. Army Corps of Engineers before any of these activities commence. Under Section 401 of the CWA, an applicant for a federal license or permit to conduct any activity that may result in a discharge to water of the United States must provide the federal agency with a Section 401 certification that is issued by the N.C. Division of Water Resources (DWR). The CWA also prohibits anyone from discharging pollutants through a point source into waters of the United States unless they have a NPDES permit. The NPDES permit is issued by the DWR and contains limits on what can be discharged, monitoring and reporting requirements, and other provisions to ensure that the discharge does not hurt water quality, wildlife, or people's health. The Fish and Wildlife Coordination Act requires federal agencies that construct, license, or permit water-resource development projects to first consult with the USFWS and state fish and wildlife agencies regarding the impacts on fish and wildlife resources and measures to mitigate these impacts.

The Tar River Spiny mussel and Dwarf Wedgemussel are listed as Endangered by the U.S. Fish and Wildlife Service, while the Yellow Lance is proposed to be listed as Threatened.

State

The species in this conservation plan are listed on the protected wild animal list as endangered, threatened, or special concern. It is unlawful to take, possess, transport, sell, barter, trade, exchange, or export any animal on the protected wild animal list without a valid permit, as promulgated under North Carolina law and administrative code (15A NCAC 101 .0102), which defines these actions as a Class 1 misdemeanor (§ 113 337b).

Conservation Incentives

Several conservation incentive programs focus on restoring water quality by preventing runoff and siltation. Each of the following incentive programs, except for the N.C. Wildlife Conservation Land Program, comes from the Farm Bill.

The Conservation Reserve Program is administered by the Farm Services agency and pays a yearly rental payment in exchange for farmers removing environmentally sensitive lands from agriculture and planting species that will improve environmental quality. The Conservation Reserve Enhancement Program provides rental payments to landowners with high priority conservation issues in exchange for removal of these lands from farm production.

The Farmable Wetlands Program is designed to restore wetlands and wetland buffer zones that are farmed. It also provides annual rental payments to farmers willing to restore wetlands and establish planted buffers.

The Grassland Reserve Program works to prevent grazing and pasture land from being converted into cropland or used for development. In return, landowners receive an annual rental payment.

The Environmental Quality Incentives Program (EQIP) provides financial and technical assistance to farmers who plan and implement conservation practices that improve soil, water, plant, animal, air and related natural resources on agricultural land and on industrial private forestland.

The N.C. Wildlife Conservation Land Program provides tax incentives to landowners willing to manage priority habitats such as wetlands, or protected state-listed species. This program is administered by the Wildlife Commission, and allows landowners a reduced assessment for taxation purposes. Although this program has not been used much in eastern North Carolina, it has significant potential to improve habitat.

The N.C. Division of Mitigation Services (DMS) works with willing landowners who are interested in conservation efforts to improve and protect water resources. All projects that receive funding from DMS must offer perpetual conservation protection through the voluntary use of a conservation easement.

The N.C. Forest Service administers cost-sharing assistance through the Forest Development Program (FDP) to support prompt reforestation after timber harvesting and afforestation of fallow ag fields. The apparent linkage between the abundance of many candidate aquatic species populations, and their relatively close proximity to existing forested watersheds underscores the importance of supporting the FDP and other programs that encourage the sustainable management of forests.

Education and Outreach

Education and outreach are important components of managing imperiled aquatic species. Citizens who are well informed regarding the merits of an imperiled species, and the habitat that supports such species, can make better decisions and support sound conservation measures to secure those species' continued survival. A concerted effort needs to be made to educate anglers about the perils of moving fish between bodies of water and the ecological damage that invasive species, such as the flathead catfish, can cause. The Wildlife Commission needs

to continue informing the public about the ecological benefits of freshwater mussels, including filtering river water and serving as important sentinel species, among others.

Conservation Partnerships

Establishing and maintaining working relationships between governing bodies (federal, state, and local), universities, private landowners, private companies, and conservation organizations will be critical to maintain water quality and long-term persistence of Carolina Madtom, Dwarf Wedgemussel, Neuse River Waterdog, Tar River Spiny mussel, and Yellow Lance. Some potential partners within the Neuse and Tar-Pamlico river basins include:

- Duke Energy
- N.C. Department of Agriculture
- N.C. Department of Environmental Quality
- N.C. Division of Parks and Recreation
- N.C. Coastal Land Trust
- N.C. Natural Heritage Program
- N.C. State University
- N.C. Museum of Natural Sciences
- N.C. Cooperative Fish and Wildlife Research Unit
- N.C. Wildlife Federation (NCWF)
- Tar River Land Conservancy
- Triangle Land Conservancy
- U.S. Fish and Wildlife Service
- Various forestry associations

In the Little Tennessee River, the Wildlife Commission, Wildlife Federation, and others formed a broad partnership to achieve conservation goals. The Little Tennessee River was designated as a Native Fish Conservation Area and more than 20 government agencies, conservation organizations, corporations, and universities are now active partners. Many of the listed collaborator agencies/organizations in this conservation plan are represented on the Little Tennessee River Native Fish Conservation Partnership. Thus, the Native Fish Conservation Area model might be an effective tool to achieve similar goals in the Neuse and Tar-Pamlico river basins.



Yellow Lance

EXHIBIT C-3

December 10, 2020



Gopher Frog Conservation Plan for North Carolina



GOPHER FROG CONSERVATION PLAN for NORTH CAROLINA

Dec. 10, 2020



NORTH CAROLINA WILDLIFE RESOURCES COMMISSION



Gopher Frog in a "defensive" posture (Jeff Humphries)



Head-started juvenile Gopher Frog released on to Holly Shelter Game Land



Gopher Frog



Gopher Frog with transmitter



Surveying for Gopher Frogs



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Executive Summary

The U.S. Fish and Wildlife Service (USFWS) is evaluating the need to list the Gopher Frog (*Rana capito*) under the federal Endangered Species Act. In North Carolina, this species exists in low numbers across the southern Coastal Plain. Known populations have suffered major losses that are likely not recoverable. Only seven of the historical 23 populations remain (70% reduction). Only 14 of the original 53 pond sites remain. Egg mass data suggest that the total population of Gopher Frogs is 200-300 individuals. Those populations are fragmented and face numerous threats including disease, severe weather (especially long periods of drought), development, and lack of proper management. To maintain the Gopher Frog, the N.C. Wildlife Resources Commission will augment populations, where possible, through head-starting efforts and the creation of additional breeding habitats, work with partners to establish goals for each population, and determine and implement Best Management Practices for wetland and upland restoration and maintenance, including appropriate application of prescribed fire. The Wildlife Commission also will continue to pursue land acquisition and other land conservation practices in areas where Gopher Frogs exist, or where appropriate habitat can be restored, managed, or created where new populations may be introduced or re-introduced. Finally, the Commission will continue genetic analyses of Gopher Frog populations. The Commission may work to establish connectivity and gene flow between existing populations, potentially through translocation.



Juvenile Gopher Frog

Biological Information

Description and Taxonomic Classification

The Gopher Frog (*Rana capito*) is a medium-sized frog (7.2-9.4 cm in snout-vent length) with a gray to brownish dorsum containing many small dark gray to black spots. The venter is white, cream, or yellowish with dark speckling or mottling. This frog has a warty skin texture unlike that of most other North American *Rana*. Tadpole identification is difficult without experience. Key characteristics for North Carolina tadpoles were presented by Braswell (1993). Published keys to tadpole identification (e.g., Altig 1970 and Travis 1981) are virtually useless when trying to separate North Carolina *R. capito* from the Southern Leopard Frog (*R. sphenocephala*) and the Pickerel Frog (*R. palustris*). *Rana capito* was formerly known as the Carolina Crawfish Frog (*Rana areolata capito*) and the Carolina Gopher Frog (*Rana capito capito*), but no subspecies are currently recognized (Young and Crother 2001). Additionally, there have been two publications suggesting changes to the genus *Rana*. Frost et al. (2006) suggested changing *Rana* to *Lithobates*, while Yuan et al. (2016) argued for changing *Lithobates* back to *Rana*. Therefore, we use *Rana* for this publication. Various accounts of this species are found in Beane et al. (2010), Altig and Lohoefer (1983), Jensen and Richter (2005), and Dorcas et al. (2007).

Life History and Habitat

Gopher Frogs in North Carolina usually breed in isolated, fish-free, ephemeral wetlands (Braswell 1993). Adult frogs remain in upland burrows (principally stumpholes) during the non-breeding season. Adult frogs in North Carolina travel as far as 3.5 km from their breeding pond to a stumpole — a hole in the ground resulting from the decay of a tree's roots — and can use the same stumps as refugia from year-to-year (Humphries and Sisson 2012). Use of refugia is critical to survival of Gopher Frogs, especially for juveniles. Roznik and Johnson (2009a) found that Gopher Frog juveniles using refugia were 25 times less likely to be preyed upon than other juveniles. Furthermore, the only frogs that survived to the end of their study were those that found refugia within eight days of leaving a wetland.

The Gopher Frog is associated with the Longleaf Pine ecosystem in the southeastern United States. This ecosystem is considered critically endangered, having been reduced by more than 98% (Noss et al. 1995). The Gopher Frog requires both appropriate breeding ponds and upland terrestrial habitat. Breeding ponds must be large enough to retain water throughout the tadpole stage, but shallow enough to dry periodically, because the Gopher Frog does not tolerate fish. Additionally, these ponds must be relatively open-canopy and have a heavy herbaceous component. Gopher Frogs deposit their egg masses on the stems of herbaceous



Gopher Frogs usually breed in isolated, fish-free, ephemeral wetlands

vegetation, and developing tadpoles graze along these same herbaceous stems. Upland habitats used in more southern localities include preexisting refugia such as Gopher Tortoise burrows, stumpholes, and other naturally occurring holes (Bailey 1991; Blihovde 1999, 2000). Recent research showed similar terrestrial habitat usage in North Carolina (Humphries and Sisson 2012).

Breeding in North Carolina typically occurs from mid-February to mid-April, with most breeding occurring in March. Fall breeding also has been documented in North Carolina (Alvin Braswell field notes, WRC staff database). The breeding call is a loud snore that lasts up to two seconds (Wright and Wright 1949). Larvae develop over 3-4 months, and transformation usually occurs from May to July, when tadpoles grow larger than 85 mm in total length (Braswell 1995). The juveniles and adults occupy terrestrial habitats except for the intervals when adults migrate to breeding ponds. Longevity information is scant. One captive male reported in Snider and Bowler (1992) was from North Carolina and lived for 9+ years. Gopher frogs in Mississippi live at least 15 years in the wild (M. Sisson, pers. comm.). Based on one observation from Florida (Franz et al. 1988), Gopher Frogs can travel up to 2.0 km from their breeding sites. Research in North Carolina corroborates long-distance travel to breeding sites, with telemetered animals traveling an average of 1.3 km away from a Sandhills breeding site, and a maximum of 3.5 km (Humphries and Sisson 2012). In addition, during a separate project, a Gopher Frog from this same Sandhills breeding site was detected by drift fence, 5.2 km away. Thus, this species requires large tracts (typically >5,000 acres) of fire-maintained upland Longleaf Pine forest with embedded isolated ephemeral wetlands.



Gopher Frog tadpole

Gopher Frog tadpoles are herbivorous, while adults eat a variety of invertebrates and possibly some smaller vertebrates. An ambush predator, the adult Gopher Frog will clear a spot near the mouth of its stumphole or burrow and await prey. Preliminary work with acidity tolerances/preferences of amphibians in ephemeral ponds in North Carolina (Smith and Braswell 1994) suggests Gopher Frogs prefer an aquatic acidity range from approximately 4.3 – 5.2 pH.

Distribution and Population Status

The northern limit to the range of *Rana capito* occurs in southeastern North Carolina, where it has been reported from 53 pond localities, representing 23 populations (Braswell 1993) historically (over the past 100 years). The historical range of this species extends from Beaufort County on the coast and Cumberland County on the inner Coastal Plain south to southern Florida, and west along the Gulf Coast to Louisiana (see Conant and Collins 1998;

Jensen and Richter 2005). The current northern extent of the range in North Carolina is on Fort Bragg in Cumberland County. In the outer Coastal Plain, the most northern extent can be found in the Croatan National Forest in Carteret County. Sites farther north in Beaufort County have been destroyed (Braswell 1993; Dorcas et al. 2011). Historically, populations of Gopher Frogs were composed of multiple, small sub-populations connected across the landscape (Semlitsch et al. 1995; Palis 1998; Greenberg 2001; Richter et al. 2009). As habitats have become fragmented and altered, extirpations have occurred, preventing recolonization due to lack of connectivity and uninhabitable landscapes.

Ten years of survey data collected by Wildlife Commission biologists reveal seven distinct populations of Gopher Frogs (Figure 1): 1) Croatan National Forest, 2) Camp Lejeune, 3) Holly Shelter Game Land (GL), 4) Military Ocean Terminal at Sunny Point (MOTSU), 5) Boiling Spring Lakes, 6) Sandhills GL, and 7) Fort Bragg. Due to landscape scale separation and fragmentation, these populations are now isolated from each another and do not function as a metapopulation. Several of these populations are supported by only 1-3 appropriate breeding wetlands, and only one population is considered somewhat secure. Egg mass data from 2016 confirmed that at least 96 females deposited eggs across all surveyed breeding sites. These data suggest a total adult population of only 200-300 animals. However, data from Camp Lejeune were not complete, so the estimate for the total population is likely higher. The most robust population known in North Carolina, obtained using drift fence data and corresponding with egg mass counts, numbers approximately 100 adults. Several populations appear to consist of fewer than 50 adults.

The Gopher Frog is currently recognized as state Endangered. It is under consideration by the U.S. Fish and Wildlife Service (USFWS) for federal protection under the Endangered Species Act. This species is designated G3-Vulnerable by NatureServe, Near Threatened by IUCN, and is currently a species of concern to the USFWS.

The Gopher Frog is currently listed as a state endangered species. It is under consideration by the U.S. Fish and Wildlife Service for federal protection under the Endangered Species Act.



Gopher Frog



Gopher Frog egg mass

Historic and Ongoing Conservation Efforts

The Gopher Frog has received consistent survey efforts to determine conservation status. Alvin Braswell, at the NC Museum of Natural Sciences, laid the ground work for an extensive database of all known historical and current breeding wetlands (1993, and see also Braswell and Youmans 1995). These documents provided the basis for the Wildlife Commission Gopher Frog project that began in 2007. Since that time, Commission staff has visited all wetlands historically known as Gopher Frog breeding sites. In addition, numerous wetlands that appear to have potential for Gopher Frog breeding have also been surveyed. A few new breeding sites have been documented, but no new populations. Telemetry work by Commission staff (Humphries and Sisson 2012) showed the distances that frogs would travel and helped establish the populations that we now recognize (Figure 1).

Because many of these populations consist of few adults, the Commission began head-starting efforts to bolster local populations. These efforts were piloted in 2011 at Holly Shelter Game Land (in a year when only seven females laid eggs) and continued at that location from 2015-2018. Additionally, head-starting efforts were established at Sandhills GL from 2015-2018, MOTSU from 2015-2018, and Boiling Spring Lakes in 2017. Head-starting involves collecting small portions of egg masses during the breeding season, raising them to metamorphosis in outdoor cattle tanks, then releasing them back at the sites of capture. These head-starting efforts were made possible

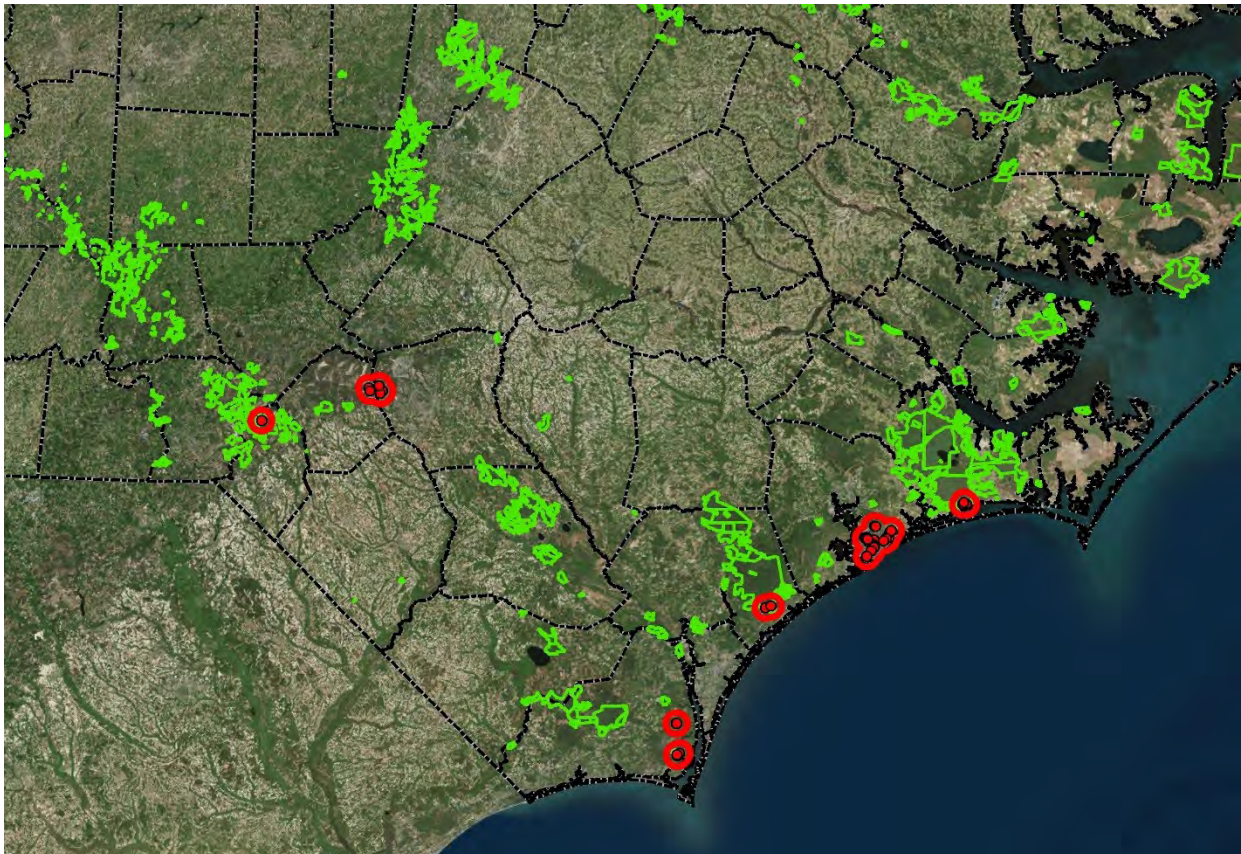


Figure 1. Distribution of known breeding ponds of *Rana capito* in North Carolina, depicted as red dots. Currently, there are only seven populations, depicted as red circles around the dots. Green outlines show extent of Wildlife Commission game lands. (Map source: Esri, DigitalGlobe, GeoEye, Earthstar Graphics, CNES/Airbus, DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community)

through collaborations with the North Carolina Aquarium at Fort Fisher and the North Carolina Zoo. Fort Fisher Aquarium staff has assisted with head-starting at Holly Shelter Game Land, MOTSU, and Boiling Spring Lakes, while North Carolina Zoo staff has assisted with the Sandhills Game Land population. Attempts also have been made to head-start eggs from Fort Bragg, but no eggs have been found since these efforts began. Future head-starting efforts will continue for all of these populations, as well as the possibility of adding Croatan National Forest.

When collecting eggs for head-starting, Commission staff also collected egg samples for genetic analysis of Gopher Frog populations. After some initial information from Eastern Kentucky University indicating very low genetic diversity among some of the populations, a longer term genetic study has been undertaken through a graduate student's research at UNC-Wilmington. Hopefully, this study will help inform head-starting efforts and identify populations that need the most attention.

In addition to conducting head-starting and genetic analyses, Commission staff has made significant effort to manage and restore Gopher Frog habitat. Specifically, Commission staff has worked on game lands, as well as on other public lands with external partners to fine-tune the timing and intensity of prescribed fires on the landscape. Summer, late growing-season, hot fires are important to maintaining the landscapes needed for Gopher Frogs. These fires are important for both upland and wetland habitats. Fires later in the year more closely mimic the historical fire regime, when lightning from thunderstorms would have started large fires hundreds of years ago. Fires such as these encourage the growth of herbaceous vegetation in both upland and wetland habitats, as well as creating new stump-holes by burning them out. Additionally, prescribed fire is most effective for these sites if conducted after breeding ponds dry because fire burns across the entire wetland, encouraging herbaceous grasses that are critical for egg deposition and tadpole herbivory patterns, as well as reducing organic material build-up and subsequent lowering of pH in the ponds (Roznik and Johnson 2009b). Proper management for Gopher Frogs also benefits other species of conservation concern (e.g., Ornate Chorus Frog, Tiger Salamander, Mabee's Salamander, etc.). Gopher Frog breeding sites routinely support as many as 15-20+ amphibian species, a large number of other vertebrate and invertebrate species, and many rare plants.



Gopher Frog head-starting tanks



Checking for Gopher Frog metamorphs in minnow trap in head-starting tank



Wildlife Commission staff creating a new pond on the Sandhills Game Land in 2013 (top photo); the same pond in 2019 (Bottom photo: Mike Martin)

Commission staff and partners have also made great strides in wetland restoration and creation. Gopher Frogs prefer open canopy, herbaceous wetlands. In sites that have experienced infrequent fires or fires outside the late growing season, wetland shrub and tree canopies often develop. Commission staff on Sandhills Game Land and Holly Shelter Game Land, as well as DoD staff on MOTSU, and USFS staff on Croatan, have all worked toward opening the canopies of wetlands by harvesting trees, and in some cases, removing heavy duff layers in unburned wetlands. Commission staff on Sandhills Game Land also created a new pond in October 2013, specifically targeting use by the Gopher Frog. As of 2018, Gopher Frogs have bred in this artificially constructed wetland in at least two separate years.

The Wildlife Commission has pursued land acquisition and conservation of lands supporting Gopher Frogs. Two tracts were acquired adjacent to the MOTSU population, and one new breeding pond was discovered on these tracts. Commission staff also has reached out to landowners with lands that appeared suitable for Gopher Frogs, and has gained access to several additional parcels — two of which include newly discovered breeding ponds. Survey work for new sites will continue, but few suitable areas appear to remain.

Threat Assessment

Reason for Listing

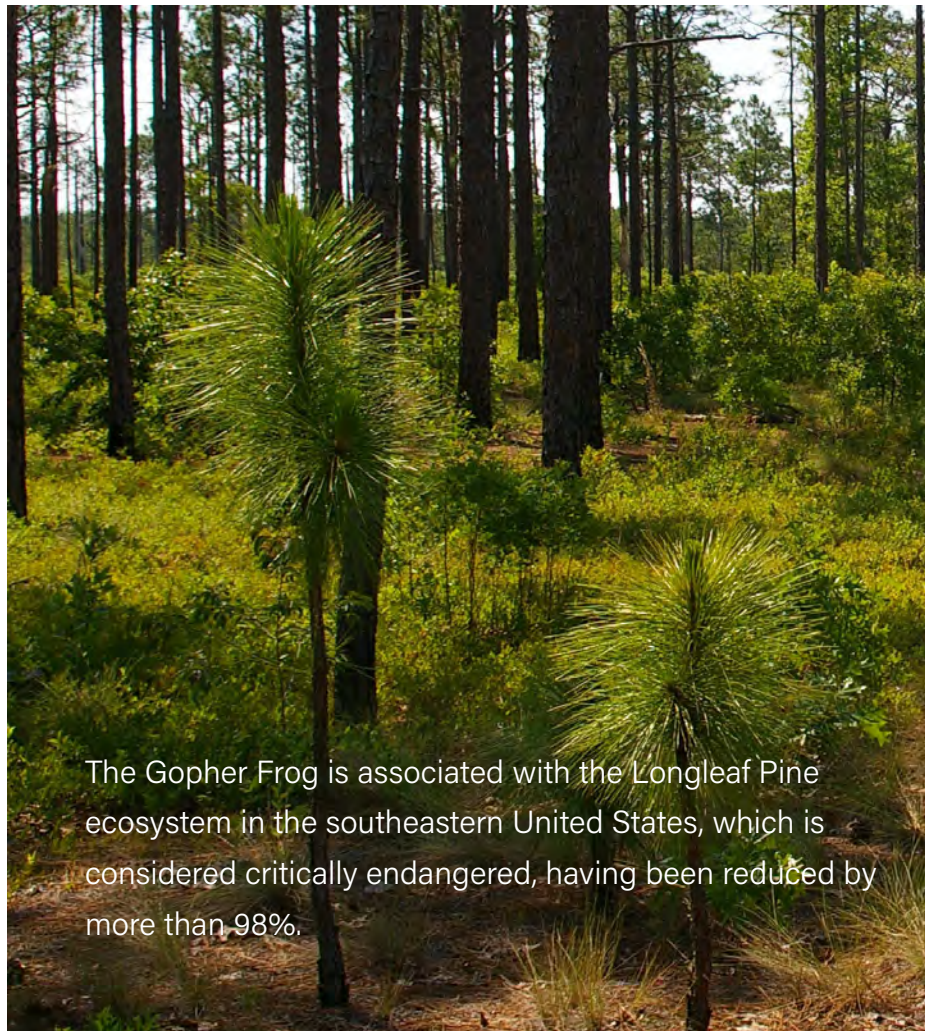
Braswell (1993) reported on the status of *R. capito* in North Carolina and recommended state Threatened status for the species based on a significant reduction in the number of active breeding sites and the threats to those remaining sites. Since that report, new Gopher Frog breeding sites have been located within the Sandhills Game Land, Holly Shelter Game Land, Fort Bragg, Boiling Spring Lakes, and MOTSU (Beane and Hoffman 1995, Beane and Hoffman 1997, and NCWRC staff). However, many more of the historical sites have been lost, and these new breeding sites do not appear to improve the outlook for the species significantly. Of the original 23 populations

detected by Braswell (1993), only seven populations remain (70% reduction). Of the 53 original pond sites, only 14 are still used by Gopher Frogs. Most have been destroyed or altered significantly (e.g., stocked with fish). Furthermore, lost populations are not likely to be recovered. Remaining populations face numerous threats including severe weather (especially long periods of drought), development, and lack of proper management. Thus, in 2017, the Commission elevated the Gopher Frog's state-listing status from Threatened to Endangered.

Present and Anticipated Threats

Surveys of Cherry Point Marine Corps Base properties in Carteret, Jones, and Craven counties during 1992-1993 did not locate any Gopher Frogs in habitats where the frog should have occurred historically. Additional survey efforts in New Hanover County, where the species was once common, have detected no Gopher Frogs. Threats to the population on and near MOTSU in Brunswick County have increased over those reported by Braswell (1993) with the additional threat of sand mining and water treatment spray fields in prime Gopher Frog breeding and terrestrial habitats. A breeding site in Scotland County was purchased by the Department of Transportation to mitigate wetlands loss, but much of the adjoining terrestrial habitats have been severely degraded. The site appears to no longer support the Gopher Frog. Coastal development continues to erode habitat. Drought and groundwater draw-down have reduced breeding and recruitment potential. Disease threats from at least three pathogens have been identified — two of which (chytrid fungus and ranavirus) have been found in North Carolina. Gopher Frog populations are unlikely to overcome the negative effects of human population growth and exploitation of natural resources in North Carolina.

A significant threat to the continued survival of the Gopher Frog in North Carolina is lack of management or inadequate management of sites. The use of prescribed fire is critical to maintaining this species on the landscape, and it must be applied appropriately. Lack of fire entirely will lead to canopy closure of wetlands, as well as alteration and degradation of Longleaf Pine uplands. Inappropriately applied winter fires threaten adult frogs moving across the landscape, and do not have the desired effects of removal of organic buildup in breeding ponds (Humphries and Sisson 2012). Late spring or summer are the ideal times for application of prescribed fire. However, this is not always possible at all sites. Managers must weigh and consider varying conditions to determine appropriate timing of fire at each site. A delicate balance is required to maintain fire on the landscape, and not lose species such as the Gopher Frog, found within Longleaf Pine systems.



The Gopher Frog is associated with the Longleaf Pine ecosystem in the southeastern United States, which is considered critically endangered, having been reduced by more than 98%.

Availability of refugia, such as stumpholes and mammal burrows, is a limiting factor at some sites. The process of “natural” stumphole formation can take many years, because a tree’s roots slowly rot away, although fires can somewhat shorten stumphole formation time. Historically, extraction of sap from living Longleaf Pines was the initial strategy for supplying the naval stores industry that rose in the 1800s, but this was replaced in the mid-1900s with the easier “stumping” method, which extracted spirits and rosin from the stumps of Longleaf Pines (Earley 2004). Thus, much of the North Carolina landscape within the Longleaf Pine ecosystem experienced stump removal, leading to fewer stumphole refugia for Gopher Frogs. Stumphole availability varies greatly across the various Gopher Frog population areas, but its limited availability appears to be a potential threat at several sites. Uneven-aged management of trees, such as is typically the case in Longleaf Pine forests managed for wildlife, is important to avoid boom-and-bust cycles of stump formation.

Populations of Gopher Frogs are separated from each other due to fragmentation of the landscape, which can be caused by development and impoundment of large waterbodies, among other activities. The resulting landscape fragmentation precludes genetic interchange between populations. A significant risk for these small isolated populations is loss of genetic diversity leading to bottlenecks and potential loss of response plasticity in the face of a complex, dynamic environment. Richter and Hinkson (2015) sought to assess the population genetics of gopher frogs in North Carolina with an emphasis on quantifying the amount of genetic variation in each wetland surveyed, and the degree of differentiation among these wetlands. Overall, genetic variation in North Carolina populations was lower, and amount of historical inbreeding (FIS) was much higher, than in populations of *R. capito* in other states, including Alabama and Florida, or in populations of a related species, *Rana sevosa*, in Mississippi. In summary, this research revealed low population genetic diversity and limited gene exchange between populations of Gopher Frogs in North Carolina. The authors recommended additional genetics work be conducted to assess how the Wildlife Commission might mitigate for some of this loss by moving individuals across the landscape through head-starting efforts.

Recent telemetry work on the Gopher Frog has revealed that this species uses large amounts of upland habitat. It will range as far as 3.5 km from its breeding sites (Humphries & Sisson 2012). Thus, large tracts of unfragmented Longleaf Pine embedded with high quality, isolated ephemeral wetlands are required for this frog’s survival. This type of habitat is rare in North Carolina, and land-use pressures on the Coastal Plain are unlikely to abate.

Climate change effects may negatively impact Gopher Frog breeding success via changes to seasonal rainfall (e.g., more extreme weather events such as droughts and floods), as well as extreme temperatures (NCDENR 2010). How these climatic changes may affect Gopher Frogs is unclear, but it may lead to ponds drying at times when they would normally have water, and ponds containing more water when they would normally be dry. These circumstances would likely result in poor or no breeding success, and significant degradation of habitats (e.g., reduced ability to burn through wetlands if they remain wet during the summer and/or introduction of fish during flood events).

CONSERVATION GOAL AND OBJECTIVES

Conservation Goal

Biologists with the N.C. Wildlife Resources Commission are working toward the conservation goal for Gopher Frogs to prevent the extinction of this species and to ensure its long-term viability as a member of the fauna of North Carolina for 100 years.

Conservation Objectives

Conservation objectives for the Gopher Frog:

1. Maintain all seven current populations of Gopher Frogs and augment each population, where possible, through head-starting efforts and by adding additional breeding ponds, where needed.
2. Work with partners to establish goals for each population and determine and implement Best Management Practices for wetland and upland restoration and maintenance, including appropriate application of prescribed fire.
3. After all current populations are thought to be sustainable and resilient (>100 breeding adults), attempt to reestablish extirpated populations using head-starting from nearby populations where possible (e.g., Carolina Beach State Park).
4. Continue to pursue land acquisition and other land conservation practices in areas where Gopher Frogs exist, or where appropriate habitat can be restored, managed, or created where new populations may be introduced or re-introduced.
5. Continue genetic analyses of Gopher Frog populations, and, where advisable, establish connectivity and gene flow between existing populations. Translocation of frogs between sites is one potential technique to manage for genetic diversity. Explore potential for genetics to ascertain susceptibility of each population to chytrid, ranavirus, and other pathogens.

CONSERVATION ACTIONS

Habitat Protection and Habitat Management

In general, steps that can be taken to improve the status of the Gopher Frog include: (1) incorporate management strategies favoring this species on properties in public and, where possible, private ownership; (2) seek recovery of the Longleaf Pine ecosystem in areas that would increase the size of favorable habitat blocks for the Gopher Frog; and (3) provide better protection for the relatively small, ephemeral wetland habitats that the species uses for breeding. In some areas, creation of breeding habitat might be an option available to help the species (Braswell 1995). Specifically, staff within various divisions of the Wildlife Commission will coordinate regularly about proper timing and use of prescribed fire on Commission game lands properties. The formation of a specialized wetland burn team would allow for the extra attention needed to achieve appropriate wetland burning. Artificial refugia have been constructed on Sandhills GL to mimic stumpholes. These artificial refugia also will be utilized at other sites where

stumpholes may be a limiting factor. Preliminary work looks promising, with both juvenile and adult frogs found using artificial burrows. The Commission will continue to survey for and restore potential breeding wetlands found on game lands, as well as consider creation of new wetlands. Additionally, Commission staff will continue to pursue acquisition of available lands either already sustaining Gopher Frogs or containing appropriate habitats that would support the potential for their reintroduction.

Commission staff will continue providing technical support to external federal, state, municipal, and private partners with extant populations of Gopher Frogs, or those with the potential for reintroduction.

Population Management

Commission staff will continue to assess population status at each location, and will make recommendations regarding head-starting efforts. Where needed, Commission staff will construct agreements to work with external partners on head-starting. Commission staff also will continue coordination of head-starting efforts of multiple populations with external agencies: North Carolina Aquarium at Fort Fisher, North Carolina Aquarium at Pine Knoll Shores, and North Carolina Zoo. Additionally, the Commission will continue collecting eggs for genetics work and supporting analyses to direct head-starting efforts. If feasible, staff will establish connectivity and gene flow between existing populations and newly established populations by translocating head-started individuals.

Incentives (Tax Break)

The Commission will encourage private landowners with Gopher Frog habitat on their property to participate in the Wildlife Conservation Land Program. This program allows qualifying landowners whose property contains state listed species to get a break in property taxes for implementing conservation actions.



Gopher Frog with a transmitter for tracking purposes

Monitoring and Research

Commission staff will: (1) Continue extensive monitoring of all known Gopher Frog populations, including annual egg mass counts in all known and potential breeding ponds; continue partial egg mass collections to support head-starting efforts. Staff will also continue surveys for new Gopher Frog populations in suitable habitats using aerial imagery, automated audio data loggers (frogloggers), and site visits.

(2) Conduct telemetry studies to determine the fate of head-started Gopher Frog metamorphs in both Sandhills GL and Holly Shelter GL populations. Telemetry will be

considered at other sites. A study has begun of head-started juvenile frogs on Sandhills GL, with initial results showing very low survival. Continued studies of head-started Gopher Frogs should consider the timing and location of released frogs, along with considerations of the effects of invasive species such as fire ants.

(3) Continue egg mass collections (two eggs per mass) for genetic analyses to determine diversity and relationships between populations, and examine gene flow between them.

Education and Outreach

The Commission will continue to contribute to reports, educational materials, publications, social media and outreach events that feature or include the Gopher Frog, as well as distribute public information about the species and associated projects through publications of conservation partners such as the North Carolina Partners in Amphibian and Reptile Conservation (NCPARC) and the North Carolina Herpetological Society (NCHS). Additionally, presentations on Gopher Frog natural history, management, research, and surveys will be given to academic, professional, and public citizen groups.

Regulations

Take or possession of this species without a valid permit is currently prohibited under NC law and administrative code (15A NCAC 10I .0102) and is considered a Class 1 misdemeanor (§ 113 337b). It is unlawful to release hatchery-raised fish on game lands without prior written authorization (15A NCAC 10D .0102), which could help prevent introduction of fish into ponds used by Gopher Frogs. Additionally, Commission regulations (15A NCAC 10B .0123) prohibit import, transport, export, purchase, possession, sale, transfer, or release into public or private waters or lands of the State, any live specimen(s) of Tongueless or African Clawed Frog (*Xenopus* spp.; known carriers of the chytrid fungus *Bd*), and several genera of Asian newts (*Cynops*, *Pachytriton*, *Paramesotriton*, *Laotriton*, *Tylototriton*; all known carriers of the chytrid fungus *Bsal*).



Staff surveying for gopher frogs on the Sandhills Game Land

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Photo: Mike Sisson

EXHIBIT C-4

December 10, 2020



Robust Redhorse Conservation Plan for North Carolina



ROBUST REDHORSE CONSERVATION PLAN for NORTH CAROLINA

Dec. 10, 2020



NORTH CAROLINA WILDLIFE RESOURCES COMMISSION



On the river in search of adult Robust Redhorse



Placing a PIT-tag in adult Robust Redhorse for tracking purposes



Collecting eggs from a female Robust Redhorse



Robust Redhorse fry in an aquarium at McKinney Lake Fish Hatchery, located in Richmond County



Juvenile Robust Redhorse shortly before being released into the Pee Dee River



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Executive Summary

The Robust Redhorse (*Moxostoma robustum*) is a large member of the sucker family (Catostomidae). It is currently listed as endangered by North Carolina, where it exists in low numbers only in the lower Pee Dee River below Blewett Falls Dam. Habitat loss and blockage resulting from dams and extreme fluctuations in flow from hydropower operations historically endangered Robust Redhorse. Introduced species such as Flathead Catfish also threaten Robust Redhorse. To conserve Robust Redhorse, N.C. Wildlife Resources Commission biologists will enhance the populations below Blewett Falls through captive propagation and stocking. Commission staff will also explore avenues such as a Candidate Conservation Agreement with Assurances that will create opportunities to stock Robust Redhorse in other areas of its historic range such as the Pee Dee River below Lake Tillery.

Female Robust Redhorse collected from the Pee Dee River. The fish was weighed, measured, PIT-tagged and released back into the river.



Biological Information

Description and Taxonomic Classification

The Robust Redhorse (*Moxostoma robustum*, Cope 1870) is the largest sucker species native to the Carolinas, exceeding 700 mm total length (TL) and 8.4 kg (RRCC 2006). Distinguished by large, fleshy, plicate lips with a generally straight posterior margin, adults and juveniles are bronze to golden, with large scales and heavy, molariform pharyngeal teeth. The caudal fin is red; other fins are often also similarly colored and males develop large tubercles on their head, snout, anal, and caudal fins during spawning season (Cope 1870).

The species was described from the Yadkin River in North Carolina by Cope (1870), but the name *Moxostoma robustum* was then mistakenly applied to another sucker species for over a century until the collection of two fish from the Savannah River (GA/SC) and the Pee Dee River (NC) in the early 1980s. Additional captures in 1991 in the Oconee River (GA) and further investigation of nomenclature applications led to correction of these errors (Bryant et al. 1996). Mitochondrial and nuclear DNA analyses have revealed that the North Carolina population in the lower Pee Dee River is genetically distinct from other Robust Redhorse population units (Darden and Tarpey 2014, Wirgin et al. 2001, Wirgin 2002).

Life History and Habitat

Robust Redhorse are large, relatively long-lived fish, with a maximum reported age of 27 years, reaching sexual maturity at four to five years in males and five to six years in females (Darden and Tarpey 2014). Adults aged using scale annuli ranged in estimated minimum age from eight to 16 years old. This indicates a long window of potential reproductive activity, even with known uncertainty margins in this methodology (Jenkins 2007, Grabowski et al. 2008, Straight and Freeman 2013).

A freshwater potamodromous species, adult Robust Redhorse move upstream within rivers during the spring to spawn on clean gravel shoals (Grabowski and Isely 2006, Fisk 2010). These migrations can exceed 100 river kilometers (km), but populations are restricted by barriers such as hydropower dams and by habitat availability (Grabowski and Isely 2006, Fisk 2010, Fisk et al 2013). In North Carolina, the species inhabits the Pee Dee River below Blewett Falls Dam to the state line (Figure 1, page 7) and is currently known to use only two primary spawning shoal complexes near confluences with major tributaries. A split in migration behavior type has been observed in this population. One subgroup remained local to the Piedmont reach of the river year-round, while the other moved long distances downstream to overwinter in deeper habitats in the Coastal Plain of SC (Fisk 2010).

Robust Redhorse feed on insects and mollusks, using their large pharyngeal teeth to crush the shells of snails and mussels. They have been observed to feed on large quantities of exotic Asian Clams (*Corbicula fluminea*) and even young fish appear adaptable in their prey selection (Freeman et al. 2002). It is unknown, however, whether exotic species have any negative dietary or metabolic effects.

Extensive mark-recapture and radio telemetry studies have revealed that adults can show a high degree of spawning shoal fidelity, with individuals captured in spawning condition on the same shoal in multiple years (Fisk 2010, Grabowski and Isley 2006, Ely and Zimpfer 2013, Straight and Freeman 2013). Adults aggregate in April through May, when water temperatures range from 16-24 degrees C (Grabowski and Isley 2006, RRCC 2006). Spawning usually consists of a "triad," two males on either flank of a female in areas of medium to high current velocity (Freeman and Freeman 2001, Straight and Freeman 2013), and fertilized eggs are deposited in interstitial spaces among gravel substrates. Larvae hatch after roughly a week, remaining in the gravel for an additional one to two weeks before emergence into the water column (Fisk et al. 2013, Jennings et al. 2004, Looney and Jennings 2004).

Little is known about the juvenile life history of Robust Redhorse, as few wild individuals have been collected despite a wide array of sampling across habitats and seasons. The reason for the difficulty in collecting immature fish is unknown, but this data gap exists in all three states. Recent telemetry data from hatchery-propagated juveniles in the Pee Dee River indicates the ability to rapidly travel long distances (over 100 km; J. Gibbons, SCDNR, personal communication).

Distribution and Population Status

Robust Redhorse are endemic to Atlantic Slope river systems in the southeast. While they may have once been more widely distributed, they are currently found in the mainstems of the Oconee, Ocmulgee, and Ogeechee rivers of the Altamaha basin in GA; the Savannah and Broad rivers of the Savannah basin in SC/GA; the Wateree and Broad rivers of the Santee basin in SC; and the Pee Dee River in NC/SC (Figure 2, page 8). The North Carolina population is restricted to the unimpounded reach of the Pee Dee River below Blewett Falls Dam and represents the northernmost extent of the species. No individuals have been collected from any upstream reaches in North Carolina upstream of Blewett Falls Dam, including the type locality, since the time of description (RRCC 2014).

Population levels are low across the entirety of its range and it is listed as State Endangered in North Carolina. Targeted sampling of spawning adults has occurred in the Pee Dee River during the spring since 2005, with a break to reduce population disturbance from 2010 to 2013. Additional surveys over a larger area of the watershed have been conducted since 1999. Including the single individual captured in 1985, 193 Robust Redhorse have been collected to date, of which 30 were identified as males, 55 as females, with the remainder being immature.

All animals are PIT-tagged to track recapture rates and model population size. Recapture rates among and within years have ranged from 25% in 2005 (total annual captures n=8) to 68.4% in 2016 (n=19), with a mean of 44.3%. A population estimate of breeding adults in the Pee Dee has been generated for each sampled year since 2006 using the software package MARK, with associated confidence intervals (Figure 3, page 8). Parameters are generated via the Cormack-Jolly Seber open population model and through 2016, estimates ranged from 31 (95% CI 23-39) in 2013 to 52 (95% CI 39-65) in 2008. However, in 2017 that estimate dropped to 18, driven by the capture of only one

Robust Redhorse are endemic to Atlantic Slope river systems in the southeast. In North Carolina, they are found only in the Pee Dee River.

new (previously untagged) adult of seven collected. However, the population estimate was back up to 62 in 2018. An additional seven juveniles between 350-480 mm were captured, along with six 2-year-old propagated juveniles stocked in November of 2016. Regardless, this population lingers at an extremely low level and, as documented natural recruitment is also very low, is at a high risk for further endangerment and extirpation without continued proactive conservation measures.

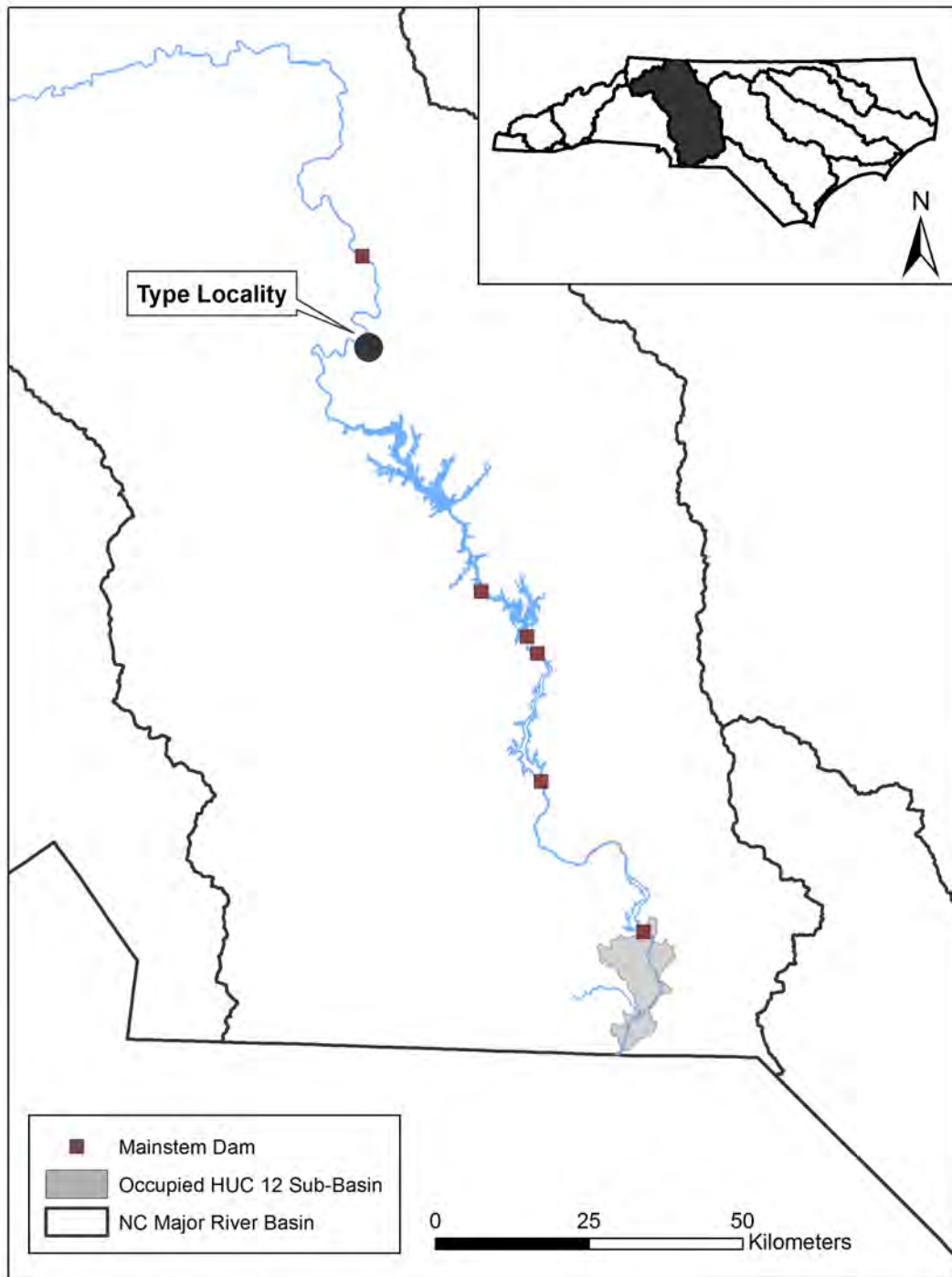


Figure 1. Range and type locality of Robust Redhorse in the Yadkin-Pee Dee River in NC.

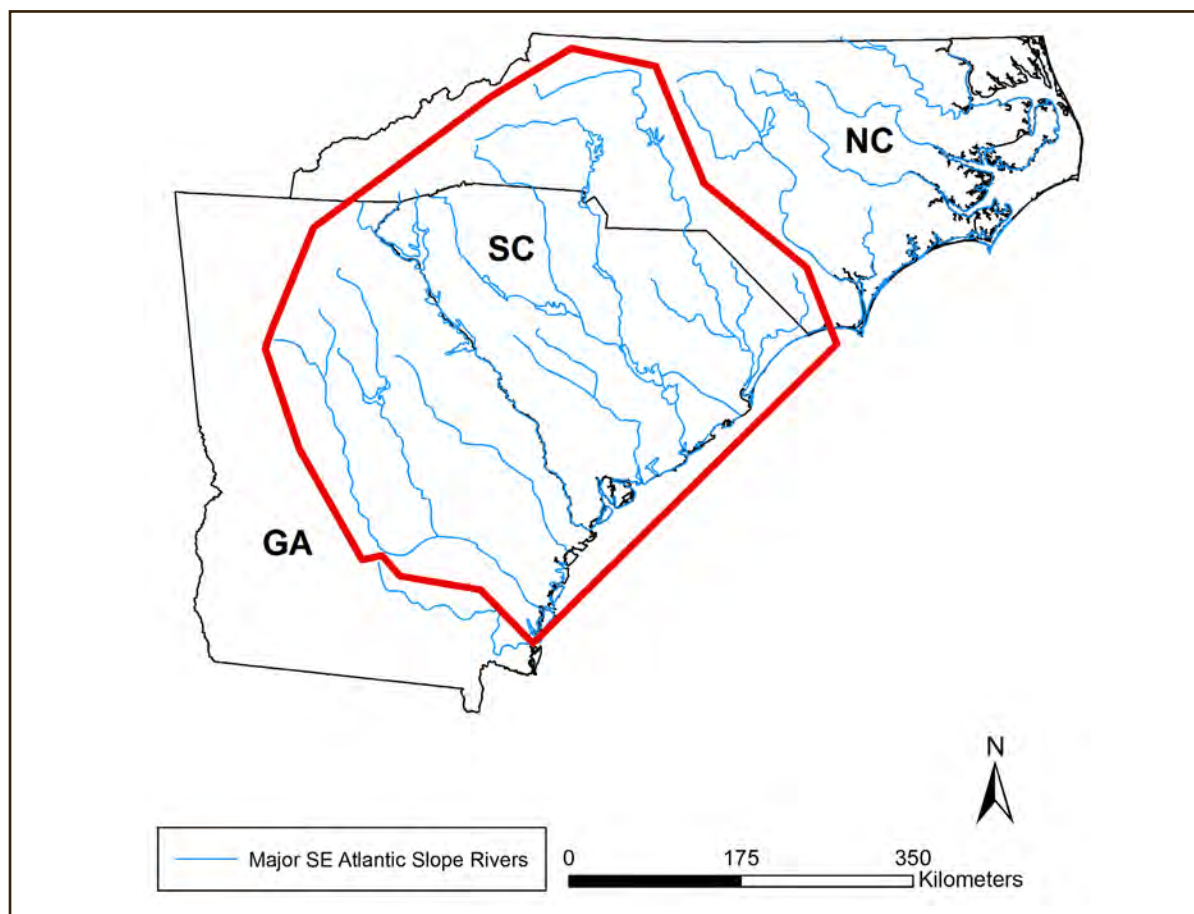


Figure 2. Historic range of Robust Redhorse in Atlantic Slope Rivers of the southeast as indicated by the red outline.

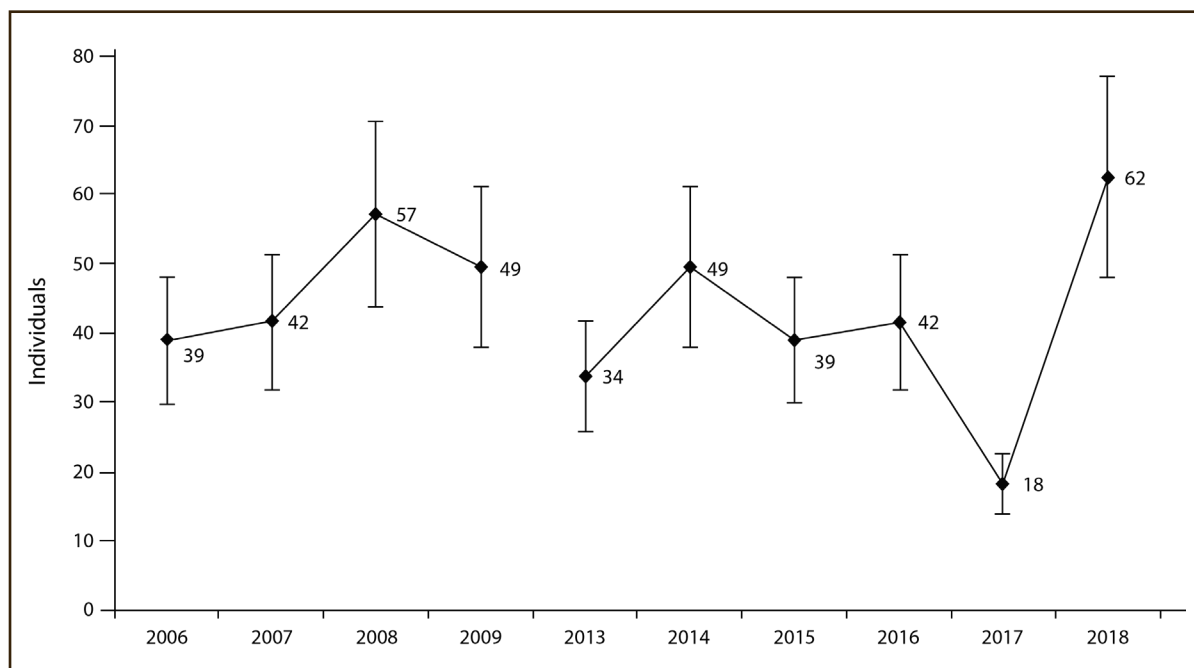


Figure 3. Annual adult breeding population estimates for Robust Redhorse on Pee Dee River spawning shoals in NC. Error bars represent 95% confidence intervals. Gap from 2010-2013 represents years spring sampling was not conducted.

Historic and Ongoing Conservation Efforts

The N.C. Wildlife Resources Commission is a member of the Robust Redhorse Conservation Committee (RRCC), a partnership formed in 1995 through a signed Memorandum of Understanding (MOU) between stakeholders across the species' three-state range — North Carolina, South Carolina and Georgia (RRCC 2010). Fellow members include federal and state natural resource agencies, GA Power, Duke Energy, SC Electric and Gas, and the SC Aquarium. Additional cooperators include universities such as NC State University and the University of Georgia, as well as the NC Museum of Natural Sciences. The RRCC has been a proactive and effective collaboration, with the goals of implementing research and conservation, enhancing recruitment in existing populations, and re-establishing the species in suitable habitat within the historic range. In addition, the group provides educational materials and resources describing the Robust Redhorse and the significant accomplishments of the RRCC on a dedicated website at <http://www.robustredhorse.com>. Following the MOU, the RRCC produced a Robust Redhorse Conservation Strategy document (Nichols 2003), encompassing protocols and actions to achieve conservation goals, a Policy outline to guide consistency across regions and activities (RRCC 2002), and a Habitat Restoration Management Plan to identify threats and potential opportunities (RRCC 2006).

The Yadkin-Pee Dee Technical Working Group (TWG) consists of a subgroup within the RRCC focused on research, conservation, and management of the Pee Dee River population of the Robust Redhorse. Chartered in 2002, the TWG additionally coordinates propagation and augmentation activities in the basin and collaborates with the larger RRCC (YPD TWG 2002).

Riparian lands adjacent to the critical North Carolina spawning areas of Robust Redhorse are protected in part via ownership by the Wildlife Commission and Duke Energy. A significant portion of these properties have been incorporated for conservation management into the Commission's Game Lands program, which includes provisions for restoration of native habitats.

Due to the significant influence of the operation of Blewett Falls Dam on the hydrology of the Pee Dee River downstream and subsequent effects on the quality and availability of Robust Redhorse spawning habitat, cooperative conservation partnership with Duke Energy Progress (Duke Energy) has been a vital component of species management and survival. During the most recent cycle of Federal Energy Regulatory Commission (FERC) relicensing, new minimum flow schedules were developed for both the Blewett Falls and Tillery Dam (the next dam upstream) projects. License issuance was significantly delayed following the 2006 filing, finally granted in 2015, but Duke Energy began voluntarily providing higher minimum spawning flows (1,200 cubic ft per second [cfs]; required minimum at the time was 150 cfs) for a 30-day period in the spring of 2009, which was then extended to a year-round minimum in 2011 whenever possible. Beginning in January 2012, even greater spring minimum flows were provided through the end of May each year, with graduated reductions over a span of weeks to mimic natural seasonal flows. Duke Energy has also installed systems at both Blewett Falls and Tillery dams to improve dissolved oxygen concentrations in tailwaters and monitoring has documented improved compliance with state standards (FERC 2015; T. Styer, Duke Energy, personal communication).

To augment existing populations and establish new ones, mitigating risk of local extirpations pushing this rare species closer to extinction, captive propagation and stocking of young fish has occurred in all three states.

Gametes collected from adult fish on the North Carolina spawning shoals were propagated in split batches — half at the Wildlife Commission's McKinney Lake Fish Hatchery and the remainder at SC Department of Natural Resources' (SCDNR) Dennis Center, using a protocol developed by the USFWS to minimize genetic risks and avoid excessive depletion of gametes available for wild spawning. Phase I (6 months old) fingerlings were stocked into the Pee Dee River at two locations on either side of the state line in November of 2014 and 2015, while Phase II (18 months old) juveniles were stocked at the same sites in November 2016. All Phase II fish were fitted with unique PIT tags and 30 (15 from each hatchery) were given surgically implanted VEMCO sonic tags, which are tracked using static receivers already deployed in the lower Pee Dee River to monitor Atlantic Sturgeon (*Acipenser oxyrinchus*) and Shortnose Sturgeon (*Acipenser brevirostrum*). An additional 50 fish were held back at each hatchery to attempt growout to sexual maturity. There were no propagated juveniles spawned in 2016 or 2017 because there were not sufficient quantities of gametes in captured adults to meet the mating design criteria. All propagated year-classes are genetically traceable using fin clip material collected from the parent fish.



Robust Redhorse juveniles were released into the Pee Dee River at two locations on the North Carolina/South Carolina state line in November 2014 and 2015.

Six of the Phase II fish were recaptured near spawning shoals during spring sampling in April and May 2017 and 26 of the 30 VEMCO-tagged fish were relocated within a few months of release. This suggests some successful short-term survival as well as innate habitat orientation, despite development in hatchery ponds. Recently completed genetic analyses indicate that two juveniles captured in 2016 and seven from 2017 were products of the stocked 2014 year-class (D. Ferrae, SCDNR, personal communication). Seven of these nine fish were captured on or near spawning shoals during spring sampling and it is possible that they or their cohorts may successfully recruit into the breeding population between 2018 and 2020.

Discussions are ongoing toward proposed reintroduction of the Robust Redhorse into the 30-km reach below Tillery Dam, following indications from a habitat suitability modeling study that the species could inhabit this reach at the minimum release flows (Fisk et al. 2014). The Commission is exploring the possibility of establishing a Candidate Conservation Agreement with Assurances to facilitate the stocking of Robust Redhorse in the reach below Tillery Dam.

Threat Assessment

Reason for Listing

The Robust Redhorse was listed as Endangered in North Carolina in the late 1990s due to its extremely restricted range and small population size, along with a decline in numbers stemming from habitat loss, movement barriers, historical overfishing and the introduction of exotic piscivores (NatureServe 2017). It is currently petitioned for listing by the US Fish and Wildlife Service.

Present and Anticipated Threats

This species has been the focus of intensive study across its range for several decades; a library of annual reports, technical publications, research articles, theses, dissertations, and press releases discussing threats, as well as life history, management actions, policy and conservation, is available on the dedicated RRCC website at <http://www.robustredhorse.com/h/reportpubs.html>. This list is updated periodically by executive members of the RRCC. The following is a summary of threats.

The Robust Redhorse is currently restricted from any expansion upstream in the Pee Dee River by the presence of Blewett Falls Dam, a large hydro-power dam operated by Duke Energy, precluding any natural recolonization of historic range. The dam hosts six turbines, impounding a 12-mile-long, 2,866-acre reservoir with a 900-foot tailrace. Operation of the dam also altered the natural flow regime, which is significant to a species which uses seasonal cues from water temperature and flow to trigger spawning aggregation. Under the previous FERC license, issued in 1958, generation occurred following electricity demand and releases from upstream reservoirs, with a year-round required minimum flow of 150 cfs and a typical generation flow of 7,200 and 9,200 cfs, creating significant fluctuations, changing over a matter of hours, in quantity of submerged habitat available on a daily basis (FERC 2015). Previous peaking schedules also created artificial low water events after eggs were laid in the spring, resulting in suspected losses due to egg desiccation, loss when the next pulse of water washed away eggs with reduced adhesion properties into unsuitable habitat, or reductions in hatch success and larval development (Fisk et al. 2013, Weyers et al. 2003). In recent years, Duke Energy has voluntarily provided ecologically beneficial spring release flows as a partner in the Robust Redhorse Conservation Committee and Yadkin-Pee Dee Technical Working Group. Beginning in 2015, the new FERC license also includes provisions for increased minimum release flows both year-round and during spring migration and spawning.



Blewett Falls Dam (Photo: Wikipedia)

Sedimentation due to both in-channel erosion and particles carried by runoff presents multiple challenges, including destruction of spawning habitat when gravel beds are covered, impaired larval development, egg mortality (Jennings 2010, Jennings et al. 2004) and reduction of prey base. These effects are exacerbated by factors such as increases in impervious surface in upstream portions of the watershed, more frequent or larger storm events and bank destabilization (e.g. forested buffer removal or livestock/vehicle access).

Water quality has also been heavily impacted by runoff containing agricultural and industrial chemical pollutants, nutrients, and emerging contaminants such as pharmaceuticals and endocrine-disrupting compounds. The latter act on fish as they develop and can result in an intersex condition, where an individual has both male and female gonadal tissue. A recent nationwide study found the highest proportion of intersex Largemouth Bass (*Micropterus salmoides*) in the lower Pee Dee River, sympatric with Robust Redhorse (Hinck et al. 2009). Details of effects, including magnitude of reproductive impact and other sublethal complications, are still largely unknown for this predominantly unregulated class of pollutants, but the likelihood of negative effects on Robust Redhorse is high, as mechanisms of deleterious impacts have been documented in other species (Lee Pow 2016, Gagné 2004). Contaminant analysis of ova from a single large adult female Robust Redhorse from the Pee Dee River revealed concentrations several orders of magnitude higher than tissue from other species, indicating potential for maternal inheritance alongside environmental exposure (Penland 2017).

Exotic species with high population levels sympatric with the Robust Redhorse include Flathead Catfish (*Pylodactis olivaris*), an aggressive predator shown to reduce native fish populations (Ashley and Rachels 1998, Pine et al. 2007), Blue Catfish (*Ictalurus furcatus*), which are also piscivorous when large (Edds et al. 2002), Smallmouth Buffalo (*Ictiobus bubalus*) and Common Carp (*Cyprinus carpio*) which are both abundant potential space and resource competitors, along with non-native mollusks such as Asian Clam (*Corbicula fluminea*) and Japanese Mystery Snail (*Cipangopaludina japonica*), whose effects are not yet known. Predation poses a direct risk to juveniles and probability of encounter is high as both species of large exotic catfish occur almost ubiquitously in the Pee Dee River below Blewett Falls Dam and continuing into South Carolina. Egg and larval predation on gravel

Flathead Catfish are aggressive predators that can reduce native fish populations.



beds could also have a disproportionate impact to that felt by other species due to the extremely low numbers of successfully spawning Robust Redhorse, where the loss of a single nest could represent a significant segment of that year-class.

Another risk for this small population is loss of genetic diversity leading to bottlenecks and loss of response plasticity in the face of a complex, changing environment. Population-level analyses suggested that the Pee Dee River supports high levels of gene diversity and low inbreeding coefficients (Darden and Tarpey 2014), but there was evidence of a “long term gradual population decline as well as a recent moderate population bottleneck.” With continued low recruitment levels and potentially high possibility of matings between siblings or other closely related fish, these trends will continue to multiply. If this metric of population health declines, the species becomes less resilient to changes in its ecosystem and more susceptible to stressors such as disease, parasites and pollutants. Darden and Tarpey (2014) estimated a retention of 90-92% of genetic diversity retained over 100 years at current calculated population estimate levels ($n = 38-55$), with a 64-69% loss in allelic richness, with the caveat that the rate of loss increases precipitously at the low end of confidence intervals ($n = 20$).

Climate change effects have the potential to negatively impact Robust Redhorse spawning success via increased water temperatures and changes to seasonal rainfall and flow patterns (Lynch et al. 2016, NCDENR 2010). Water temperatures above 27 C exceed thermal tolerances of eggs, larvae and fry (Jennings et al 1998), conditions already observed near the end of May and early June in the Pee Dee River. Adults may also migrate at times not conducive to spawning success or fail to migrate at all if flow timing is altered or reduced by drought (Ely and Zimpfer 2013). Similarly habitat quality and quantity will be reduced if less water is available (Fisk 2010). Additional effects of climate change potentially compounding on other concurrent environmental stressors include resuspension of sediments during more frequent storms, concentration of nutrients and slowed transport pathways through increased evaporation rates, algal blooms, fish kills and other productivity shifts (NCDENR 2010). The precise mechanisms and outcomes of climate change impacts have not yet been identified in most cases, primarily due to the lack of focused research and standardized data sets (Lynch et al. 2016) and further work is needed to inform an effective management response.

Conservation Goal and Objectives

Conservation Goal

Wildlife Commission biologists are working to prevent the extinction of Robust Redhorse, with particular focus on Robust Redhorse in the Pee Dee River. To reach this conservation goal, biologists need to ensure the long-term viability of Robust Redhorse as a member of the fauna of North Carolina for the next 100 years. A viable population will contain multiple individuals, numerous age-classes, and recruitment over multiple generations.

Conservation Objectives

Wildlife Commission biologists have developed a conservation strategy to maintain the population of Robust Redhorse in the Pee Dee River and expand its current range into the next upstream reach below Tillery Dam. Objectives include:

1. Maintain a viable population of Robust Redhorse and high genetic diversity ($\geq 90\%$ of current levels; Darden and Tarpey 2014) in the Pee Dee River below Blewett Falls Dam. Genetic diversity is defined in Moyer and Darden (2014).
2. Reestablish a population of Robust Redhorse in the Pee Dee River between Tillery Dam and Blewett Falls Reservoir.
3. Increase numbers and recruitment in the Robust Redhorse population below Blewett Falls Dam.

Conservation Actions

Habitat Protection and Habitat Management

The Wildlife Commission will continue cooperative efforts with Duke Energy to maintain adequate dissolved oxygen concentrations in dam tailwaters, as well as manage riparian lands for protected native forested buffers. The Commission will work with partners in the Yadkin-Pee Dee TWG to continue improving understanding of contaminant loads and effects in the river. The TWG will also engage other stakeholders where appropriate to improve compliance with existing water quality regulations if needed and to investigate the efficacy of proposing new or modified regulations.

Protecting habitat integrity, including hydrology, is crucial for Robust Redhorse survival. Comments on permit reviews should stress minimizing inputs that include chemical pollutants such as herbicides, pesticides, pharmaceuticals and industrial compounds, as well as sediment and nutrients carried by storm water. Wildlife Commission Technical Guidance staff will recommend that all permits issued in the sub-basins of the Pee Dee River and its tributaries implement the recommendations of the Commission's *Guidance Memorandum to Address and Mitigate Secondary and Cumulative Impacts to Aquatic and Terrestrial Wildlife Resources and Water Quality* (NCWRC 2002). Forestry activities should incorporate forest practice guidelines (FPGs) or best management practices (BMPs) as required by certifying organizations such as those of the Sustainable Forestry Initiative/Forest Stewardship Council/American Tree Farm System certification standards. This can help retain adequate conditions for aquatic ecosystems.

Population Management

Utilize captive propagation and/or translocations to establish a population of Robust Redhorse in the Pee Dee River reach below Tillery Dam over a series of years. This would be followed by monitoring to document successful establishment and persistence over time.

Increase abundance and recruitment of Robust Redhorse below Blewett Falls Dam. Strategies to achieve progress will include augmenting the current population with propagated fish to boost numbers, protecting instream and riparian habitat around both the spawning shoals and the riverine travel corridor, and identification and reduction of current barriers to successful recruitment.

The Wildlife Commission will continue to participate in the Yadkin-Pee Dee TWG and the larger RRCC to implement effective conservation and management for the Pee Dee River population of Robust Redhorse, including pursuit of research objectives and opportunities for grant funds. If a statewide Safe Harbor Agreement is implemented with the USFWS, reintroduction of Robust Redhorse into the Tillery reach of the river will be pursued under the partner assurances of that framework, in cooperation with TWG members, pending approval from the Habitat, Nongame, and Endangered Species Committee. The Commission has planned to produce a minimum of 20 year-classes of captively reared Robust Redhorse to stock into this system in cooperation with SCDNR; three have been completed to date (2014, 2015, 2018 year-classes). Production is wholly dependent on successful collection of gametes from broodstock during spring sampling on spawning shoals. The timing and accessibility of ripe adults are driven by water temperatures and flow, including the availability of sufficient quantities of water delivered from successive hydroelectric projects upstream to release from Blewett Falls Dam. Therefore, a completion date for this phase of augmentation must remain adaptive to these constraints.

Incentives (Tax Break)

The Wildlife Commission will encourage private landowners adjacent to the Pee Dee River and its tributaries to participate in the Wildlife Conservation Lands program. This program allows qualifying landowners whose property is in proximity to streams with state listed species to get a break in property taxes for implementing conservation actions.

Monitoring and Research

The Wildlife Commission will continue to participate in population monitoring as part of the Yadkin-Pee Dee TWG's cooperative sampling efforts, collecting data for further modeling and metrics, as well as broodstock for propagation of juveniles.

Identify habitat use, movement patterns, and life history details of juvenile Robust Redhorse in the Pee Dee River between larval emergence and recruitment into the spawning population. This includes investigation of current barriers to recruitment, which may encompass predation by exotic species, mortality or sublethal effects from contaminants, or other environmental stressors reducing survival to sexual maturity.

The Commission will cooperate with SCDNR to monitor the genetic health of the Pee Dee Robust Redhorse population through analysis of fin clip material collected during sampling, as well as determine the proportion of fish recruiting into the breeding population that are products of wild, in-river spawning. In addition, the contributions of hatchery-reared fish will be tracked as stocked individuals mature, reproduce and contribute to the population.

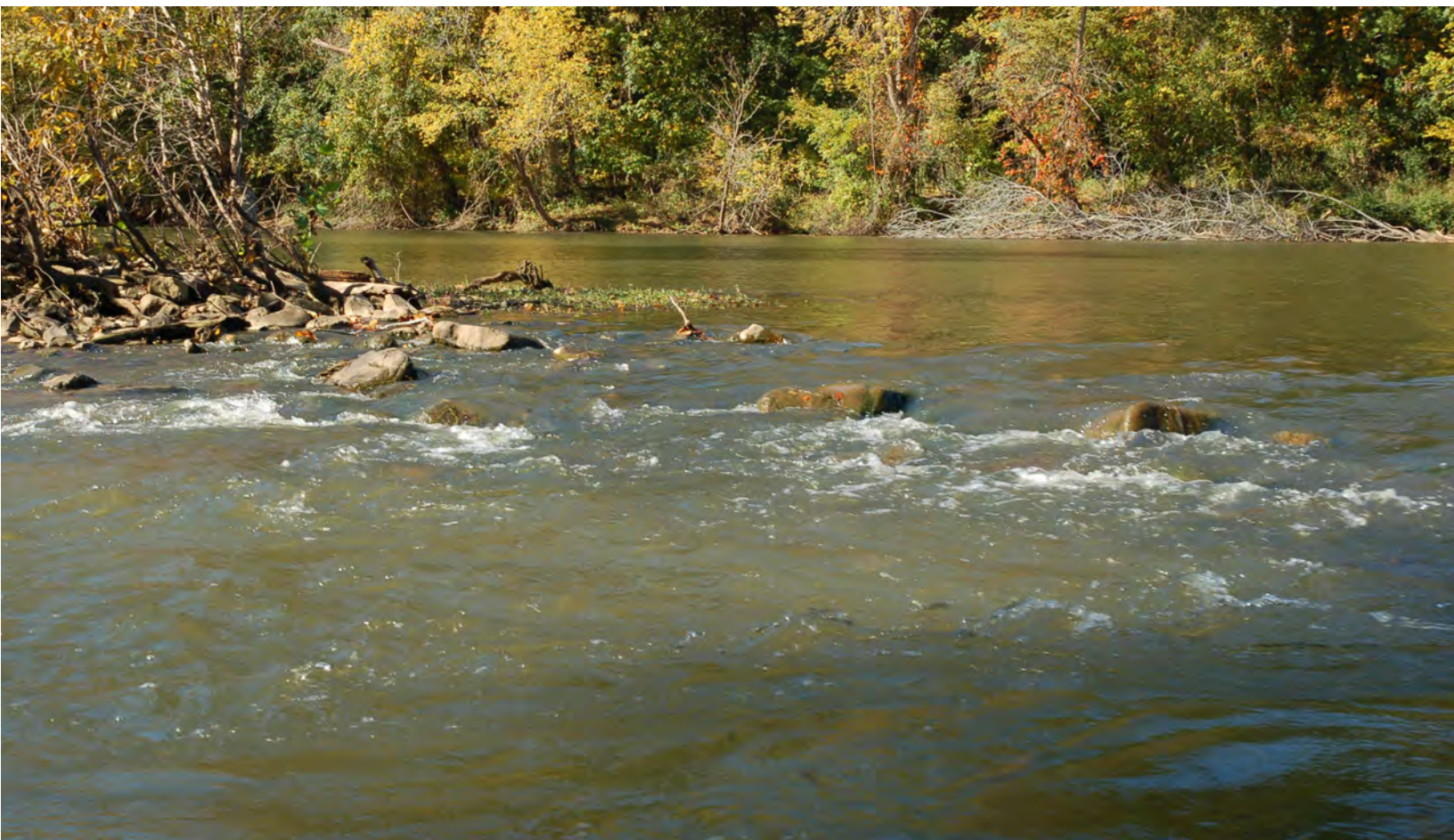
Education and Outreach

The Wildlife Commission will continue to contribute to reports, educational materials, and other publications that comprise the RRCC website, as well as distribute public information about the species and associated projects through channels such as the NC Chapter of the American Fisheries Society and the Commission. Results of research and monitoring projects will be presented at scientific meetings of fisheries and conservation biologists and administrators.

Commission biologists will work with Wildlife Education staff to promote education and awareness of the Robust Redhorse and efforts to conserve the species and its habitat. As part of this process, staff will develop and share outreach materials to help increase public awareness.

Regulations

Take or possession of this species without a valid permit is currently prohibited under NC law and administrative code (15A NCAC 101 .0102) and is considered a Class 1 misdemeanor (§ 113 337b). Wildlife Commission regulations prohibit transport, purchase, possession or sale of live individuals of Japanese and Chinese Mystery Snail, Grass Carp, Black Carp, Bighead Carp or Silver Carp or stocking these species into public or private waters. Additionally, no fish can be stocked into public fishing waters without a permit and only certified triploid Grass Carp may be purchased, possessed or stocked with a permit. The Commission is currently considering implementing a rule that would prohibit bow fishing in the Pee Dee River for all fish except catfish. This would protect the Robust Redhorse from take associated with this activity.



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Exhibit D-1

December 10, 2020

North Carolina Wildlife Resources Commission Land Acquisition Investigation Form

Phase II: FINAL ACQUISITION DETAILS

Tract Name: Kings Bridge Tract, Henderson County

WRC Action/Approval to Pursue (Date): December 9, 2020

Acquisition Plan (specify total project costs AND sources of funding):

Transfer of property from Conserving Carolina to the NCWRC. National Fish and Wildlife Foundation Duke Power Settlement agreement funds will be used by NCWRC to acquire property from Conserving Carolina.

<i>National Fish and Wildlife Foundation Grant</i>	<i>\$475,000</i>
<i>TOTAL COST</i>	<i>\$475,000</i>

Acquisition Plan Includes Bargain Sale? Yes No N/A

If Yes, Explain Details: Bargain sale from Conserving Carolina to the WRC represents a \$1,470,000 reduction in acquisition cost off the appraised tract value.

Total Cost Based on Appraisal? Yes No N/A

If Yes, Describe in Table:

Requested By	Appraiser	Effective Date	Appraised Value
<i>Super Sod Real Property Holdings LLC and Conserving Carolina</i>	<i>Robert J. Fletcher (Fletcher Realty)</i>	<i>Dec 1, 2020</i>	<i>\$1,945,000</i>

Appraisal Handled by State Property Office? Yes No N/A

Source(s) of Stewardship Funds (indicate federal:state match rates):

Federal Assistance Grant – 75% federal: 25% state

Five-Year Stewardship Costs & Revenue Projections (worksheet attached):

Total Stewardship Expenditures	\$19,500.00
Total Projected Revenue	\$0.00

Exhibit X-X

December 10, 2020

North Carolina Wildlife Resources Commission Land Acquisition Investigation Form

Phase II: COSTS AND REVENUE WORKSHEET

Estimated Five-Year Stewardship Costs and Revenue Projections:

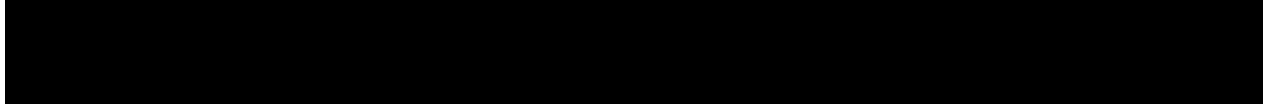
Kings Bridge Tract, Henderson County

Estimated Stewardship Costs					
Activity	Quantity	Unit	Expense Type	Unit Cost	Total Cost
Boundary posting and signage	1	Site	One-time	\$5,000	\$5,000
Kiosks	1	Each	One-time	\$750	\$750
Routine maintenance (5 yr. period)	5	Year	Recurring	\$2,250	\$11,250
Gravel	1	Site	One-time	\$2,500	\$2,500
TOTAL					\$19,500

Estimated Revenue Projections				
Source	Quantity	Unit	Unit Revenue	Total Revenue
TOTAL				\$ 0.00

**North Carolina Wildlife Resources Commission
Land Acquisition Investigation Form
– PHASE I: INITIAL INVESTIGATION –**

WRC Staff Contact:	Jessie Birckhead
Date First Presented to Commission:	9-Dec-20
Tract Name:	King's Bridge Tract
County:	Henderson (Tax Map Number 9640-69-8997)
Acreage:	86.63
Tax Value:	\$540,600
Property Owner/Representative:	Conserving Carolina, Kieran Roe Executive Director



Primary Purpose:

<input checked="" type="checkbox"/>	Resource Protection
<input checked="" type="checkbox"/>	Resource Management
<input checked="" type="checkbox"/>	User Access
<input type="checkbox"/>	WRC Facility

Program Potential:

<input type="checkbox"/>	Game Land
<input checked="" type="checkbox"/>	Wildlife Conservation Area
<input checked="" type="checkbox"/>	Access Area
<input type="checkbox"/>	None

Type of Acquisition:

<input checked="" type="checkbox"/>	Purchase
<input type="checkbox"/>	Lease
<input type="checkbox"/>	Easement

Type of Parcel:

<input checked="" type="checkbox"/>	Tract
<input checked="" type="checkbox"/>	Riparian Corridor

Grant Potential:

<input type="checkbox"/>	CWMTF
<input type="checkbox"/>	Federal Aid (PR, WB, etc.)
<input checked="" type="checkbox"/>	Other: NFWF Grant
<input type="checkbox"/>	Other

Owner Interest:

<input checked="" type="checkbox"/>	High
<input type="checkbox"/>	Moderate
<input type="checkbox"/>	Low
<input type="checkbox"/>	No

Tax Value:

<input checked="" type="checkbox"/>	Year Assessed
<input type="checkbox"/>	PUV?

Stewardship Considerations:

<input type="checkbox"/>	75% Source: PR
<input type="checkbox"/>	25% Match: State

Funding Considerations:

<input type="checkbox"/>	Donation
<input checked="" type="checkbox"/>	Bargin Sale
<input checked="" type="checkbox"/>	Partner Contribution

Reviewed Appraisal & Purchase Requirements?

<input checked="" type="checkbox"/>	Yes
<input type="checkbox"/>	No
<input type="checkbox"/>	N/A

Recommendation:

<input checked="" type="checkbox"/>	Pursue
<input type="checkbox"/>	Do Not Pursue
<input type="checkbox"/>	Defer

Additional Comments:

Conserving Carolina, a local land trust organization in Hedersonville, NC is working to transfer an 86.63 ac tract to the NC Wildlife Resources Commission for longterm resource conservation, management and protection.

North Carolina Wildlife Resources Commission
Land Acquisition Investigation Form
– PHASE I: INITIAL INVESTIGATION –

Tract Name:	King's Bridge Tract
County:	Henderson

Resources Assessment and Biological Benefits (brief):

Acquisition of this property will provide the following direct benefits: the addition of 86 acres of contiguous habitat to an adjacent 370 acres of land in the floodplain that will remain undeveloped, adding protection to a reach of the French Broad River that contains populations of Federal and State Endangered Appalachian Elktoe mussel and Botched Chub ranked as Rare in the state, and protecting habitat to known populations of State Rare Boblink and Baltimore Checkerspot butterfly. It is in the floodplain and is currently used as cropland, contributing to storm water run-off, sediment and erosion, and fertilizer-based nutrients to the French Broad River, which is on the 303(d) list of impaired waters. Thirteen percent of the basin is in agricultural land use, mostly in the floodplain. Only 58 percent of streams in this subwatershed have forested stream buffers. The restoration of bottomland floodplain forest and native grassland on the tract will reduce sediment and erosion and water quality threats, and provide wildlife habitat and connectivity. Additionally, 23 wildlife Species of Greatest Conservation Need are found in the subwatershed of this parcel. Tract acquisition would support ongoing efforts in the upper French Broad River watershed to restore floodplain connectivity and promote riverine fish species passage to spawning and nursery habitats such as backwater sloughs and depressional wetlands, once prominent along the river systems. Floodplain connectivity, riparian buffer and wetland habitats have been extensively modified and eliminated over the past century due to ditching and other land use practices. Monitoring efforts at a recently completed floodplain restoration project revealed immediate and continued use of restored slough habitats by Muskellunge, Black and Golden redhorse, and other fish species. The Kings Bridge tract provides an excellent opportunity to further restore river connectivity to the adjacent floodplain habitat features, and support agency efforts by working at a landscape scale to promote ecological uplift to not only aquatic species, but semi-aquatic and terrestrial species alike.

Tract Name	King's Bridge
Date	November 28, 2020
Staff Completing Form	Brooke Massa, Scott Loftis

Species	0.296
	Terrestrial
Overall Biodiversity	0
SGCN Species	1
Game Species	0
	Wetland
Overall Biodiversity	0
SGCN Species	1
Game Species	0
	Aquatic
Overall Biodiversity	2
SGCN Species	2
Game Species	2

Comments
The existing land use is agricultural, with non-existent to minimal buffers on surface waters. The stretch of the French Broad on this property contains populations of Federal and State Endangered Appalachian Elktoe mussel and Botched Chub ranked as Rare in the state. There are currently no terrestrial game or SGCN species on the property, but habitat restoration activities will increase the occurrence of these species. Twenty-three SGCN are present in the watershed. There are also no wetland species present, but restoration of the floodplain will enhance habitat for forested wetland species, many of which are SGCN. However, Shorebirds, peregrine falcons, bald eagles and numerous song birds including warblers and acadian flycatchers potentially use the property at times and would benefit from habitat restoration of the tract.

Habitat	0.556
Size	0
Quality	1
Diversity	1
Rare/Important	2
Connectivity	3
Buffer	3

Comments
Acquisition will enhance connectivity of aquatic and terrestrial habitats. Adjacent lands are protected by the City of Asheville and HOA. The parcel buffers important habitat on the French Broad River. Acquisition would support restoration of river connectivity to the floodplain, enhancing not only aquatic but also semi-aquatic and terrestrial species occurrence.

Public Access	0.889
Hunting/Viewing	2
Fishing	3
Boating	3

Comments
Acquisition of this tract will enhance fishing and river use access, and will provide for wildlife viewing activities.

Wildlife Uses	0.867
Hunting	1
Viewing	3
Fishing	3
Boating	3
Education	3

Comments
Wildlife viewing, particularly birding, would have strong appeal. The Pisgah Center for Wildlife Education, located less than 20 miles from the tract, could use the property for education and outreach field activities. Acquisition of the site would enhance and promote fishing and boating opportunities on the French Broad River.

Other Values	0.556
Timber Harvest	1
Local Economy	1
Quality of Life	3

Comments
Acquisition of this property would provide for wildlife viewing opportunities and enhance quality of life for nearby residents. Increased fishing and river use would benefit the local economy.

Feasibility & Logistics	0.800
Existing Infrastructure	2
Compatibility of Multiple Uses on Tract	2
Compatibility with Adjoining Land	2
Inholding/Corridor	3
Proximity to Users	3

Comments
The Mills River Land and Water Access Depot is located approximately 10 miles from the property. The property is bounded on one side by Haywood Road (NC 191), which would provide access to the property and river. There is no infrastructure on the property.

Restoration/Mitigation Potential	0.917
Species Restoration	3
Habitat Restoration	3
Access Improvement	2
Threat Mitigation	3

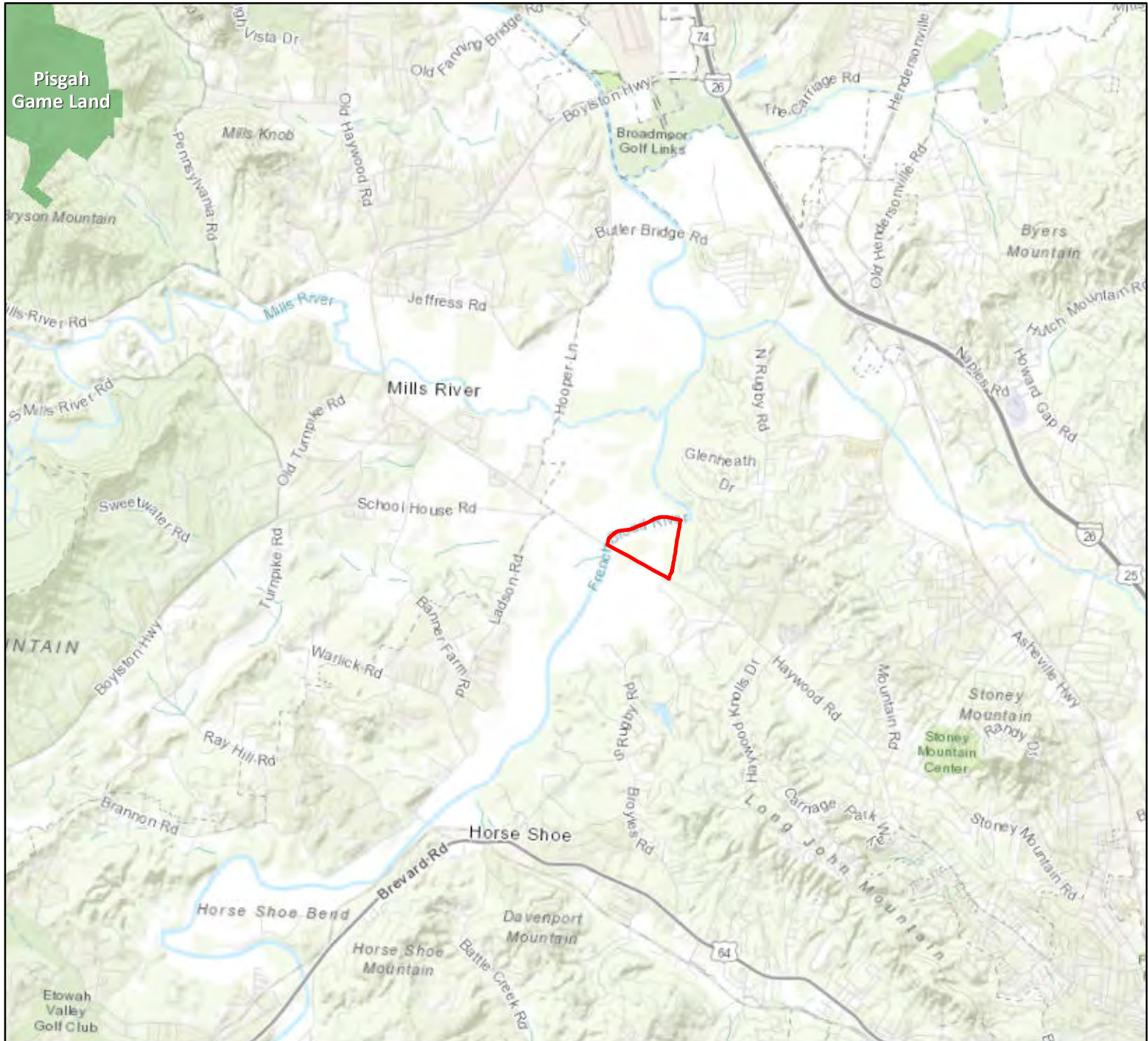
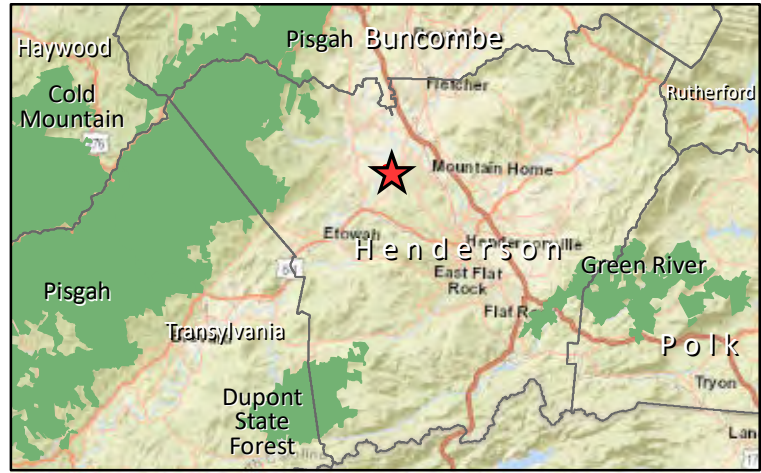
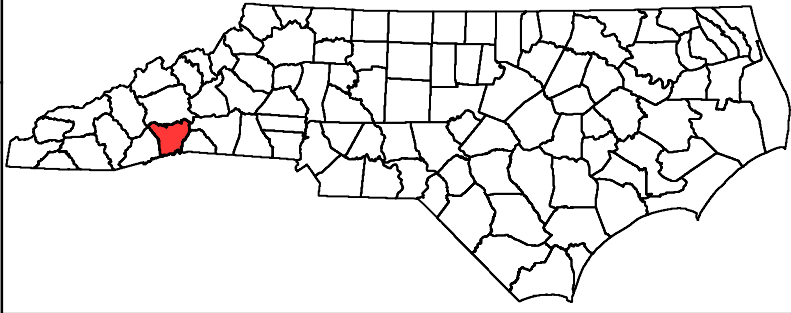
Comments
Restoration of a forested floodplain will enhance habitat and improve water quality. Early successional habitat restoration can be achieved on this property. Acquisition of this property will alleviate the threat of development and problematic agricultural practices.

Threats	0.200
Number	1
Severity	0
Imminence	1
Manageability	0
Management Cost	1

Comments
Property acquisition would minimize or eliminate potential threats.

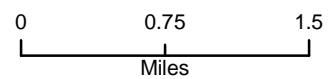
Overall Score	4.680
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Kings Bridge Tract Henderson County 86.63 Acres

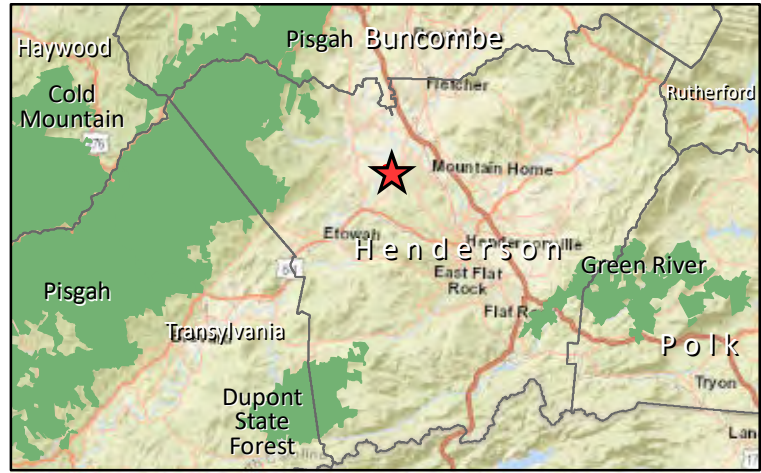
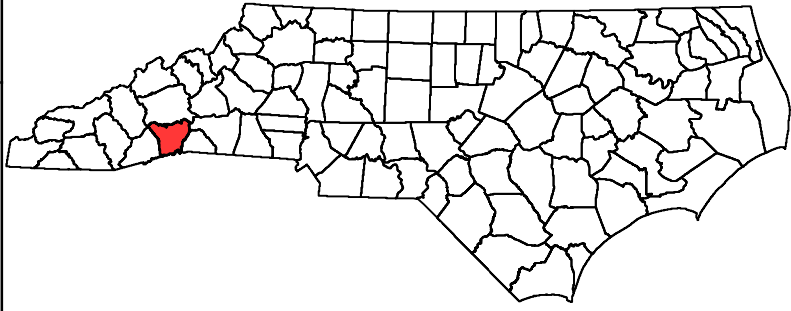


December 2, 2020


 Kings Bridge Tract



**Kings Bridge Tract
Henderson County
86.63 Acres**



December 2, 2020

 Kings Bridge Tract

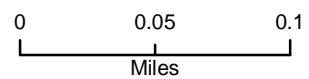


Exhibit D-2

December 10, 2020

North Carolina Wildlife Resources Commission Land Acquisition Investigation Form

Phase II: FINAL ACQUISITION DETAILS

Tract Name: Hall Tract

WRC Action/Approval to Pursue (Date): 30 June 2020

Acquisition Plan (specify total project costs AND sources of funding):

WRC License Receipts	\$29,000
TOTAL COST	\$29,000

Acquisition Plan Includes Bargain Sale? Yes No N/A

If Yes, Explain Details:

Total Cost Based on Appraisal? Yes No N/A

If Yes, Describe in Table:

Requested By	Appraiser	Effective Date	Appraised Value
WRC	Shackleford Appraisals, LLC	October 27, 2020	\$29,000

Appraisal Handled by State Property Office? Yes No N/A

Source(s) of Stewardship Funds (indicate federal:state match rates):

Federal Assistance Grant – 75% federal: 25% state

Five-Year Stewardship Costs & Revenue Projections (worksheet attached):

Total Stewardship Expenditures	\$11,484.00
Total Projected Revenue	\$0.00

Exhibit X-X

December 10, 2020

North Carolina Wildlife Resources Commission Land Acquisition Investigation Form

Phase II: COSTS AND REVENUE WORKSHEET

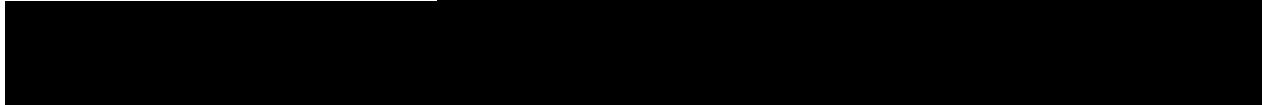
Estimated Five Year Stewardship Costs and Revenue Projections: HALL TRACT

Estimated Stewardship Costs					
Activity	Quantity	Unit	Cost Type	Unit Cost	Total Cost
Boundary Removal	1.2	Mile	One-time	\$135	\$162
Site Prep Spray	24	Acre	One-time	\$120	\$2,880
Prescribed Burn	32.6	Acre	One-time	\$30	\$978
Longleaf Pine Planting	24	Acre	One-time	\$140	\$3,360
Native Grass Planting	24	Acre	One-time	\$171	\$4,104
TOTAL					\$11,484

Estimated Revenue Projections				
Source	Quantity	Unit	Unit Revenue	Total Revenue
TOTAL				\$0

**North Carolina Wildlife Resources Commission
Land Acquisition Investigation Form
– PHASE I: INITIAL INVESTIGATION –**

WRC Staff Contact:	Chesley Ward
Date First Presented to Commission:	30-Jun-20
Tract Name:	Hall Tract
County:	Bladen
Acreage:	32.60
Tax Value:	\$20,790
Property Owner/Representative:	Brenda Hall



Primary Purpose:

<input checked="" type="checkbox"/>	Resource Protection
<input checked="" type="checkbox"/>	Resource Management
<input type="checkbox"/>	User Access
<input type="checkbox"/>	WRC Facility

Program Potential:

<input checked="" type="checkbox"/>	Game Land
<input type="checkbox"/>	Wildlife Conservation Area
<input type="checkbox"/>	Access Area
<input type="checkbox"/>	None

Type of Acquisition:

<input checked="" type="checkbox"/>	Purchase
<input type="checkbox"/>	Lease
<input type="checkbox"/>	Easement

Type of Parcel:

<input checked="" type="checkbox"/>	Tract
<input type="checkbox"/>	Riparian Corridor

Grant Potential:

<input checked="" type="checkbox"/>	CWMTF
<input checked="" type="checkbox"/>	Federal Aid (PR, WB, etc.)
<input type="checkbox"/>	Other
<input type="checkbox"/>	Other

Owner Interest:

<input checked="" type="checkbox"/>	High
<input type="checkbox"/>	Moderate
<input type="checkbox"/>	Low
<input type="checkbox"/>	No

Tax Value:

2015	Year Assessed
yes	PUV?

Stewardship Considerations:

75%	Source: Federal Aid Grant
25%	Match: State

Funding Considerations:

<input type="checkbox"/>	Donation
<input type="checkbox"/>	Bargin Sale
<input type="checkbox"/>	Partner Contribution

Reviewed Appraisal & Purchase Requirements?

<input type="checkbox"/>	Yes
<input checked="" type="checkbox"/>	No
<input type="checkbox"/>	N/A

Recommendation:

<input checked="" type="checkbox"/>	Pursue
<input type="checkbox"/>	Do Not Pursue
<input type="checkbox"/>	Defer

Additional Comments:

GIS data shows that the tract is 32.6 acres in size but tax data indicates that it is 19.73 acres. There is a hunting cabin on the property that is in disrepair. There is also two abandoned vehicles that appear to have been there for several years.

North Carolina Wildlife Resources Commission
Land Acquisition Investigation Form
– PHASE I: INITIAL INVESTIGATION –

Tract Name:	Hall Tract
County:	Bladen

Resources Assessment and Biological Benefits (brief):

The Hall Tract is a ± 32.6 acre inholding within Suggs Mill Pond Game Land in Bladen County. All pine timber was harvested from the property in 2017 and vegetation has naturally regenerated since then. Soils on the tract would have historically supported a dry longleaf pine community type. Currently, it is in a shrub seccessional community and provides valuable habitat for as many as 23 SGCN within a large area dominated by forested plant communities.

Tract Name **Hall Tract**
 Date **March 11, 2020**
 Staff Completing Form **Chesley Ward**

Species	0.148
	Terrestrial
Overall Biodiversity	1
SGCN Species	1
Game Species	2
	Wetland
Overall Biodiversity	0
SGCN Species	0
Game Species	0
	Aquatic
Overall Biodiversity	0
SGCN Species	0
Game Species	0

Comments
 Because the tract is small and has recently been clearcut, overall biodiversity and species are low for terrestrial species. Game species score higher because of their known presence. Only a narrow drain exists on the property so wetland and aquatic species score very low.

Habitat	0.556
Size	1
Quality	1
Diversity	1
Rare/Important	1
Connectivity	3
Buffer	3

Comments
 This tract is an inholding, totally surrounded by existing game land. An all-weather road connects it to game land and itself has an extensive trail system. Acquiring it would allow much better prescribed burning opportunities on adjacent stands. The tract itself would be included in the surrounding habitat management activities.

Public Access	0.333
Hunting/Viewing	3
Fishing	0
Boating	0

Comments
 There is good access to the property and it has a good existing trail system.

Wildlife Uses	0.400
Hunting	3
Viewing	3
Fishing	0
Boating	0
Education	0

Comments
 Like the game land that surrounds it, the tract offers excellent hunting and wildlife viewing opportunities.

Other Values	0.556
Timber Harvest	3
Local Economy	1
Quality of Life	1

Comments
 Well drained soils and good access allow for excellent timber management and harvest.

Feasibility & Logistics	0.800
Existing Infrastructure	1
Compatibility of Multiple Uses on Tract	3
Compatibility with Adjoining Land	3
Inholding/Corridor	3
Proximity to Users	2

Comments
 A good trail systems already exists on the property but there is an old hunting cabin in disrepair that is a liability that would have to be removed. Two old abandoned vehicles would also have to be removed. Being an inholding, it would fit perfectly into the management on Suggs Mill Pond Game Land.

Restoration/Mitigation Potential	1.000
Species Restoration	3
Habitat Restoration	3
Access Improvement	3
Threat Mitigation	3

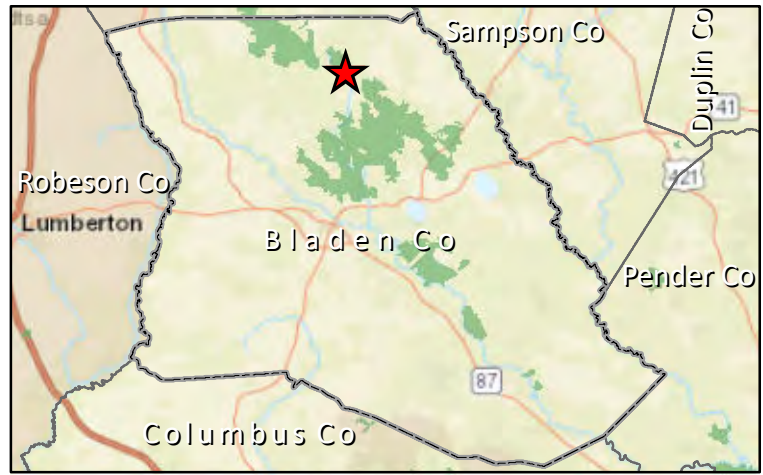
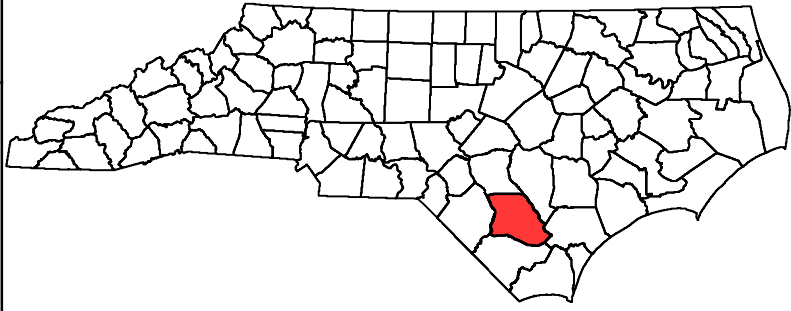
Comments
 Almost the entire tract can be restored to it's historical community type, dry longleaf pine, which would have the potential to restore associated wildlife species. It will give much better access to existing portions of Suggs Mill Pond Game Land.

Threats	0.533
Number	1
Severity	3
Imminence	1
Manageability	1
Management Cost	2


Comments
 Outside of WRC ownership, it is highly unlikely to be restored. It is threatened by the likelihood that a residence may be established on it, making our adjacent land management efforts more difficult.

Overall Score	3.259
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**Hall Tract
Bladen County
32.60 Acres**



June 24, 2020

 Hall Tract

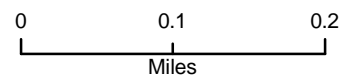


EXHIBIT E

December 10, 2020



⊠ North Carolina Wildlife Resources Commission ⊠

December 2, 2020

MEMORANDUM

TO: Brian McRae, Land and Water Access Division Chief

FROM: Jessie Birckhead, Land Acquisition and Grants Manager

SUBJECT: Request for Boating Access Area Naming

At the July 23rd, 2020 Commission meeting the Board approved acquisition by donation of the Hannah's Ferry Pump Station Boating Access Area site from Three Rivers Land Trust. On October 13th, 2020 we received a written request from Three Rivers to consider naming the site after Milton and Louis Crowther, the original owners of the site. Per the Commission's Resolution "Policy and Procedure for Naming Lands or Facilities in Recognition of Significant Contributions to the Wildlife Resources of North Carolina", the Commission may consider a proposal to name an existing facility by request. Attached to this memo is the written request from Three Rivers Land Trust and a copy of the Commission's naming policy resolution.

Staff have reviewed the request and if the Commission elects to name the site for the Crowther Family the recommendation would be to use the name "Crowther Boating Access Area" to keep the facility name succinct. Regardless of naming for the site, WRC staff are working with Three Rivers Land Trust to include information about the donation and the Crowther family on the informational kiosk that will be installed at this Boating Access Area.

Staff respectfully requests Commission consideration of this proposal from Three Rivers Land Trust.

Land and Water Access

Mailing Address: 1720 Mail Service Center, Raleigh, N.C. 27699-1720

Physical Address: 1751 Varsity Drive, Raleigh, N.C. 27606

Phone: 919-707-0150

Fax: 919-707-0162



MEMORANDUM OF REQUEST

To: Brian McRae, Land and Water Access, Section Chief

From: Travis K. Morehead, Executive Director

Date: October 13, 2020

Subject: BAA Naming Request (Hannah's Ferry Road)

1. The purpose of this memorandum is to request that the North Carolina Wildlife Resources Commission consider naming the Boating Access Area (BAA) located at the end of Hannah's Ferry Road in Salisbury, NC after Milton and Louise Crowther.
2. On October 6, 2020, the North Carolina Council of State approved accepting a 10-acre donation of this existing and heavily used BAA, located on private land owned by Three Rivers Land Trust.
3. TRLT would respectfully request that this BAA be named either the Milton and Louise Crowther BAA or the Crowther Family BAA. The Crowther's worked with Three Rivers Land Trust in 2005 and 2009 to conserve their family land (approximately 200 acres) along the South Yadkin River. Eventually transferring the fee ownership of these tracts to TRLT while maintaining a life estate on the property.
4. When TRLT staff realized that the BAA was no longer being operated and maintained by Alcoa, Louise Crowther graciously agreed to end the life estate and vest the entire interest of the property to TRLT with no compensation, so that TRLT could gift the site to WRC.
5. We believe that the Crowther family's commitment to conservation merits naming the boating access area in their honor.
6. Thank you for your consideration of this request and your commitment to public access for recreation in North Carolina.
7. The point of contact for this memorandum is the undersigned.

A handwritten signature in blue ink, appearing to read "Travis K. Morehead", is enclosed in a thin black rectangular border.

Travis K. Morehead
Executive Director
Three Rivers Land Trust

RESOLUTION

NORTH CAROLINA WILDLIFE RESOURCES COMMISSION

Policy and Procedure for Naming Lands or Facilities in Recognition of Significant Contributions to the Wildlife Resources of North Carolina

Whereas many worthy capital projects to benefit fish and wildlife resources are undertaken that can be assisted through campaigns that extend the opportunity to name a tract of land or a facility in recognition of financial or other significant contributions toward the completion of the project; and

Whereas many persons have supported fish and wildlife resource conservation projects and programs in the past through financial and other significant contributions that warrant recognition;

Now therefore be it resolved by the North Carolina Wildlife Resources Commission in official session this day, July 13, 2005, that the following policy and procedure be adopted and applied to situations where lands or facilities are to be named in recognition of financial or other significant contributions that benefit fish and wildlife resources or the programs of the agency:

“Organizations or persons whose goals and objectives are consistent with those of the agency and who wish to use naming recognition in their fund raising campaign may apply to the agency in writing giving the details of the campaign, a justification for the campaign in terms of benefit to fish and wildlife resources or programs of the agency, and a specific description of the lands or facilities to be named. The proposal will be presented to the Commission and, if approved, the sponsoring organization or person will be granted permission to use naming in their campaign consistent with the information submitted in the application. The sponsor agrees to screen names requested by donors to ensure propriety and good taste and to submit the proposed names to the agency for final approval by the executive director. The Commission may also name or consider proposals to name existing facilities or lands in recognition of significant past or present contributions by persons or organizations following this same policy and procedure.”

EXHIBIT F-1

December 10, 2020



PUBLIC COMMENTS RECEIVED DURING THE OPEN COMMENT PERIOD 15A NCAC 10F .0308 CLAY COUNTY – LAKE CHATUGE AT GIBSON COVE

A virtual public hearing was held on October 8, 2020 to receive comments on the proposed permanent rule for extension of a no-wake zone in the waters of Gibson Cove, shore to shore, on Lake Chatuge. There were no comments received at the public hearing.

During the open comment period there were no comments received.

EXHIBIT F-2

December 10, 2020



PERMANENT RULEMAKING FINAL ADOPTION AMENDMENT TO 15A NCAC 10F .0308 – CLAY COUNTY, LAKE CHATUGE AT GIBSON COVE

Clay County submitted an application for a proposed revision to enlarge a no-wake zone on Lake Chatuge at Gibson Cove, which currently is located within 50 yards of a TVA-owned boating access area. The Commission approved submission of Notice of Text in the *NC Register*, with an open comment period and virtual public hearing. The Commission requested that the Enforcement Division conduct another assessment of three locations on Lake Chatuge including Gibson Cove, before considering final adoptions. Enforcement submitted a revised assessment matrix for Gibson Cove. The reassessment finds that creating a no-wake zone within the entire cove is not necessary to mitigate boating safety hazards. Instead Enforcement suggests that the no-wake zone within Gibson Cove extend shore to shore beginning at a line north of the boating access area, southward ending at the end of the cove as shown on the attached map. The regulated area will protect the boating access area and a TVA-owned floating boat dock where a search and rescue boat is kept. The revised assessment matrix for Gibson Cove on Lake Chatuge is attached to this exhibit.

Staff seeks final action by the Commission to approve a revision to 15A NCAC 10F .0308(a)(3), for a no-wake zone in Gibson Cove shore to shore from a line north of the boating access area, southward to the end of the cove.

15A NCAC 10F .0308 CLAY COUNTY

(a) Regulated Areas. This Rule shall apply to the following waters in Chatuge Lake:

- (1) within 50 yards of the boat ramp at Ho Hum Campground;
- (2) the waters of Shooting Creek, from a line shore to shore 50 yards west of the High Bridge on NC Highway 175, to a line at the southeast end of Shooting Creek shore to shore, from a point at 35.01960 N, 83.72752 W; to a point at 35.01979 N, 83.72638 W;
- (3) ~~within 50 yards of the waters of Gibson Cove access area; Cove, west-south of a line at the mouth from a point on the north shore at 35.01424 N, 83.79614 W to a point on the south shore at 35.01022 N, 83.79533 W;~~ from a point on the east shore at 35.01005 N, 83.79750 W to a point on the west shore at 35.01099 N, 83.79929 W, southwest to the end of Gibson Cove.



**NO-WAKE ZONE REVISED WATER SAFETY HAZARDS MATRIX
GIBSON COVE ON LAKE CHATUGE**

SECTION 1:

Name of organization/entity: Clay County

Primary contact information: Debbie Mauney, County Manager 828-389-0089

Exact location of requested no-wake zone:

Gibson Cove NWZ: N35.01099, W-83.79929 and N35.01005, W-83.79778

Body of water and County: Lake Chatuge, Clay County

Location: Gibson Cove Campgrounds

Popular name of area, if any: _____

Width of No-Wake Zone: Narrowest Point: **Gibson Cove 276'**

Widest Point: **Gibson Cove 568.5'** _____

Brief Description of area (example: bridge overpass, obstructed views, Intracoastal Waterway; etc):

There are two public Campgrounds, a dock owned by the county, and a public boating access area located within Gibson Cove off the main channel of Lake Chatuge.

Attach map of designated no-wake zone

Ensure proposed no-wake zone map/and or location is agreed upon by point of contact

Attach detailed reason given from point of contact for the request

The County is trying to provide safety to all users of the reservoir, including swimmers who need designated swim areas. They state that the high concentration of swimmers, boaters, and

personal watercraft increase the likelihood of a deadly accident, especially since these are popular recreation and camping areas.

Is the proposed no-wake zone located within an area that is regulated by the U.S Army Corps of Engineers or the Division of Coastal Management (CAMA) i.e.; Intracoastal Waterway?

YES TVA

NO

(When dealing with the point of contact, please advise that placement of markers in these waters is subject to prior approval of above agency in waters where applicable. NCWRC has no authority to supersede these rules.)

SECTION 2:

PUBLIC SAFETY HAZARD

What public safety hazard exists? There are two campgrounds, one boating access area, and a TVA owned private dock at this location. This location has high boat traffic.

Is this a public swimming or recreational area?

NO

YES

Would the establishment of a roped swimming area or placement of no-wake regulatory buoys be more appropriate?

ROPED SWIM AREA

NO-WAKE BUOYS

SECTION 3:

NAVIGATIONAL HAZARDS

Identify any and all potential hazards associated with the proposed no-wake zone (check all that apply)

OBSTRUCTIONS (Identify) _____

NARROW CHANNEL (give approximate width) _____

SHALLOW WATER (give average depth) _____

OBSTRUCTED VISION (for approximately how great a distance) _____

STRUCTURES (Check all applicable)

- | | |
|---|---|
| <input type="checkbox"/> DAM | <input type="checkbox"/> LOCK |
| <input type="checkbox"/> SPILLWAY | <input type="checkbox"/> JETTY |
| <input type="checkbox"/> FLOOD CONTROL STRUCTURE | <input type="checkbox"/> SUBMERGED STRUCTURE |
| <input type="checkbox"/> TRESTLE | <input type="checkbox"/> SANDBAR |
| <input type="checkbox"/> POWER LINE | <input type="checkbox"/> SHOAL |
| <input type="checkbox"/> FUELING DOCK | <input checked="" type="checkbox"/> PRIVATE DOCKS |
| <input type="checkbox"/> RESTAURANT DOCKS | <input type="checkbox"/> BRIDGE |
| <input checked="" type="checkbox"/> ACCESS AREA/BOAT LAUNCH | <input type="checkbox"/> PIER |

OTHER (list and describe): Regarding the private dock, TVA owns a covered dock in which a boat is kept for search and rescue purposes. This dock is located near the already existing boating access area of the proposed Gibson Cove no wake zone.

SECTION 4:

If approved, will the no-wake zone extend into a designated channel?

NO

YES (if yes, identify on map)

What is the total distance boaters will travel at a no-wake speed:

Gibson Cove 900' _____

Estimated time to travel for boaters through the proposed no-wake zone at no-wake speed:

Gibson Cove 1 Minute

SECTION 5:

List any other known incidents, safety concerns or problems that have occurred?

Although there have not been any reported boating incidents in this area, we have received numerous complaints from campers and swimmers regarding large wakes created by boaters entering and exiting this area at high rates of speed. We also have detected boaters operating their vessels with no lights at night in this area in this congested area.

Rate traffic density in this area from light to heavy **LIGHT 1 2 3 4 5 6 7 8 9 10 HEAVY**

Is traffic density specific to weekend/and or holidays? No _____

Does traffic density or ability to maneuver a vessel due to traffic cause safety issues? YES
NO

Rate the likelihood of an incident occurring in this area compared to other similar areas on this same body of water **VERY UNLIKELY 1 2 3 4 5 6 7 8 9 10 MORE LIKELY**

SECTION 6:

OFFICER ASSESSMENT OF WATER SAFETY HAZARDS

YES:

NO:

Reasons: The area in question has a high level of boating traffic intermixed with two public campgrounds. The area in question also has a very popular public boating access area owned by the TVA and a TVA owned floating boat dock where a search and rescue boat is kept. By having the area designated as no wake, the chances of boating incidents would be greatly reduced.

Officer: *S.M. Carpenter*

Date: 10/16/2020

15A NCAC 10F .0308 (a) (3) - Proposed No Wake Zone
Gibson Cove, Chatuge Lake, Clay County

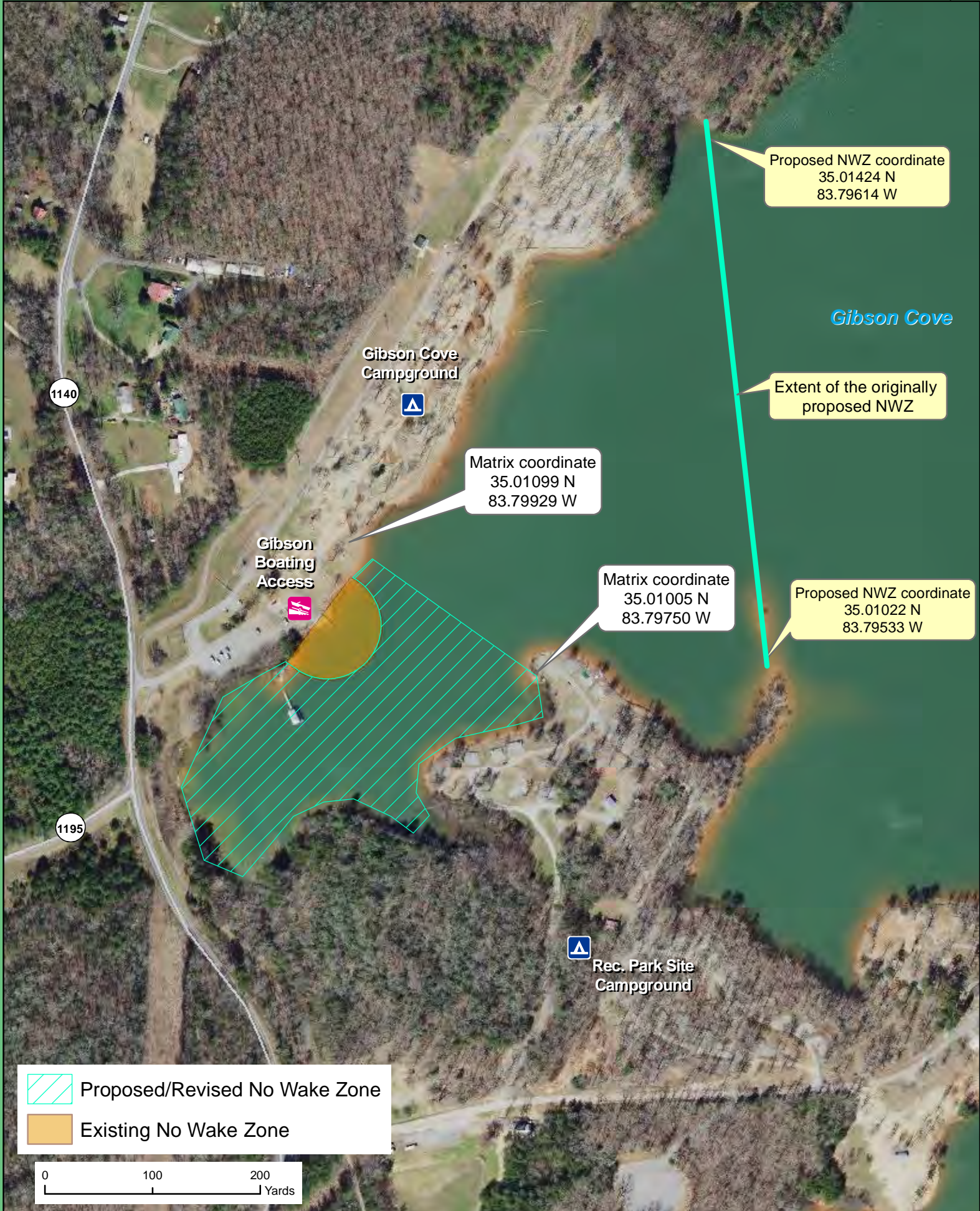


EXHIBIT G-1

December 10, 2020



PUBLIC COMMENTS RECEIVED DURING THE OPEN COMMENT PERIOD 15A NCAC 10F .0308 CLAY COUNTY – LAKE CHATUGE PENINSULA AROUND CLAY COUNTY RECREATIONAL PARK

A virtual public hearing was held on October 8, 2020 to receive comments on the proposed permanent rule for a no-wake zone within 50 yards of the peninsula at the Clay County Recreational Park. There were no comments received at the public hearing.

During the open comment period there were no comments received.

EXHIBIT G-2

December 10, 2020



PERMANENT RULEMAKING FINAL ADOPTION AMENDMENT TO 15A NCAC 10F .0308 – CLAY COUNTY, LAKE CHATUGE – CLAY COUNTY RECREATIONAL PARK

Clay County submitted an application for a proposed no-wake zone on Lake Chatuge within 50 yards of the peninsula at the Clay County Recreational Park. The Commission approved submission of Notice of Text in the *NC Register*, with an open comment period and virtual public hearing. The Commission requested that the Enforcement Division conduct another assessment of three locations on Lake Chatuge before considering final adoptions.

Enforcement submitted the revised assessment matrix for the Clay County Recreational Park, which suggests changing the coordinates of the proposed location of this no-wake zone so that the regulated area is more clearly described to be no greater than 50 yards from the shoreline. The revised assessment matrix for the Clay County Recreational Park is attached to this exhibit.

Staff seeks final action by the Commission to approve 15A NCAC 10F .0308(a)(8) with revised text to show the coordinates where the no-wake zone will be situated around the peninsula. The revised map is attached.

15A NCAC 10F .0308 CLAY COUNTY

(a)

(8) within 50 yards of the peninsula at Clay County Recreational Park, from a point on the north shore at 35.00859 N, 83.79303 W, 35.00850 N, 83.79254 W, east to a point in the water at 35.00894 N, 83.79168 W, 35.00874 N, 83.79187 W, south to a point in the water at 35.00778 N, 83.79096 W, 35.00782 N, 83.79119 W, southwest to a point in the water at 35.00655 N, 83.79192 W, 35.00672 N, 83.79211 W, west to a point on the shore at 35.00678 N, 83.79261 W, 35.00696 N, 83.79259 W.



NO-WAKE ZONE WATER SAFETY HAZARDS MATRIX

SECTION 1:

Name of organization/entity: Clay County

Primary contact information: Debbie Mauney, County Manager 828-389-0089

Exact location of requested no-wake zone:

Rec Park NWZ: N35.006719, W-83.792109 and N35.007320, W-83.791600 and N35.007820, W-83.791188 and N35.008740, W-83.791867

Body of water and County: Lake Chatuge, Clay County

Location: Clay County Recreation Park Campground

Popular name of area, if any: N/A

Width of No-Wake Zone: Narrowest Point: 150'

Widest Point: 203'

Brief Description of area (example: bridge overpass, obstructed views, Intracoastal Waterway; etc):

There is a public campground and recreation area which has a beach area alongside the main channel of Lake Chatuge.

Attach map of designated no-wake zone

Ensure proposed no-wake zone map/and or location is agreed upon by point of contact

Attach detailed reason given from point of contact for the request

The County is trying to provide safety to all users of the reservoir, including swimmers who need designated swim areas. They state that the high concentration of swimmers, boaters, and personal watercraft increase the likelihood of a deadly accident; especially since these are popular recreation and camping areas.

Is the proposed no-wake zone located within an area that is regulated by the U.S Army Corps of Engineers or the Division of Coastal Management (CAMA) i.e.; Intracoastal Waterway?

YES TVA

NO

(When dealing with the point of contact, please advise that placement of markers in these waters is subject to prior approval of above agency in waters where applicable. NCWRC has no authority to supersede these rules.)

SECTION 2:

PUBLIC SAFETY HAZARD

What public safety hazard exists? This is a lake front recreation park and campground managed by the county for the public.

Is this a public swimming or recreational area?

NO

YES

Would the establishment of a roped swimming area or placement of no-wake regulatory buoys be more appropriate?

ROPED SWIM AREA

NO-WAKE BUOYS

SECTION 3:

NAVIGATIONAL HAZARDS

Identify any and all potential hazards associated with the proposed no-wake zone (check all that apply)

OBSTRUCTIONS (Identify) _____

NARROW CHANNEL (give approximate width)

SHALLOW WATER (give average depth) On the point, the water is about 4 feet when the water is at its highest level throughout the year.

OBSTRUCTED VISION (for approximately how great a distance) 100 Feet

STRUCTURES (Check all applicable)

DAM

LOCK

SPILLWAY

JETTY

FLOOD CONTROL STRUCTURE

SUBMERGED STRUCTURE

- | | |
|--|--|
| <input type="checkbox"/> TRESTLE | <input type="checkbox"/> SANDBAR |
| <input type="checkbox"/> POWER LINE | <input type="checkbox"/> SHOAL |
| <input type="checkbox"/> FUELING DOCK | <input type="checkbox"/> PRIVATE DOCKS |
| <input type="checkbox"/> RESTAURANT DOCKS | <input type="checkbox"/> BRIDGE |
| <input type="checkbox"/> ACCESS AREA/BOAT LAUNCH | <input type="checkbox"/> PIER |

OTHER (list and describe): This area is a recreational area for public recreation and camping. The recreation area is located alongside the main channel of Lake Chatuge, which has a high density of boating traffic.

SECTION 4:

If approved, will the no-wake zone extend into a designated channel?

NO

YES (if yes, identify on map)

What is the total distance boaters will travel at a no-wake speed:

Rec Park 875'

Estimated time to travel for boaters through the proposed no-wake zone at no-wake speed:

Rec Park 2 Minutes

SECTION 5:

List any other known incidents, safety concerns or problems that have occurred?

We have received numerous complaints from campers and swimmers using this area for recreation about large wakes created by boats entering and exiting this area at high rates of speed. We have also received complaints from the public of boats motoring very close to swimmers at high rates of speed. In the past, we have detected boaters operating their vessels with no lights at night in this area as well.

Rate traffic density in this area from light to heavy **LIGHT 1 2 3 4 5 6 7 8 9 10 HEAVY**

Is traffic density specific to weekend/and or holidays? No

Does traffic density or ability to maneuver a vessel due to traffic cause safety issues? YES
NO

Rate the likelihood of an incident occurring in this area compared to other similar areas on this same body of water **VERY UNLIKELY** 1 2 3 4 5 6 7 8 9 10 **MORE LIKELY**

SECTION 6:

OFFICER ASSESSMENT OF WATER SAFETY HAZARDS

YES:

NO:

Reasons: The area in question has a high level of boating traffic intermixed with a public campground, recreation area, and beach that are managed by the county. By adding a no wake zone, it will alert boaters to slow down prior to entering the area in hopes of greatly reducing the risks of boating incidents.

Officer: *S.M. Carpenter 153*

Date: 11/9/2020



Chatuge Lake

Clay County
Recreational
Park

35.00850 N
83.79254 W

35.00874 N
83.79187 W

35.00782 N
83.79119 W

35.00696 N
83.79259 W

35.00672 N
83.79211 W



revised by LE



previously proposed

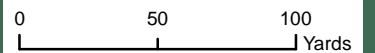


EXHIBIT H-1

December 10, 2020



Ten Public Comments for 15A NCAC 10F .0308 Clay County Lake Chatuge at Dayton Cove - Received between September 15 and November 16, 2020 Open Comment Period

Public Comments Received

Faye Fretz - I have several power boats and I like bass fishing on Lake Chatuge. I often fish in Dayton Cove. There are a lot of boats on Dayton Cove and I think that's great but I've personally had close calls with other boaters because they've been going too fast and too close and not paying enough attention to people who fish. I definitely think Dayton Cove should have a No Wake Zone.

Tony, Sue, Carson, Ansley & Asher Sanders - Our family is writing you today in support of the No Wake Zone addition to Dayton Cove on Lake Chatuge. We reside at XX for the last 3 years and have 3 children. Since moving into the home the amount of boat traffic using Dayton Cove has steadily increased and continually bear witness to many close calls on the water. These close calls involve everything from anchored boats, swimmers, kayakers, paddle boarders and even our family within 50 feet of our own dock. Jet Skiers and boaters alike travel at high rates of speed to the back of this cove and then back out again as rapidly as they entered. There are many occasions that those same boaters are towing skiers, wake boarders and tubes. The distance from shoreline to shoreline in this cove narrows as you enter and have seen many occasions were a widely swung tuber/skier has nearly hit another boater or swimmer. There are frankly some weekends we simply ask our kids not to be in the water due to these dangers. Our dock is located in the section where when boaters attempt to turn around when they realize there is a dead end that they come far too close to our dock. While it is not allowed in NC we had to resort to anchoring an orange buoy 100ft from the dock to deter boaters from getting too close. Our hope is that you approve this no wake zone for Dayton Cove for the safety and enjoyment of all that visit and live here on Lake Chatuge. Safety is our paramount on our lakes and want to ensure everyone has a positive experience.

George and Meg Cook - As full-time residents in XXX NC, we are frequently walking along the shoreline of Dayton Cove on Lake Chatuge. We have also had the pleasure of swimming, kayaking and canoeing in this cove, and we wanted to share our concerns about the safety of children, other residents and visitors. As you may know, Dayton Cove is very narrow and calm, with shallow areas and drop-off points throughout the cove. While this is an ideal location for children and adults to swim, kayak and canoe, it also attracts wave runners/jet skis and power boat traffic. We have personally witnessed near miss accidents, as fast and reckless watercraft speed through this small narrow cove, making quick/tight turns at high rates of speed; nearly missing vulnerable swimmers, kayaks, and other watersports. To eliminate an inevitable tragedy, we would like to thank you for considering the request for Dayton Cove on Lake Chatuge to be deemed a No Wake Zone.

Laura Imbordino - I would like to add my thoughts to the movement for a no wake zone for the Dayton Cove area of Lake Chatuge. As a new owner, I was really anticipating doing some paddle boarding and swimming in this area, but I'm afraid I've heard of speeding watercraft making it extremely dangerous for the residents and others who attempt this. I hope you will seriously consider implementing a no wake zone in this area so that not only the residents around this cove, but also any others looking for safe water, will be able to enjoy all of our future experiences in this area.

Public Comments Received

Lynn Knowles - We have lived in Dayton Cove since 1986. Lake Chatuge has grown in popularity and population with number of houses, docks and boats in our cove without traffic from outside. As an example this chart outlines just one side of our subdivision in Dayton Cove - the lakefront homeowners.

1986		2020
7	# Houses	20
7	# Docks	20
6	Motorized/licensed boats	34
2	Canoes	8
1	Waverunners	8
0	Standup Paddleboats	18
0	Sailboats	2
0	Kayaks	24

Dayton Cove is a very popular spot for fishermen, boats that anchor to swim and enjoy the day, boat flotillas “6 to 8 boats to tie up together almost every weekend” and non-motorized boats from the right hand side of our subdivision (there are an additional 35 lots in our subdivision that all use Dayton Cove with more boats - mainly kayaks, canoes and paddleboats) We are also a popular spot for the boats from the campgrounds that are on the main part of the lake where it is hard for them to anchor to take a break and swim. This alone makes the cove extremely busy and dangerous when boats from the main part of the lake turn into our cove with ski boats, speeding fishermen, and wake boats. There are many swimmers “kids and adults” around the 20 docks in the cove and we have had many uncomfortable near-misses of non-motorized boats and swimmers vs these speeding boats.

Over the past 5 to 6 years there has been an increase in the number of rental boats on Lake Chatuge plus we now have 3 Boat Dealers on the lake. So what happens is people rent or purchase a new boat, launch it in the water and have no idea of boating laws, lake levels or the layout of the lake - especially dead-end coves. Boats just go in random directions speeding with no concern for other moving vessels, swimmers around docks or boats that are anchored.

Lake Chatuge has 7000 acres with 130 miles of shoreline. Our cove is so far away from the launch spots for the Ranger Patrol, if we have a problem and call it can take up to 2 hours for a Ranger to get to us. Our Rangers do a good job, but they are spread out too thin. I feel our only solution to our safety concerns is to make the cove a No-Wake cove to protect the boaters and swimmers. I feel like the cove is a ticking time bomb for an accident. It is getting busier every year with its popularity and the Chamber of Commerce from both GA and NC who are pushing Tourism in our area. Please vote yes to help us slow down the speeding traffic in our narrow cove before someone gets killed or injured severely!

Linda Joyce and Thomas Nichols - We would appreciate your support in creating a No Wake Zone for Dayton Cove on Lake Chatuge. We have had several experiences with water skiers and the boats pulling them whipping around in the cove and causing dangerous conditions.

Swimmers, including children, and persons on kayaks, canoes and paddle boards enjoy the cove as a safer place to be than out on the lake. When boats and jet skiers come whizzing in at high speeds it creates a harmful wake and could cause injury.

Thank you for your consideration of this request.

Jeffrey E. Rogers and Devon Wilson - I would like to add to public comments re. a proposed No Wake Zone in Dayton Cove, Lake Chatuge.

My wife and I are residents of the xx subdivision just south of xx, where a number of residents have docks on Dayton Cove. We do not have a waterfront lot, but regularly use small boats--kayaks, canoes, rowboats, and a small sailboat--in this corner of the lake, especially in the Dayton Cove area. Until recently, we have always felt that this cove was a very special place, relatively free of the high-speed, high-powered boats found in the wide open parts of the lake. There is a strong sense of community paddling along the docks, pausing to speak with neighbors and visitors who are often in their own kayaks or on paddleboards, or just swimming off their dock or boat.

In recent years, however, power-boat traffic has greatly increased in our little cove, with high-speed bass-boats, wake-boats and jetskis moving way too fast and coming way too close to docks, swimmers, and small boats. I have very close to tipping over in my canoe several times when encountering large wakes. Needless to say, this has discouraged folks from coming out and enjoying the lake.

We have always welcomed visitors to the cove no matter where they live. We just wish all boat traffic would use common sense when it comes to navigating or exploring in narrow coves such as Dayton. We therefore sincerely hope its designation as a No Wake Zone will be carefully considered.

Bruce and Kate Kotz - Thank you for considering Dayton Cove on Lake Chatuge as a no wake zone, and this opportunity to comment. In the five years we have lived in this cove we have seen an increase in motorized boat and jet ski traffic. Being one of last docks before the cove dead ends I am shocked at how fast and how risky boaters and jet skiers have become even way down on our end of this narrow cove. As you know the horsepower and speeds seem to keep increasing on powered vessels and the total numbers of powered and man or non powered water vessels continues to increase even though the narrow cove size remains the same. We have had many close calls off of our dock while floating or swimming. It is a very popular cove to anchor in which makes passing lanes even more narrow. We are honestly scared a personal accident injury is just around the corner, if something does not change.

In the spirit of safety I urge you to strongly consider the proposal to make Dayton Cove on Lake Chatuge a no wake zone. Thank you for your consideration.

Anne Rice - I watch the "crazies"

There are boaters and people on jet skis that use Dayton Cove on Lake Chatuge that are either ignorant of the boating safety rules or the safety of others. They only think of their own enjoyment.

From my dock, I have observed my neighbor's boat dock run into by a boat, jet skis coming between 2 docks at a high rate of speed to do a u turn because they were not paying attention and that was their only recourse to prevent a collision with another boat. I have also seen a boat pulling skiers come within 10 feet of my dock so the skiers could be dropped off at a neighboring dock, and jet skis treating the parked boats in the cove as an obstacle course.

My dock is on the wider area of the cove, but this is deceptive. In the past several years we have had a dramatic increase in traffic on the lake. There is a campground across from the cove and several boat and jet ski rental facilities nearby. Dayton Cove is calm water and many boats will come from these places and drop anchor to spend the day swimming and paddle boarding in the larger area of the cove from the mouth of the cove back to where it narrows or at the end of the cove. This decreases the width of the cove for boats pulling tubers and the jet skis. These people enter the cove at a high rate of speed not paying attention to what is ahead of them. There have been near collisions at the mouth of the cove. With the 100ft distance that vehicles are to stay away from boat docks, and the boats parked on the other side of the cove, there is not enough room for all the boat traffic to maneuver.

I request that a No Wake Zone be approved for Dayton Cove before there is a serious injury or someone is killed.

One virtual public hearing was held on October 8, 2020.

- One comment was received from **Paul Harwood**, resident of Clay County who represents a large community on lake Chatuge. He encourages Commissioners to approve the no-wake zone. Most own boats and fish. There is a large campground across from the cove. The cove narrows quickly. There are docks on the left and parked boats on the right. There is swimming off docks, paddling kayaks and canoes. There is increased dangerous action from tubes behind pontoon boats. He says there have been close calls. The lake borders Georgia and NC and the cove has a reputation as a calm cove.

September 22, 2020

NWZ Coordinator Betsy Haywood

Re: No Wake Zone -- Dayton Cove, Lake Chatuge

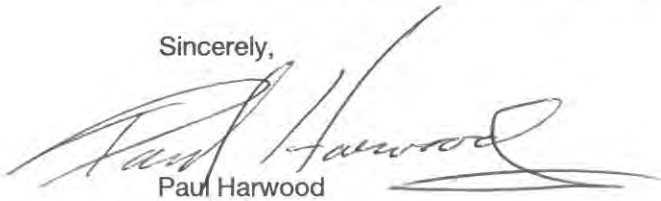
Dear Ms. Haywood

As residents of McClure Point subdivision, we would like to thank you for considering the request for a No Wake Zone for Dayton Cove on Lake Chatuge. We are very concerned for the safety of our residents and others who come to the cove to enjoy the beauty of Lake Chatuge. We have seen the boat traffic increase drastically over the past several years. We believe this contributes to the extreme dangerous conditions we are now witnessing in the cove. Other factors include reckless and dangerous maneuvers by boat and wave runner drivers in a small confined area.

Enclosed please find a packet containing documents, photos, comments, signatures, etc. which we believe will justify and support our concerns and the request for a No Wake Zone in Dayton Cove.

Again thank you for your time and consideration.

Sincerely,

A handwritten signature in cursive script that reads "Paul Harwood". The signature is written in black ink and is positioned above the printed name "Paul Harwood".

Paul Harwood

The following comments from one of our residents reflect a portion of our concerns.

Please note that these comments will also be submitted to the No Wake Zone coordinator to be included with any additional comments received.

- As a resident of Dayton Cove, I'm very concerned about the number of dangerous boating incidents that I regularly observe on the cove. Many swimmers and non-powered watercraft use Dayton Cove and although not all boaters operate in an unsafe manner, many do. My concerns primarily relate to power boats and jet skis that operate at high speeds dangerously close to non-powered watercraft and vulnerable swimmers, many of whom are children.
- It's important to note that most of Dayton Cove is protected from wind, thus the cove tends to have calmer water compared with most main sections of Lake Chatuge. These calm waters make the entire length of Dayton Cove an attractive destination for boats and jet skis that frequently race or recklessly "stunt" at high rates of speed.
- Because Dayton Cove is usually calm, it's also a popular destination for many boats to anchor for extended periods so that their occupants can relax, float and swim. One area where many boats often anchor is the larger section near the front of the cove; another is closer to the end of the cove.
- Dayton Cove is a small, blind cove that dead-ends. At about halfway, Dayton Cove narrows to approximately 300 feet before the cove widens slightly, then ends. It's in this area that power boat and jet ski operators realize they are approaching the end of the cove and can go no further. It's at this point they execute 180 degree turns to reverse course, often at high rates of speed.
- It happens that this same area of Dayton Cove is very frequently used by numerous non-powered watercraft — kayaks, paddle boards, paddle boats, canoes and floats. It's also common for swimmers, often children, to swim in or across the cove.
- Too often, I've seen close calls where the operators of power boats and jet skis ignore the safety of those swimmers and non-powered watercraft by coming within very close proximity to them at high rates of speed. Those swimmers and non-powered watercraft are vulnerable, and the danger and risks to them are significant.
- My wife was on her paddle board when a fast-moving boat came within about forty feet of her and its large wake knocked her off the board. The boat operator was completely oblivious to what happened and when I waved him over to ask him to slow down and be more careful, he merely cursed at me and gave me a vulgar hand gesture. My wife's is not the only incident I've seen; I've observed many other instances involving close calls with swimmers, paddle boards, kayaks, canoes and floats.
- Unless speed limits are put in place and enforced, it's only a matter of time before a serious incident is likely to occur in Dayton Cove.
- Thank you for your consideration and invitation to solicit public input into the decision-making process regarding a No Wake Zone in Dayton Cove. The work you do is very important and I'm grateful for your commitment to public service.

No Wake Petition For Dayton Cove

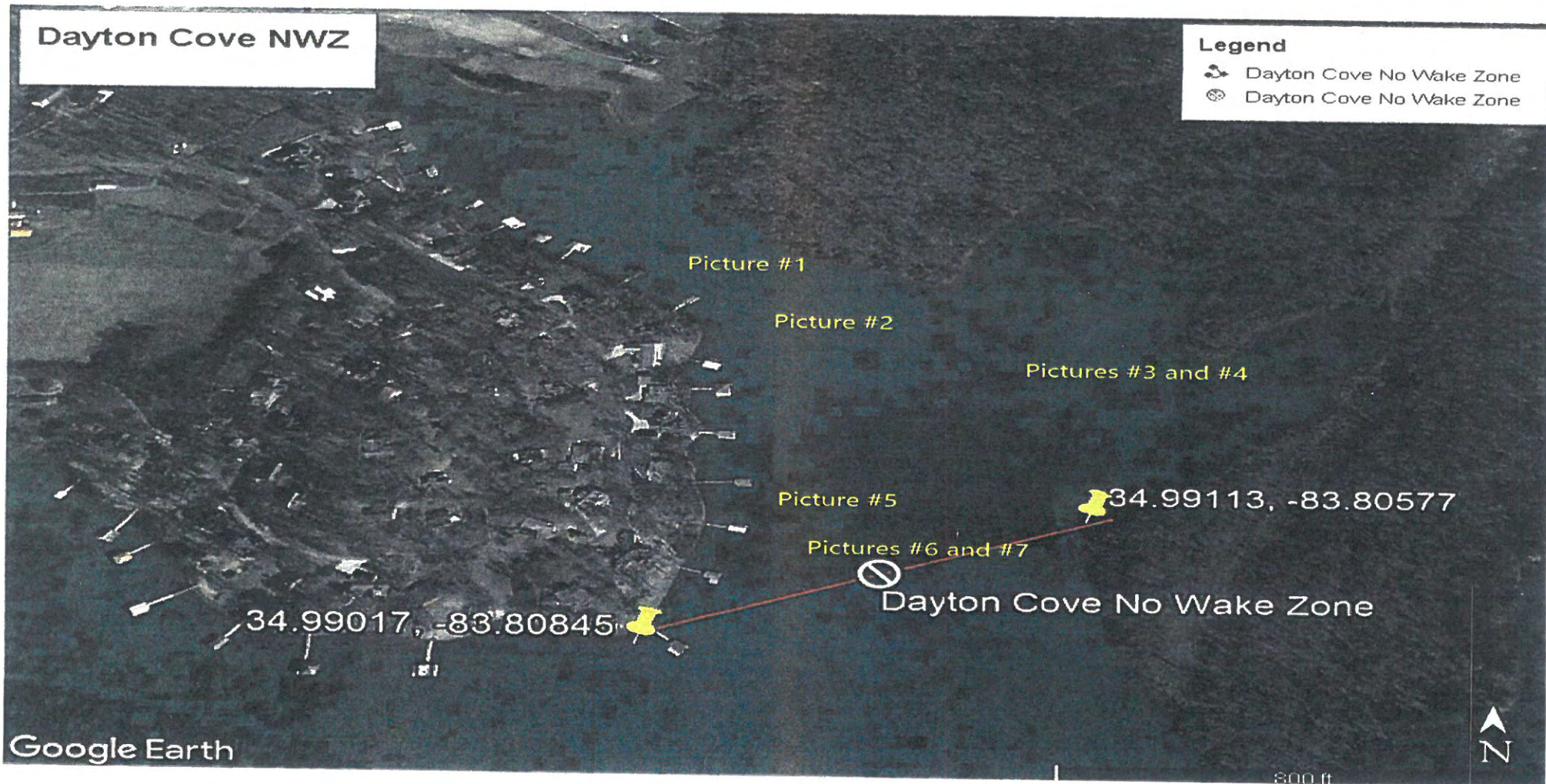


Photo #1- This part of the backend of the cove narrows very suddenly and is around a blind corner. As a result we very often get this result. More than one craft trying to squeeze by others at this point. Some at high speeds.



Photo # 2- This same smaller part of the cove is very calm and as a result attracts many that want to park their boats to picnic, float, paddle and swim.



Photos #3 and #4- This larger alcove is part of the main cove. It has become a popular place for many to park their boats and swim, float and picnic. These are typical scenes especially from April through September with too many boats and jet skis pulling into and out of this area with too much speed.

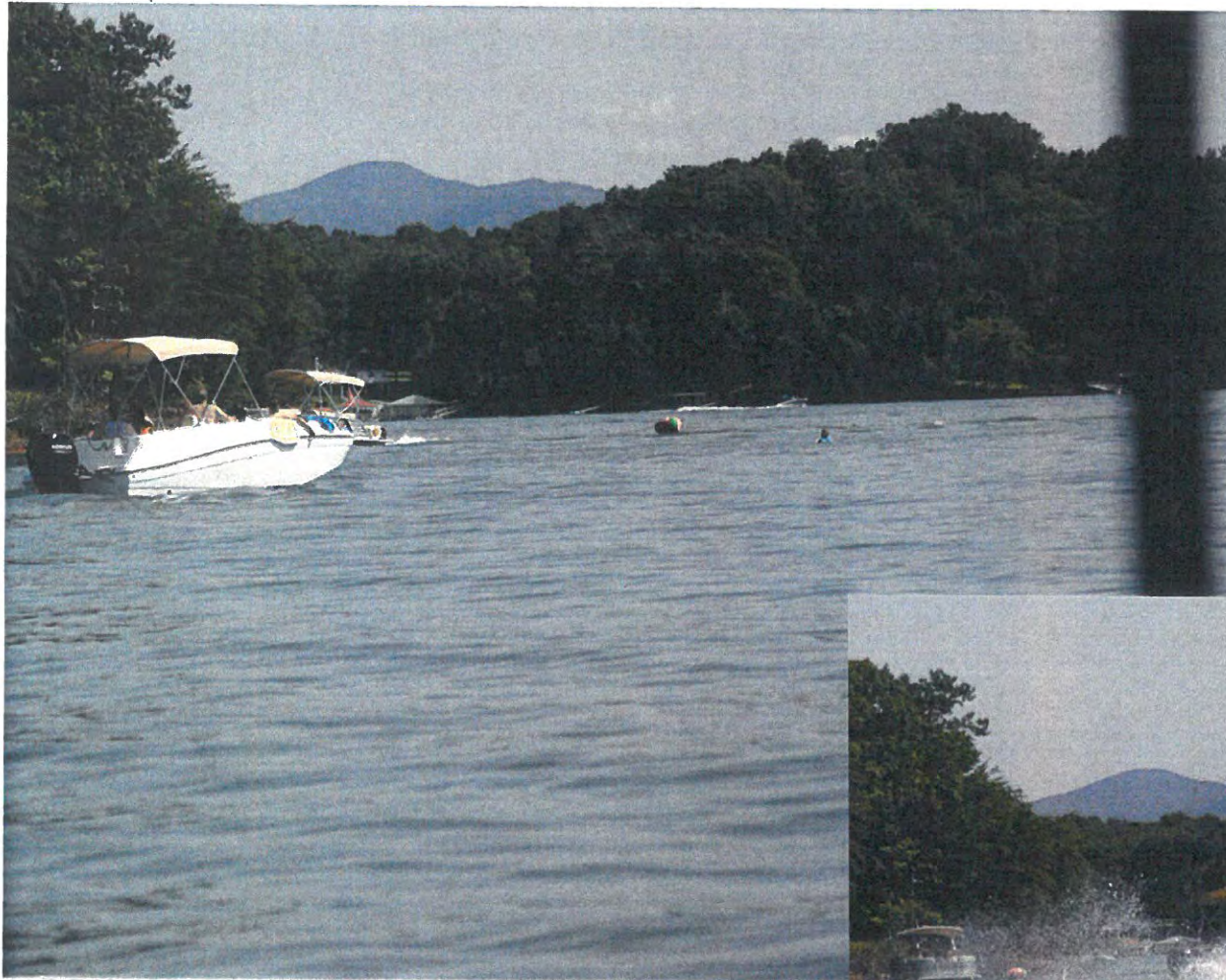


#4 Photo



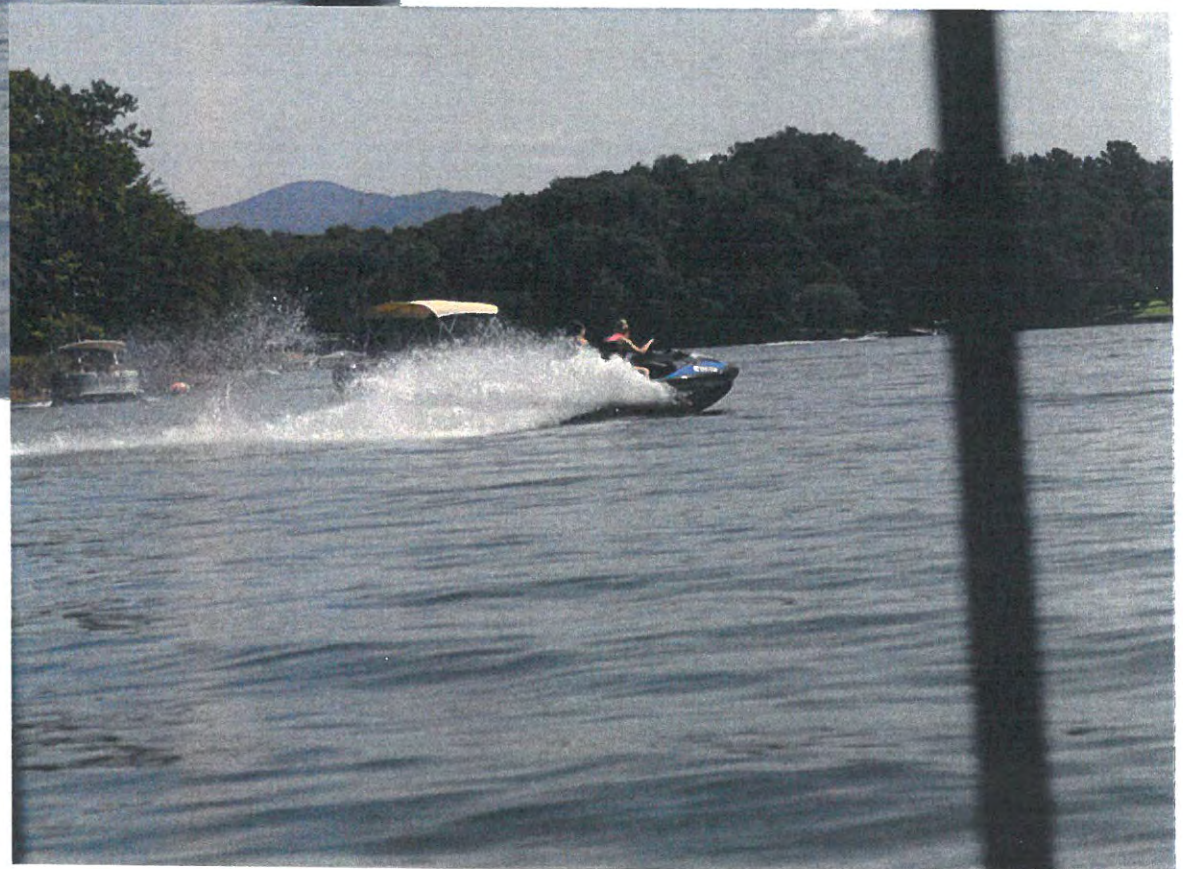
Photo #5- Many boats pull inner tubes through the cove. Many do not know it narrows but they try to maintain speed as they turn around. It has resulted in several close calls with swimmers and floaters simply trying to stay close to their docks.





Photos #6 and #7- #6 shows a dropped child and the boat circling back around to pick him up. A second boat (leaving the #3, #4 area) is approaching both the dropped child and circling boat.

In the second photo a jet skier has just sped past the second boat and is about to turn left to roar out of Dayton cove unaware there was a person in the water. They saw him in time and swerved away to avoid an accident.

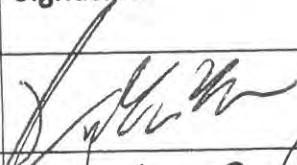




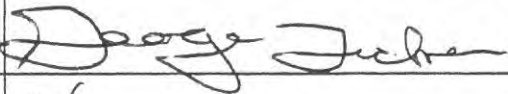
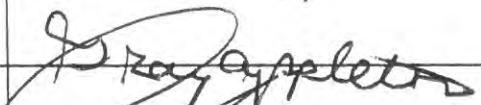
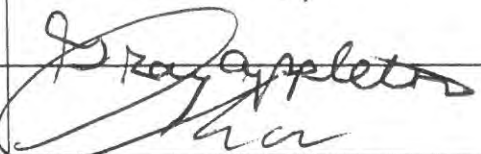
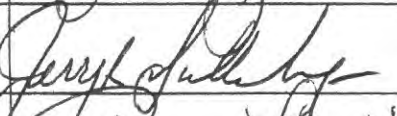
We are trying to keep Dayton Cove **SAFE** and continue to enjoy it with others on beautiful
Lake Chatuge!

Please help us do that by making Dayton Cove a No Wake Zone


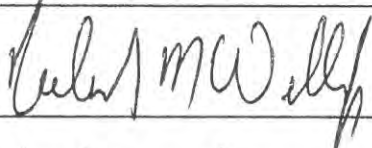

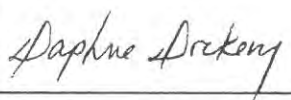


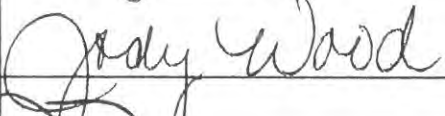

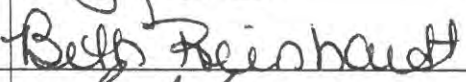


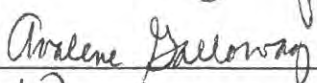
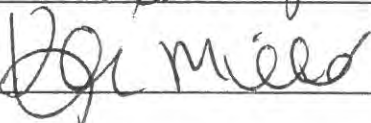


Date	Signature	Printed Name	Address	Comment
8/10/19	Linda M. Joyce	Linda M. Joyce	168 Lakeshore Dr. Hayesville, NC	
8/10/19	Thomas Nichols	Thomas Nichols	408 Lakeshore Dr. Hayesville, NC	
8/11/19	Jonathan Miller	Jonathan Miller	134 Lakeshore Dr.	
8/12/19	Paul Harwood	PAUL HARWOOD	270 Lakeshore	
8/30/19	Mark Granger	MARK GRANGER	1031 McClure Dr.	
8-30-19	Darlene Granger	Darlene Granger	1031 McClure Dr.	
8-30-19	Steve Kaufman	Steve Kaufman	1038 McClure Dr.	
8-30-19	Jill Long	JILL LONG	462 LAKESTHORE DR.	
8-30-19	Henry Rosenkrantz	Henry Rosenkrantz	443 Lakeshore Dr.	
8-30-19	Carl Rosenkrantz	Carl Rosenkrantz	443 Lakeshore Dr.	
8-30-19	Hori Klibanoff	Hori Klibanoff	106 Lakeshore Dr.	
	Eugene Klibanoff	Eugene Klibanoff	106 Lakeshore Dr.	
8-30-19	Linda Coprial	LINDA COPRIAL	967 McClure Dr. 277 STEELSON	
8-30-19	Michael Coprial	Michael S Coprial	967 McClure Dr.	

Date	Signature	Printed Name	Address	Comment
8/5/19		David E Fisher	69 Lakeshore Drive	
8/5/19	William T. Carter Jr	William Carter	960 McClure Drive	
8/5/19		LINDA AKISCH	951 McClure Dr	
8/5/19	Anna Rice	Anna Rice	175 Lakeshore	
8/5/19	Flo Frasure	Flo Frasure	161 "	
8/5/19	Devon Wilson	Devon Wilson	850 McClure Dr	
8/5/19	John Knowles	JOHN KNOWLES	53 Lakeshore Dr	
8/5/19	Joanne Massey	Joanne Massey	1000 McClure Dr	
8/5/19	Lynn Knowles	Lynn Knowles	53 Lakeshore Dr	
8/4/19	Beth A Sullenberger	Beth A Sullenberger	436 Lakeshore	
8/5/19	Janice Harwood	Janice Harwood	276 Lakeshore Dr	
8/5/19	Leslie Carter	Leslie Carter	276 Lakeshore Dr	
8/5/19		Randy Fretz	29 Lakeshore Dr.	
8/5/19	Gay Fretz	Gay Fretz	29 Lakeshore Dr.	Show me damage evident

Date	Signature	Printed Name	Address	Comment
6 Aug 2019		GEORGE TUCKER	389 LAKESHORE DR	
6 AUG 2019	Victoria S. Tucker	VICTORIA TUCKER	" " "	
8/6/19	Linda Appleton	LINDA Appleton	423 Lakeshore Dr.	yes!
8/6/19		Gray Appleton	423 Lakeshore Dr.	
8/6/19		Chris deClain	443 Lakeshore Dr.	
8/5/19	Kathy Yellin	KATHY YELLIN	434 Lakeshore Dr.	
8/5/19	Paul Yellin	PAUL YELLIN	434 Lakeshore Dr.	
8-6-19		Jerry R. SULLENBERGER	436 LAKESHORE DR.	
8/6/19	Pam Leslie	Pam hestlie	63 Hilltop Dr.	
8/6/19	Anthony L. Leslie I	Tony Leslie	63-Hilltop Dr.	Safety Concern
8/6/19	Sally Dennis	Sally Dennis	60 Hilltop Dr.	
8/6/19	Joy Dennis	Joy Dennis	60 Hilltop Dr.	
8/6/19	Emily Gerdes	Emily Gerdes	924 McClure Dr.	
8/6/19	Nic Gerdes	Nic Gerdes	924 McClure Dr.	

Date	Signature	Printed Name	Address	Comment
8-6-19	SHARON SHARON SICKEL	Sharon Sickel	279 LAKE SHORE	
8-6-19	Fred Sickel	Fred Sickel	279 Lakeshore Dr.	
8/6/19	Affrey E. Rogers	JEFFREY ROGERS	850 McCLURE DR	
8-6-19	W.A. Rice Jr	W.A. Rice Jr.	175 Lakeshore	
8-6-19	Susan Sanders	Susan Sanders	193 Lakeshore Dr.	
8-6-19	Tony Sanders	Tony Sanders	193 Lakeshore Dr	
8-7-19	Sheldon Staton	Sheldon Staton	917 McClure Dr	
8-10-19	Kimberly Roach	Kimberly Roach	1023 McClure Dr.	
8-10-19	Cassandra O'Neal	Cassandra O'Neal	908 McClure Dr.	
8-10-19	John W. O'Neal	John O'Neal	908 McClure Dr.	
8-10-19	Pam Staton	Pam Staton	917 McClure Dr	
8-10-19	Paisley Staton	Paisley Staton	917 McClure Dr	
8-10-19	Daniel Holland	DANIEL HOLLAND	123 Lakeshore DR	
8-10-19	Donna Holland	DONNA HOLLAND	123 LAKE SHORE DR	

Date	Signature	Printed Name	Address	Comment
		PATRICK DUNN	392 LAKE SHORE	
8/4/19		Richard Wells	31 Hilltop Drive	
8/4/19		Stephanie Wells	31 Hilltop Dr.	
8/4/19		Daphne Dockery	968 McClure Dr.	
8/4/19		Walt Massey	1000 McClure Dr.	
8/4/19		Gary Wood	287 Lakeshore Dr.	
8/4/19		Jody Wood	287 Lakeshore Dr.	
8/4/19		Jan Reinhardt	352 Lakeshore Dr.	
8.4.19		Beth Reinhardt	352 Lakeshore Dr.	
8.4.19		LINDA A. SCHULER	951 McClure Dr.	
8-4-19		Edward Breitfeld	95 Lakeshore Dr.	
8-4-19		Avalene Galloway	1051 McClure Dr.	
8-4-19		Kelly Miller	134 Lakeshore Dr.	

Date	Signature	Printed Name	Address	Comment
8/31/19	Nancy Steinfeldt	Nancy Steinfeldt	501 Lakeshore Dr. 478er	
8/31/19	Alyson Fappu	Alyson Fappu	359 Lakeshore Drive	
8/31/19	Phillip Magrann	Phillip Magrann	329 Lakeshore Drive	
8/31/19	Kenneth C Dockery	Kenneth Dockery	968 McClure Pt.	
8/31/19	Daphne R Dockery	Daphne R Dockery	968 McClure Dr.	
8/31/19	Donna Dockery	Donna Dockery	968 McClure Dr.	
8/21/19	Parker Gilbert	Parker Gilbert	147 Lakeshore Point	
8/5/19	Bruce Kotz	Bruce Kotz	819 McClure Dr.	Thank you!
8/5/2019	KATE KOTZ	KATE KOTZ	819 McClure Dr.	We need this!
8/5/19	George E Cook	GEORGE E. COOK	629 McClure Dr.	
8/5/19	Meg Cook	Meg Cook	629 McClure Dr.	Please!!
8/5/19	Philip A. Scherer	PHILIP A. SCHERER	761 McClure Dr	IMPERATIVE
8/5/19	Rainer Sadlack	Rainer Sadlack	95 Lakeshore Dr	please allow this!
8-10-19	MERWIN GERTSCHY	MERWIN GERTSCHY	218 LAKESHORE DR	PLEASE!
8-10-19	DELYNNE GERTSCHY	DELYNNE GERTSCHY	218 LAKESHORE DR.	Please

EXHIBIT H-2

December 10, 2020



PERMANENT RULEMAKING FINAL ADOPTION 15A NCAC 10F .0308 – CLAY COUNTY, LAKE CHATUGE AT DAYTON COVE

Clay County submitted an application requesting consideration of rulemaking for a no-wake zone in Dayton Cove on Lake Chatuge. The Commission approved submission of Notice of Text in the *NC Register* with an open comment period and a virtual public hearing. At that time the Commission requested that the Enforcement Division conduct additional assessments of three locations on Lake Chatuge including Dayton Cove before considering final adoption. Enforcement submitted a revised assessment matrix for Dayton Cove that does not describe sufficient statutory criteria to warrant regulation of the cove. Other than the 20 private boat docks along the left shoreline, there are no other safety concerns throughout the remaining shorelines or in the cove's channel that are any different than at other coves on public trust waters. Traffic density within the cove is rated at medium, with an assessed less than average likelihood of an accident occurring. The cove is a large cove in which no boating incidents have occurred. Half of the cove's shoreline is wooded and remains undeveloped. The revised assessment Matrix is attached.

There was one attendee at the virtual public hearing that was held on October 8, 2020. During the open comment period which ended on November 16, 2020, the agency received many communications including photographs from residents of the area, who are in favor of the cove being regulated. **(Exhibit H-1)**

Since the Wildlife Resources Commission by statute is required to balance the need for mitigation of boating and water recreation hazards against the rights of citizens to enjoy public trust waters at unregulated speed when possible, Staff seeks final action by the Commission to approve, deny, or revise the proposed amendment to 15A NCAC 10F .0308 at Dayton Cove on Lake Chatuge.

15A NCAC 10F .0308 CLAY COUNTY

(a) Regulated Areas. This Rule shall apply to the following waters in Chatuge Lake:

(9) the waters of Dayton Cove, north of a line at the mouth from a point on the west shore at 34.99033 N, 83.80840 W to a point on the east shore at 34.99072 N, 83.80555 W.

(b) Speed Limit. It shall be unlawful to operate a vessel at greater than no-wake speed within any of the regulated areas identified in Paragraph (a) of this Rule.

(c) Swimming Areas. No person operating or responsible for the operation of a vessel shall permit it to enter a marked public swimming area.

(d) Placement of Markers. The Board of Commissioners of Clay County shall be the designated agency for placement of the markers implementing this Rule, subject to the approval of the Tennessee Valley Authority and the United States Army Corps of Engineers.

History Note: Authority G.S. 75A-3; 75A-15



REVISED

NO-WAKE ZONE WATER SAFETY HAZARDS MATRIX – DAYTON COVE

SECTION 1:

Name of organization/entity: *_Clay County*

Primary contact information: *_Paul Harwood, resident at 276 Lakeshore Drive on Lake Chatuge; 704-905-8512; harwoodpaul88@gmail.com (Hoke McClure Neighborhood Association)*

Exact location of requested no-wake zone:

Body of water and County: *Lake Chatuge, Clay County* _____

Location: *Dayton Cove* _____

GPS: N34.99017 W-83.80845 and N34.99113 W-83.80577

Popular name of area, if any: *Dayton Cove* _____

Width of No-Wake Zone: Narrowest Point:**324'** _____ Widest Point:**1000'** _____

Brief Description of area (example: bridge overpass, obstructed views, Intracoastal Waterway; etc) *_It is a large cove with many private docks along the left side when entering from the main channel. The right side is wooded and owned by TVA.*

Attach map of designated no-wake zone

Ensure proposed no-wake zone map/and or location is agreed upon by point of contact

Attach detailed reason given from point of contact for the request

Point of contact states that many boats go in and out of cove around the peninsula at high speeds. It is a favorite spot for jet skis, boats, kayaks and swimmers to congregate. There is a bottle neck and blind spot past the peninsula where people tend to swim.

Is the proposed no-wake zone located within an area that is regulated by the U.S Army Corps of Engineers or the Division of Coastal Management (CAMA) i.e.; Intracoastal Waterway?

YES Tennessee Valley Authority (TVA)

NO

(When dealing with the point of contact, please advise that placement of markers in these waters is subject to prior approval of above agency in waters where applicable. NCWRC has no authority to supersede these rules.)

SECTION 2:

PUBLIC SAFETY HAZARD

What public safety hazard exists? **There are 20 private boat docks along the left side as one enters from the main channel.**

Is this a public swimming or recreational area?

NO

YES would the establishment of a roped swimming area or placement of no-wake regulatory buoys be more appropriate? ROPED SWIM AREA

NO-WAKE BUOYS

SECTION 3:

NAVIGATIONAL HAZARDS

Identify any and all potential hazards associated with the proposed no-wake zone (check all that apply)

OBSTRUCTIONS (Identify) **20 private boat docks on left side of cove** _____

NARROW CHANNEL (give approximate width) _____

SHALLOW WATER (give average depth) _____

OBSTRUCTED VISION (for approximately how great a distance) _____

STRUCTURES (Check all applicable)

DAM

LOCK

SPILLWAY

JETTY

FLOOD CONTROL STRUCTURE

SUBMERGED STRUCTURE

TRESTLE

SANDBAR

POWER LINE

SHOAL

FUELING DOCK

PRIVATE DOCKS

RESTAURANT DOCKS

BRIDGE

ACCESS AREA/BOAT LAUNCH

PIER

OTHER (list and describe) **There is a golf course located on the right side of the channel starting midway of the channel and extending to the far back of the channel.**

SECTION 4:

If approved, will the no-wake zone extend into a designated channel?

NO

YES (if yes, identify on map)

What is the total distance boaters will travel at a no-wake speed? **Approximately 2500'** _____

Estimated time to travel for boaters through the proposed no-wake zone at no-wake speed? **3-5 Minutes** _____

SECTION 5:

List any other known incidents, safety concerns or problems that have occurred?

No Boating incidents have occurred in this cove.

Rate traffic density in this area from light to heavy

LIGHT 1 2 3 4 5 6 7 8 9 10 HEAVY

Is traffic density specific to weekend/and or holidays?

No _____

Does traffic density or ability to maneuver a vessel due to traffic cause safety issues? YES

NO

Rate the likelihood of an incident occurring in this area compared to other similar areas on this same body of water **VERY UNLIKELY 1 2 3 4 5 6 7 8 9 10 MORE LIKELY**

SECTION 6:

OFFICER ASSESSMENT OF WATER SAFETY HAZARDS

YES:

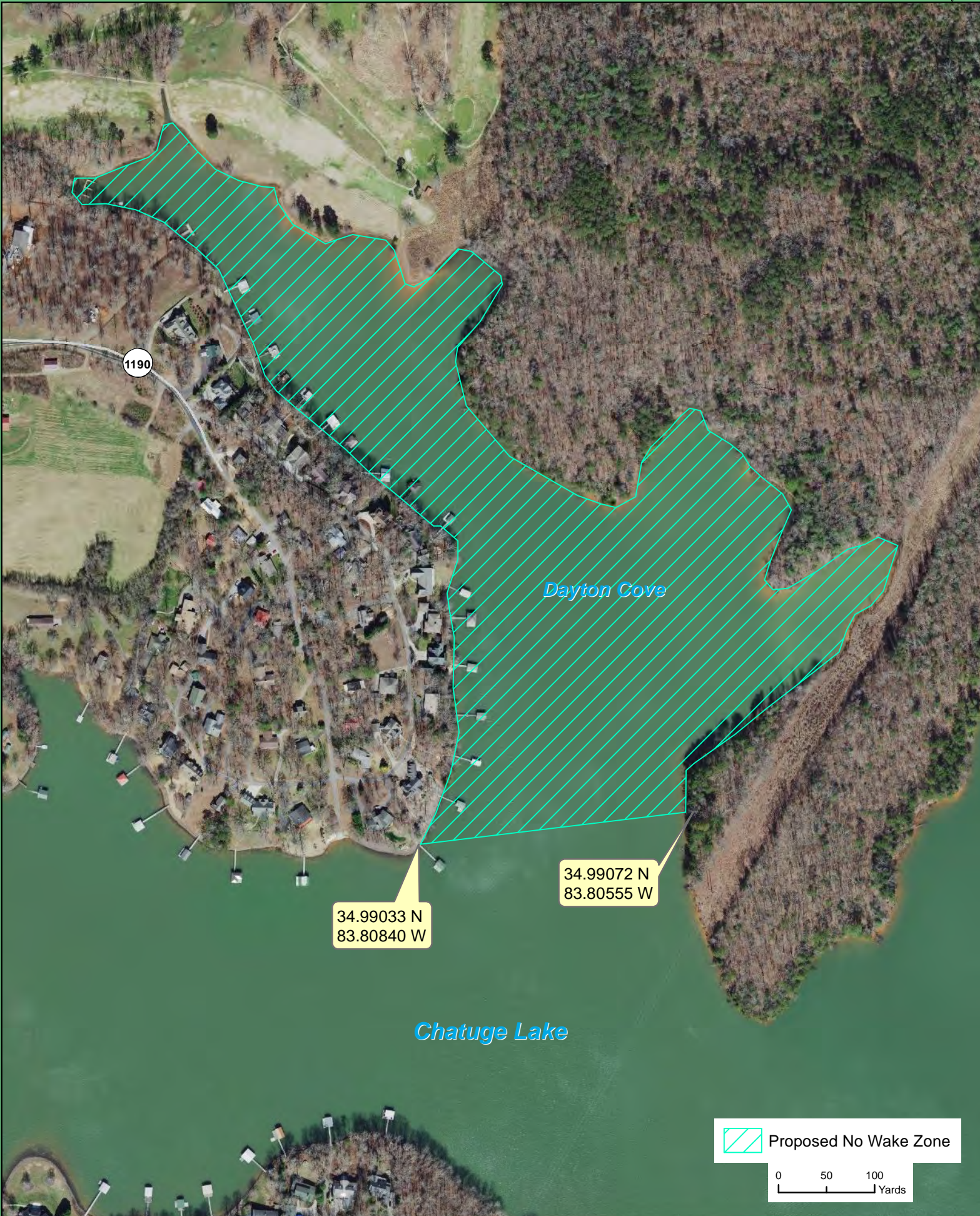
NO:

Reasons: **Other than the 20 private boat docks along the left shoreline, there are no other safety concerns throughout the remaining shorelines or in the coves channel. The cove is a large cove in which no boating incidents have occurred. Also, half of the cove's shoreline is wooded and remains undeveloped. It is a collaborative agreement within WRC LED staff that there are no safety issues presented within Dayton Cove to warrant the issuance of a no wake zone for such a large area.**

Officer: *Sgt. Mickey Carpenter #153*


Date: 9-29-2020

15A NCAC 10F .0308 (a) (9) - Proposed No Wake Zone
Dayton Cove, Chatuge Lake, Clay County



34.99033 N
83.80840 W

34.99072 N
83.80555 W

 Proposed No Wake Zone

0 50 100
Yards

EXHIBIT I-1

December 10, 2020



PUBLIC COMMENTS RECEIVED DURING THE OPEN COMMENT PERIOD 15A NCAC 10F .0317 STANLY COUNTY – LAKE TILLERY AT BOATHOUSE AND MARINA, NORWOOD

A virtual public hearing was held on October 8, 2020 to receive comments on the proposed permanent rule for a no-wake zone within 50 yards of the fuel docks at the Boathouse and Marina in Norwood, in Stanly County. No comments were received at the public hearing.

During the open comment period there were no comments received.

EXHIBIT I-2

December 10, 2020



PERMANENT RULEMAKING FINAL ADOPTION 15A NCAC 10F .0317 – STANLY COUNTY, LAKE TILLERY

Stanly County submitted an application for water safety rulemaking on Lake Tillery. Notice of Text was published in the *NC Register* on September 15, 2020, with one virtual public hearing on October 8, 2020 and an open comment period, for a permanent rule to replace a temporary rule around the fueling stations at the Boathouse and Marina on Lake Tillery in Norwood.

Per the assessment matrix there were significant safety hazards that will be mitigated by placement of a no-wake zone within 50 yards of the docks at the Boathouse and Marina. Staff seeks your final action on this proposed rule amendment.

15A NCAC 10F .0317 STANLY COUNTY

(a) Regulated Areas. This Rule shall apply to the following waters described as follows:

- (1) Badin Lake.
- (2) Lake Tillery.
 - (A) Turner Beach Cove shore to shore, south of a point at 35.22529 N, 80.09318 W.
 - (B) The waters within 50 yards of the fuel docks at the Boathouse and Marina at 712 Berry Hill Drive in Norwood.

(b) Speed Limit Near Ramps. No person shall operate a vessel at greater than no-wake speed within 50 yards of any public boat launching ramp while on the waters of a regulated area described in Paragraph (a) of this Rule.

(c) Swimming Areas. No person operating or responsible for the operation of a vessel shall permit it to enter any marked public swimming area on the waters of a regulated area described in Paragraph (a) of this Rule.

(d) Speed Limit. No person shall operate a vessel at greater than no-wake speed within any of the regulated area described in Paragraph (a) of this Rule:

(e) Placement of Markers. The Board of Commissioners of Stanly County shall be the designated agency for placement of markers implementing this Rule.

(f) Notwithstanding Paragraphs (a) through (e) of this Rule, no person shall operate a vessel at greater than no-wake speed in the waters of Lake Tillery shore to shore, within 85 yards north and 85 yards south of the NC Hwy 24/27/73 bridge eastbound and westbound spans, otherwise known as the James B. Garrison Bridge. The North Carolina Wildlife Resources Commission shall be the designated agency for placement and maintenance of markers for this regulated area.

15A NCAC 10F .0317 (a) (2) (B) Proposed No Wake Zone
Boathouse & Marina on Berry Hill Drive, Norwood, Stanly County



EXHIBIT J-1

December 10, 2020



**PUBLIC COMMENTS RECEIVED DURING THE OPEN COMMENT PERIOD
15A NCAC 10F .0323 BURKE COUNTY – LAKE JAMES AT HIGHWAY 126
BRIDGE AND CANAL BRIDGE BOATING ACCESS AREA**

A virtual public hearing was held on October 8, 2020 to receive comments on the proposed permanent rule for extension of a no-wake zone on Lake James in Burke County, shore to shore, beginning northeast of the Highway 126 ridge and ending 50 yards sound of the Canal Bridge Boating Access Area. . No comments were received at the public hearing.

During the open comment period there were no comments received.

EXHIBIT J-2

December 10, 2020



PERMANENT RULEMAKING FINAL ADOPTION 15A NCAC 10F .0323 – LAKE JAMES, BURKE COUNTY

Burke County submitted an application for rulemaking on Lake James, to extend and combine two no-wake zones into one – beginning northeast of the Highway 126 bridge shore to shore and ending 50 yards south of the Canal Bridge Boating Access area, shore to shore. Notice of Text was published in the *NC Register* on September 15, 2020 with one virtual public hearing on October 8, 2020 and an open comment period, for an amendment to extend and combine the no-wake zones.

Per the Wildlife Enforcement assessment matrix growth at that area of the lake has created numerous boating hazards. The Lake James Marina sees heavy vessel traffic and has expanded its facilities and fueling station. Northeast of the Highway 126 bridge the Lake James State Park rents kayaks, canoes, and paddle boards. Additionally, the no-wake zone within 50 yards of the Canal Bridge Boating Access Area no longer is adequate to protect boats that enter and exit that BAA. NC Parks has endorsed enlarging the no-wake zone near the Boating Access Area due to safety concerns.

Staff seeks final action by the Commission on this proposed rule amendment. If approved, the Rule will be submitted to the Rules Review Commission for final approval. The earliest effective date would be February 1, 2021.

15A NCAC 10F .0323 BURKE COUNTY

(a) Regulated Areas. This Rule applies only to the following waters or portions of waters in Burke County:

- (1) Lake Hickory;
- (2) Lake James, delineated by markers consistent with Paragraph (e) of this Rule, at the following locations:
 - (A) Holiday Shores Subdivision;
 - (B) Lake James Campground;
 - (C) Laurel Pointe Subdivision;
 - (D) The waters of Boyd Moore Cove shore to shore, north of a line from a point on the northwest shore at 35.76667 N, 81.82337 W to a point on the southeast shore at 35.76558 N, 81.82245 W;
 - (E) East Shores development;
 - (F) Eastern shore of Lake James at Mallard Cove;
 - (G) That portion of Lake James shore to shore, beginning ~~50 yards northeast of the NC Highway 126 bridge at a line from a point on the north shore at 35.74398 N, 81.88426 W, to a point on the south shore at 35.74334 N, 81.88383 W, and ending at a line 215 yards southwest of the NC Highway 126 bridge, from a point on the northwest shore at 35.74257 N, 81.88679 W to a point on the southeast shore at 35.74160 N, 81.88516 W;~~ 385 yards northeast of the NC Highway 126 bridge at a line from a point on the north shore at 35.74652 N, 81.88231 W to a point on the south shore at 35.74440 N, 81.88017 W, and ending at a line 550 yards southwest of the NC Highway 126 bridge and 50 yards south of the Canal Bridge Boating Access Area dock from a point on the northwest shore at 35.74163 N, 81.88943 W to a point on the southeast shore at 35.73869 N, 81.88652 W;
 - ~~(H) Within 50 yards of the Canal Bridge Boating Access area dock;~~
 - ~~(H)~~ (H) The waters within 50 yards of the end of the South Pointe Subdivision peninsula from a point east of the peninsula at 35.76399 N, 81.83768 W, and surrounding the peninsula from a point east of the peninsula at 35.76399 N, 81.83768 W, and surrounding the peninsula to a point west of the peninsula at 35.76307 N, 81.83648 W; and
 - ~~(I)~~ (I) The waters of Sherman's Hollow Cove shore to shore, and contiguous with those waters beginning at a point on the west shore of the mouth of Sherman's Hollow Cove at 35.76423 N, 81.82748 W, extending northeast within 50 yards of Linville Point to a point on the northeast shore of Linville Point at 35.76596 N, 81.82432 W.
- (3) Lake Rhodhiss.

(b) Speed Limit. No person shall operate a vessel at greater than no-wake speed within 50 yards of any designated public boat launching ramp, bridge, marina, boat storage structure, boat service area, dock, or pier; or while on designated waters of the areas described in Paragraph (a) of this Rule.

(c) Speed Limit in Mooring Areas. No person shall operate a vessel at greater than no-wake speed while within a marked mooring area on the regulated areas described in Paragraph (a) of this Rule.

(d) Restricted Swimming Areas. No person operating or responsible for the operation of a vessel shall permit it to enter any marked public swimming area on the regulated areas described in Paragraph (a) of this Rule.

(e) Placement of Markers. The Board of Commissioners of Burke County is the designated agency for placement of the markers implementing this Rule, subject to the approval of the United States Coast Guard and the United States Army Corps of Engineers.

*History Note: Authority G.S. 75A-3; 75A-15; 102-1.1;
Eff. July 1, 1976;
Amended Eff. December 1, 1995; December 1, 1994; December 1, 1992; March 1, 1992;
Temporary Amendment Eff. April 1, 1999;
Amended Eff. July 1, 2000;
Temporary Amendment Eff. August 15, 2001;
Amended Eff. July 1, 2009; May 1, 2009; August 1, 2002;
Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December
6, 2016;
Amended Eff. November 1, 2017.*

15A NCAC 10F .0323 - Recommended No Wake Zone Extension
Lake James, Burke County



EXHIBIT K-1

December 10, 2020



PUBLIC COMMENTS RECEIVED DURING THE OPEN COMMENT PERIOD 15A NCAC 10F .0323 BURKE COUNTY – TEMPORARY RULEMAKING FOR NO WAKE ZONE AND SAFETY ZONE, LAKE JAMES STATE PARK AT MILL CREEK

A virtual public hearing was held on November 16, 2020 to receive comments on the proposed temporary rule for a no-wake zone and safety zone in part of Mill Creek on Lake James, during a pedestrian bridge project at Lake James State Park in Burke County. No comments were received at the public hearing.

During the open comment period there were no comments received.

EXHIBIT K - 2

December 10, 2020



TEMPORARY RULEMAKING FINAL ADOPTION 15A NCAC 10F .0323 – BURKE COUNTY, LAKE JAMES AT MILL CREEK

Simultaneous commencement of temporary rulemaking is required when an agency adopts an emergency rule (*See G.S. 150B-21.1A*). The WRC approved staff's submission of a Notice of Text in the *NC Register*, with open comment period and one virtual public hearing, for temporary rulemaking (following emergency rulemaking) on a portion of Mill Creek on Lake James in Burke County, during a construction project of a pedestrian bridge at Lake James State Park.

Staff seeks final approval by the WRC of the temporary no-wake zone in Mill Creek on Lake James at Lake James State Park in Burke County, shore to shore for a distance of 345 yards, and a safety zone where vessel entry not authorized by the North Carolina Wildlife Resources Commission is prohibited, in the creek northeast and northwest of the no-wake zone. The no-wake zone and safety zone are necessary to mitigate water safety hazards caused by construction equipment during construction of a pedestrian bridge connected with the Lake James Visitor Center and Fonta Flora Trail. After completion of the pedestrian bridge project this temporary rule will be allowed to expire.

15A NCAC 10F .0323 BURKE COUNTY

(a) Regulated Areas. This Rule applies ~~only~~ to the following waters or portions of waters in Burke County:

- (1) Lake Hickory;
- (2) Lake James, delineated by markers consistent with Paragraph (e) of this Rule, at the following locations:
 - (A) Holiday Shores Subdivision;
 - (B) Lake James Campground;
 - (C) Laurel Pointe Subdivision;
 - (D) The waters of Boyd Moore Cove shore to shore, north of a line from a point on the northwest shore at 35.76667 N, 81.82337 W to a point on the southeast shore at 35.76558 N, 81.82245 W;
 - (E) East Shores development;
 - (F) Eastern shore of Lake James at Mallard Cove
 - (G) *That portion of Lake James shore to shore, beginning ~~50 yards northeast of the NC Highway 126 bridge at a line from a point on the north shore at 35.74398 N, 81.88426 W, to a point on the south shore at 35.74334 N, 81.88383 W, and ending at a line 215 yards southwest of the NC Highway 126 bridge, from a point on the northwest shore at 35.74257 N, 81.88679 W to a point on the southeast shore at 35.74160 N, 81.88516 W; 385 yards northeast of the NC Highway 126 bridge at a line from a point on the north shore at 35.74652 N, 81.88231 W to a point on the south shore at 35.74440 N, 81.88017 W, and ending at a line 550 yards southwest of the NC Highway 126 bridge and 50 yards south of the Canal Bridge Boating Access Area dock from a point on the northwest shore at 35.74163 N, 81.88943 W to a point on the southeast shore at 35.73869 N, 81.88652 W;~~*
 - ~~(H) Within 50 yards of the Canal Bridge Boating Access area dock;~~
 - ~~(H)~~ *The waters within 50 yards of the end of the South Pointe Subdivision peninsula from a point east of the peninsula at 35.76399 N, 81.83768 W, and surrounding the peninsula from a point east of the peninsula at 35.76399 N, 81.83768 W, and surrounding the peninsula to a point west of the peninsula at 35.76307 N, 81.83648 W; and*
 - ~~(I)~~ *The waters of Sherman's Hollow Cove shore to shore, and contiguous with those waters beginning at a point on the west shore of the mouth of Sherman's Hollow Cove at 35.76423 N, 81.82748 W, extending northeast within 50 yards of Linville Point to a point on the northeast shore of Linville Point at 35.76596 N, 81.82432 W.*
- (3) Lake Rhodhiss.

(b) Speed Limit. No person shall operate a vessel at greater than no-wake speed within 50 yards of any designated public boat launching ramp, bridge, marina, boat storage structure, boat service area, dock, or pier; or while on designated waters of the areas described in Paragraph (a) of this Rule.

(c) Speed Limit in Mooring Areas. No person shall operate a vessel at greater than no-wake speed while within a marked mooring area on the regulated areas described in Paragraph (a) of this Rule.



(d) Restricted Swimming Areas. No person operating or responsible for the operation of a vessel shall permit it to enter any marked public swimming area on the regulated areas described in Paragraph (a) of this Rule.

(e) Placement of Markers. The Board of Commissioners of Burke County is the designated agency for placement of the markers implementing this Rule, subject to the approval of the United States Coast Guard and the United States Army Corps of Engineers.

(f) Notwithstanding Paragraphs (a) through (e) of this Rule, no person shall operate a vessel at greater than no-wake speed in the waters known as Mill Creek at Lake James State Park, on Lake James shore to shore, beginning 345 yards northwest of a line from a point on the southwest shore at 35.76016 N, 81.87322 W to a point on the northeast shore at 35.762040 N, 81.87150 W, and ending at a line from a point on the southwest shore at 35.76215 N, 81.87624 W to a point on the northeast shore at 35.76343 N, 81.87442 W. Vessel entry not authorized by the North Carolina Wildlife Resources Commission shall be prohibited by establishment of a safety zone in the waters of Mill Creek on Lake James, northeast and northwest of a line from a point on the southwest shore at 35.76215 N, 81.87624 W to a point on the northeast shore at 35.76343 N, 81.87442 W. The North Carolina Wildlife Resources Commission shall be the designated agency for placement and maintenance of markers for this regulated area.

History Note: Authority G.S. 75A-3; 75A-15; 102-1.1;



 Safety Zone
 Temporary NWZ

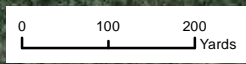


EXHIBIT L-1

December 10, 2020



Public Comments for 15A NCAC 10H .1200 Controlled Fox Hunting Preserve Rules

Public Comments Received

No Comments Received

One public hearing was held on October 29, 2020.

EXHIBIT L-2

December 10, 2020



Proposed Amendments to 15A NCAC 10H .1200 - Controlled Fox Hunting Preserves Recommended by Agency Staff for Readoption

The rules in 15A NCAC 10H .1200 were part of the agency's 2016 periodic review of rules package. All rules in this Section were determined to be necessary with substantive public interest. Because these rules have only been amended once since 1990, for the addition of coyotes, revisions were necessary to update language, clarify requirements and improve regulatory oversight. The readoption deadline is December 31, 2020.

10H .1201

Establishes definitions used throughout 10H .1200 and details standard conditions of controlled hunting preserve operator licenses, including applicant requirements. Proposed changes include the following:

- Updated title of Rule to reflect content;
- Added definitions for terms used throughout the controlled fox hunting preserve rules;
- Detailed application requirements; and

10H .1201 Definitions and General Requirements (page 3)

10H .1202

Provides clarification on size and boundary requirements, features within the preserve, stocking and dog densities. Specific changes include the following:

- Specific fencing requirements to qualify as "dog-proof";
- Minimum escape den requirements;
- Detailed purchase, transfer and transportation requirements for foxes and coyotes; and
- Dog density requirements based on acreage.

10H .1202 Establishment and Operation (pages 4-5)

10H .1203

Provided details on and clarified animal health, reporting, and quarantine requirements. Specific changes include the following:

- Specified that all foxes and coyotes released on the preserve must appear healthy and free from disease;

- Removed language allowing Commission to conduct an examination and inspection of foxes and coyotes;
- Specified that all dead foxes and coyotes, except those taken by lawful methods, must be reported to the Commission within 48-hours of discovery; and
- Detailed possible quarantine scenarios and lift requirements.

10H .1203 Quality of Foxes and Coyotes Released (page 6)

10H .1204

Provided details on record-keeping requirements for all foxes and coyotes released into or removed from the preserve. Specific changes include the following:

- Commission will provide a form for record-keeping;
- Records must be available to the Commission upon request during normal preserve operating hours;
- Records must be submitted prior to reissuance of the license; and
- Records must be retained by the license holder for 12 months following license expiration.

10H .1204 Records Required (page 7)

10H .1205

Updated language, included references, and provided details on hunting license requirements.

10H .1205 Hunting License Required (page 8)

10H .1206

Updated language and provided details on minimum standards of care. Specific changes include the following:

- Updated title of Rule to reflect content;
- Detailed food and water requirements for foxes and coyotes; and
- Provided details on new fox and coyote acclimation requirements.

10H .1206 Minimum Standards for Care of Foxes and Coyotes (page 9)

10H .1207

Updated language for consistency with other licenses subject to administrative control. Specific changes include the following:

- Updated title of Rule to reflect content;
- Establishes Commission inspection of license holder preserves
- Details criteria under which the Commission may issue warnings, modify, revoke, or suspend licenses;
- Reference to statute regarding notice to revoke; and
- Presents options for disposition of unlawfully possessed and seized wildlife.

10H .1207 License Revocation and Enforcement (page 10)

1 **15A NCAC 10H .1201 ~~LICENSE TO OPERATE~~ DEFINITIONS AND GENERAL REQUIREMENTS**

2 (a) The Rules in this section apply to all controlled hunting preserve operator licenses issued by the Wildlife Resources
3 Commission (Commission) in accordance with G.S. 113-273(g) for controlled fox hunting preserves.

4 (b) The following definitions shall apply to all rules in this Section:

5 (1) “Acclimation” means an adjustment period to allow foxes and coyotes to become accustomed to the
6 controlled fox hunting preserve.

7 (2) “Controlled fox hunting preserve” means an enclosed area where foxes and coyotes are pursued
8 with dogs.

9 (3) “Escape den” means a stationary manmade structure that provides refuge for foxes and coyotes from
10 dogs.

11 (4) “Dog proof fence” means a perimeter fence designed to prevent the ingress or egress of dogs, foxes,
12 or coyotes over, under, or through the fence.

13 (5) “Fox” means red fox and gray fox including their color morphs.

14 ~~It shall be unlawful for any individual, firm, association or corporation~~ Any individual wanting to operate a
15 controlled fox hunting preserve without shall first obtain a controlled hunting preserve operator license from the
16 Commission. ~~North Carolina Wildlife Resources Commission a license for this purpose.~~

17 ~~A controlled fox hunting preserve license shall entitle the holder or holders and their guests, to hunt foxes and~~
18 ~~coyotes at any time within the fenced area. Controlled fox hunting preserve licenses shall not be transferable, either~~
19 ~~as to operator or as to site of operation.~~

20 ~~(d)~~ Applicants for a controlled hunting preserve operator license shall be prepared to show proof of ownership or
21 lease of the land contained in the proposed controlled fox hunting preserve. ~~preserve or that they have this land under~~
22 ~~lease for the duration of the license period.~~

23 ~~(e)~~ Application for a controlled fox hunting preserve operator licenses shall be made on forms obtained from the
24 Commission, online at www.ncwildlife.org or at the Commission headquarters located at 1751 Varsity Drive, Raleigh,
25 NC 27606. Information required by the applicant shall include:

26 (1) the applicant’s name, address, telephone number, date of birth;

27 (2) the preserve name, address, county, acreage, and GPS coordinates of preserve entrance; and

28 (3) species within the preserve.

29 (f) Controlled hunting preserve operator licenses shall not be transferable, either by transferring the license or by
30 relocating the site of the preserve.

31 ~~(g)~~ Upon receipt of an application accompanied by the statutory license fee, the Commission shall issue a controlled
32 fox hunting preserve operator license, provided it is determined that the location and operation of such a hunting
33 preserve is consistent with the wildlife conservation program and in the public interest; and further provided that all
34 regulations herein the Rules in this Section regarding establishment of such areas have been complied with.

1 **15A NCAC 10H .1202 ESTABLISHMENT AND OPERATION**

2 ~~(a) Size of Preserve. Controlled fox hunting preserves operated for commercial purposes shall be an area of not less~~
3 ~~than 500 acres except that smaller areas containing terrain and topographical features which offer escape cover to the~~
4 ~~fox and coyote populations are allowed under specific approval by the Wildlife Resources Commission~~

5 ~~(b)(a) Boundary of Preserve. Unless otherwise approved by the Commission based upon the topography and~~
6 ~~hydrology of the preserve, A a controlled fox hunting preserve must preserve shall be enclosed with a dog-proof fence~~
7 ~~that is also designed to prevent the escape of foxes and coyotes released within the pen. This fencing must be~~
8 ~~maintained at all times. meets the following minimum requirements:~~

- 9 (1) is at least four (4) feet high;
10 (2) has a top electrified wire at least three (3) feet above the ground surface;
11 (3) has a bottom electrified wire no more than one (1) foot above the ground surface; and
12 (4) is free from structures or vegetation purposely placed or allowed to exist that enables wild animals
13 to enter or exit the preserve.

14 (b) Escape Dens. Controlled fox hunting preserves less than 106 acres shall have a minimum of three escape dens.
15 Those preserves equal to or greater than 106 acres shall have one additional escape den per 1-35 acre interval
16 thereafter.

17 (c) Stocking Preserve ~~With with Game. Game:~~ The following shall apply to foxes and coyotes released into a preserve:

- 18 (1) only foxes and coyotes may be released onto controlled fox hunting preserves;
19 (2) In addition to purchasing operators may purchase live foxes and coyotes as provided in from:
20 (A) licensed trappers in accordance with G.S. ~~413-273(g), 113-273(g); operators of~~
21 controlled fox hunting preserves may also purchase live foxes and coyotes from
22 (B) other licensed controlled fox hunting preserves; preserves;
23 (C) licensed North Carolina fur propagators, propagators; or
24 (D) persons holding foxes or coyotes legally under a North Carolina wildlife captivity
25 license. license.

26 ~~(2)(3) Licensed licensed~~ controlled fox hunting preserve operators may hold legally obtained foxes and
27 coyotes under rules that apply to a captivity license in accordance with food, sanitation, and
28 enclosure requirements in 15A NCAC 10H .1404;

29 (4) licensed controlled fox hunting preserve operators and may transport legally acquired foxes and
30 coyotes from the place of purchase to the controlled fox hunting preserve. preserve; and

31 ~~(3)(5) Foxes foxes and coyotes may shall~~ not be imported into North Carolina for release into controlled
32 fox hunting preserves.

33 ~~(4) The release of exotic wildlife into the controlled fox hunting preserves is specifically prohibited.~~

34 ~~(5) The possession of exotic wildlife on controlled fox hunting preserves is specifically prohibited.~~

35 (6) individuals transporting live foxes and coyotes to or from a licensed operator shall have a valid
36 transportation permit.

1 (7) individuals transporting live foxes and coyotes on behalf of a licensed operator shall have a valid
2 transportation permit or a copy of the operator's current license.

3 (d) Dog Density. Each controlled fox hunting preserve shall have an upper limit for dog density rounded to the nearest
4 dog as follows:

5 (1) fox only preserve: .5 dog per 1 acre;

6 (2) fox and coyote preserve: .75 dog per 1 acre; and

7 (3) coyote only preserve: 1 dog per 1 acre.

8

1 **15A NCAC 10H .1203 QUALITY OF FOXES AND COYOTES RELEASED**

2 ~~(a) All foxes and coyotes purchased~~ purchased, acquired, transferred, released, sold, or raised for release on controlled
3 fox hunting preserves shall be appear visibly healthy and free from disease. ~~disease of any kind. An examination and~~
4 ~~inspection of the foxes and coyotes by the Wildlife Resources Commission may be conducted at any time.~~

5 ~~(b) All dead foxes and coyotes, except those killed~~ taken by lawful method(s) dogs during a hunt, or diseased foxes
6 ~~and coyotes found within the pen shall be reported to the Commission within 48-hours of discovery.~~ submitted to a
7 North Carolina Department of Agriculture diagnostic lab for diagnosis. A copy of the diagnostic report shall be mailed
8 ~~to the Wildlife Resources Commission. Possession of unhealthy or diseased foxes and coyotes shall be grounds for~~
9 ~~revocation or denial of a controlled fox hunting preserve license.~~

10 ~~(c) The Commission may quarantine any controlled fox hunting preserve where contagious diseases are located.~~
11 identified, depending on the type and severity of the disease and the risk to other wildlife or humans. Quarantine may
12 include:

- 13 (1) temporarily prohibiting removal or introduction of foxes and coyotes except as specifically provided
14 by written permit issued by the Commission.
- 15 (2) notification to the county health department;
- 16 (3) cleaning or disinfection of the facility; and
- 17 (4) temporary license suspension.

18 ~~(d) A quarantine shall not be lifted or cancelled until the Commission determines that there is no longer a threat of~~
19 disease exposure to humans, foxes, coyotes, domestic dogs or other animals.

1 **15A NCAC 10H .1204 RECORDS REQUIRED**

2 ~~(a) License holders shall keep an accurate record~~ record, on a form provided by the Commission, ~~including bill of sale~~
3 for all foxes and coyotes ~~released into and~~ or removed from the preserve from licensed trappers, other licensed
4 ~~controlled fox hunting preserves, licensed fur propagators, or persons holding foxes or coyotes legally under a~~
5 ~~captivity license. released into the controlled fox hunting preserve~~ Records shall contain the following information:

- 6 (1) preserve operator license, propagator license, or captivity license number, if applicable;
- 7 (2) trapper identification number or name and address, if applicable;
- 8 (3) transportation permit number, if applicable;
- 9 (4) species and quantity of each;
- 10 (5) date of purchase or transfer; and
- 11 (6) county of origin.

12 (b) Records shall be ~~maintained and~~ available for inspection by ~~officials of representatives of the North Carolina~~
13 ~~Wildlife Resources Commission at all times.~~ upon request and during normal operating hours.

14 (c) Records shall be submitted to the Commission prior to the reissuance of the license.

15 (d) Records shall be retained by the license holder for 12 months following expiration of the license.

16

1 **15A NCAC 10H .1205 HUNTING LICENSE REQUIRED**

2 ~~(a) Every person hunting-participating in the pursuit of wildlife on a controlled fox hunting preserve shall have in his~~
3 ~~possession a proper-valid resident or nonresident hunting license or special-controlled hunting preserve hunting license~~
4 ~~for the current year as required by law. in his or her possession, in accordance with 15A NCAC 10B .0114.~~

5 ~~(b) Nonresidents participating in a Commission-sanctioned field trial-trial, as defined in 15A NCAC 10B .0114,~~
6 ~~properly approved in advance by a Wildlife Enforcement Officer are exempt from North Carolina licensing~~
7 ~~requirements in section (a) of this Rule, provided providing they possess-have a valid hunting license from their state~~
8 ~~of residence-residence in their possession.~~

9

1 **15A NCAC 10H .1206 MINIMUM STANDARDS FOR CARE OF FOXES AND COYOTES**

2 ~~(a) A minimum of one dog proof escape den for each 35 acres contained in the controlled fox hunting preserve must~~
3 ~~be provided and maintained.~~

4 ~~(b)(a) Adequate food, Food and clean water, and cover shall be provided to foxes and coyotes. provided to~~
5 ~~maintain a viable population of foxes within the controlled fox hunting preserve.as follows:~~

6 (1) food shall be of a type and quantity that is appropriate for the species; and

7 (2) a constant supply of drinking water shall be available or provided.

8 ~~(c) Since the intent of these rules is to promote a fair chase situation involving a resident population of foxes, the~~

9 ~~(b) operator should make provisions~~The following conditions shall apply to acclimate the acclimation of newly
10 introduced foxes and coyotes: to the escape mechanisms located within the pen prior to pursuing the foxes with dogs.

11 (1) the acclimation period shall be at least seven (7) days;

12 (2) food and water meeting the requirements in Paragraph (a) of this Rule shall be provided in the area
13 used for acclimation; and

14 (3) chase by dogs during the acclimation period shall be prohibited.

15

1 **15A NCAC 10H .1207 LICENSE REVOCATION AND ENFORCEMENT OF LICENSE TO OPERATE**

2 (a) Representatives of the Commission shall be permitted to enter the premises of any licensed controlled fox hunting
3 preserve upon request to the license holder or during the preserve's operating hours for inspection, enforcement, or
4 scientific purposes.

5 (b) The Executive Director of the Commission or his or her designee may warn, cite, suspend, or revoke a license
6 holder's controlled hunting preserve operator license if the license holder violates applicable provisions of Subchapter
7 IV of Chapter 113 of the North Carolina General Statutes, certain provisions of G.S. 14-360, the Rules of this Section,
8 or any condition of the license. The determination whether to warn, cite, suspend, or revoke a license shall be based
9 upon the seriousness of the violation, which may include:

- 10 (1) felony animal abuse as specified in G.S. 14-360(a1) and (b) of the North Carolina General Statutes;
- 11 (2) purposefully releasing foxes and coyotes into the wild;
- 12 (3) falsifying records; or
- 13 (4) failing to notify the appropriate agencies after a potential disease exposure or outbreak.

14 In accordance with provisions of G.S. 113-273(g) the Wildlife Resources Commission may revoke or suspend the
15 license of any controlled fox hunting preserve operator upon violation of these rules.

16 (c) ~~Where there is evidence of such a violation, the Executive Director or his designee~~ The Commission shall give the
17 ~~operator~~ license holder written notice in accordance with G.S. 113-276.2(e) before revoking a license. ~~20 days notice~~
18 ~~in writing to show cause to the Executive Director or his designee why his license should not be suspended or revoked.~~

19 (d) If a fox or coyote is unlawfully possessed, the Commission may determine disposition of the unlawfully possessed
20 animal(s), which may include seizure, release, relocation, or euthanasia.

21 (e) If the Commission revokes a controlled hunting preserve operator license, the Commission may determine
22 disposition of the animals, which may include seizure, release, relocation, or euthanasia.

23

EXHIBIT M-1

December 10, 2020



Public Comments for 15A NCAC 10B .0409 Sale of Live Foxes and Coyotes to Controlled Fox Hunting Preserve

Position	Comment
Agree	<p>Please keep the forms simple and send draft to the NC Trappers Association and Controlled Fox Hunting Preserves to get input on the development before forms are finalized/distributed.</p> <p>Recommend removing item (5) below:</p> <p>Licensed trappers shall keep accurate written records, on a form provided by the Commission, for all foxes and coyotes sold or transferred to a controlled fox hunting preserve. Records shall contain the following information:</p> <ul style="list-style-type: none">(1) preserve operator license number, if applicable;(2) transportation permit number;(3) county of origin;(4) number of animals of each species;(5) date of capture; and(6) date of sale or transfer. <p>This will add a significant burden and cost to trappers because in order to accomplish this individual holding cages would be necessary to keep animals separated to know date of capture when sold.</p> <p>Will there be a cost for the transportation permit as that would add another financial burden to the trapper?</p>

One public hearing was held on October 29, 2020.

EXHIBIT M-2

December 10, 2020



Proposed Amendments to 15A NCAC 10B .0409 – Sale of Live Foxes and Coyotes to Controlled Fox Hunting Preserves Recommended by Agency Staff for Readoption

Because of proposed changes to the CFHP rules, the rule regulating the live sale of foxes and coyotes to fox preserves needed to be updated to clarify requirements for consistency with 10H .1200 rules. Specific changes include the following:

- Exempted from captivity license and permit requirements during the trapping season and up to 30 days thereafter;
- Restricted holding of trapped foxes and coyotes to 30 days after capture;
- Specified food, water and shelter requirements for live-trapped foxes and coyotes;
- Added transportation permit requirement for anyone transporting live foxes and coyotes (free permit);
- Added record keeping requirements on Commission-supplied form; and
- Specified record inspection, submittal and retention requirements.

10B .0409 Sale of Live Foxes and Coyotes to Controlled Fox Hunting Preserves (page 2)

1 **15A NCAC 10B .0409 SALE OF LIVE FOXES AND COYOTES TO CONTROLLED FOX HUNTING**
2 **PRESERVES**

3 ~~(a)~~ In counties with a trapping season for foxes and coyotes that do not prohibit live sale, Licensed licensed trappers
4 may, subject to the restrictions on taking foxes in G.S.113- 291.4, live-trap foxes and coyotes during any open trapping
5 that season for foxes and coyotes, and sell them to licensed controlled fox hunting preserves in accordance with the
6 following conditions: conditions set forth in this rule.

7 ~~(b)~~ Licensed trappers are exempt from eaging, captivity permit or and captivity license requirements set forth in
8 15A NCAC 10H .0300 for any live-trapped foxes or coyotes trapped for the purpose of sale to controlled fox hunting
9 preserves. This exemption shall apply during the trapping season for foxes and coyotes, and for no more than 40-30
10 days after the trapping season.

11 (c) Live-trapped foxes and coyotes shall not be held for more than 30 days after capture.

12 (d) Licensed trappers shall provide drinking water, food of a type and quantity appropriate for the species, and shelter
13 that protects the foxes and coyotes from direct sunlight and precipitation.

14 ~~(e)~~ Licensed trappers are shall be exempt from tagging requirements set forth in this Section so long as the foxes
15 are kept alive.

16 (f) Licensed trappers and any individual(s) transporting live foxes and coyotes shall have a current and valid
17 transportation permit prior to taking possession of the live foxes and coyotes.

18 (g) Licensed trappers shall keep accurate written records, on a form provided by the Commission, for all foxes and
19 coyotes sold or transferred to a controlled fox hunting preserve. Records shall contain the following information:

20 (1) preserve operator license number, if applicable;

21 (2) transportation permit number;

22 (3) county of origin;

23 (4) number of animals of each species;

24 (5) date of capture; and

25 (6) date of sale or transfer.

26 (h) Records required pursuant to this Rule shall meet the following requirements:

27 (1) available for inspection by representatives of the Commission upon request;

28 (2) submitted to and received by the Commission annually by May 1; and

29 (3) retained by the trapper for 12 months following transportation permit expiration.

30

EXHIBIT N

December 10, 2020



Petition for Proposed Amendments to 15A NCAC 10H .1200 - Controlled Fox Hunting Preserves Recommended by Agency Staff for Public Notice, Comment, and Presentation at Public Hearing

In accordance with 15A NCAC 10A .0401 and .0402, the Executive Director received a petition for rulemaking on September 10, 2020. This petition for proposed amendments to 15A NCAC 10H .1201, .1202, .1203, and .1204 was distributed, via email, to all Commissioners for consideration on September 11, 2020.

The following changes were requested by the petitioner:

10H .1201

- Hunting on the preserve restricted to the hours of 8:00am through 6:00pm, Monday through Saturday;
- No hunting on Sundays;
- No dogs left on preserves overnight; and
- The Commission must notify Code Enforcement Officials with jurisdiction at the location of the preserve to check compliance with local rules and regulations prior to issuing a license.

10H .1201 License to Operate (page 3)

10H .1202

- Additional requirements for fox preserves under 500 acres in an area zoned residential and within one mile or less of a residence, including:
 - A natural buffer;
 - 100-foot setback from adjoining property;
 - 300 yards between the preserve fence and a residence; and
 - Property must be zoned "Commercial" prior to receiving a license.
- Preserves must be enclosed with a dog-proof fence that has rollers at the top, and extends 16-feet above ground and 5-feet below ground.
- Two foxes and coyotes allowed per 50-acres.

10H .1202 Establishment and Operation (pages 4)

10H .1203

- The Commission must inspect foxes and coyotes at preserves at least twice a year.

10H .1203 Quality of Foxes and Coyotes Released (page 5)

10H .1204

- Failure to maintain accurate up-to-date records upon inspection will result in a citation and repeat offenses will result in a revocation of the controlled fox hunting preserve license.

10H .1204 Records Required (page 6)

1 **15A NCAC 10H .1202 ESTABLISHMENT AND OPERATION**

2 (a) Size of Preserve. Controlled fox hunting preserves operated for commercial purposes shall be an area of not less
3 than 500 acres except that smaller areas containing terrain and topographical features which offer escape cover to the
4 fox and coyote populations are allowed under specific approval by the Wildlife Resources Commission.

5 (1) in areas less than 500 acres, zoned residential and within a one mile (or less) radius of residence(s)
6 the following is required:

7 (A) A natural buffer

8 (B) 100 ft Set Back from adjoining property

9 (C) Dog proof fence shall be no closer than 300 yards to a home residence.

10 (D) CONTROLLED FOX HUNTING PRESERVES shall be required to obtain “Commercial
11 Zoning” code prior to receiving a license.

12 (b) Boundary of Preserve. A controlled fox hunting preserve must be enclosed with a dog-proof fence that is also
13 designed to prevent the escape of foxes and coyotes released within the pen. This fencing must be maintained at all
14 times.

15 (1) A controlled fox hunting preserve must be enclosed with a dog-proof fence with rollers at top that
16 is 16 height and 5 feet depth to prevent the escape of foxes and coyotes released within the pen.

17 (c) Stocking Preserve With Game:

18 (1) In addition to purchasing live foxes and coyotes as provided in G.S. 113-273(g), operators of
19 controlled fox hunting preserves may also purchase live foxes and coyotes from licensed controlled
20 fox hunting preserves, licensed North Carolina fur propagators, or persons holding foxes legally
21 under a North Carolina wildlife captivity license.

22 (2) Licensed controlled fox hunting preserve operators may hold legally obtained foxes and coyotes
23 under rules that apply to a captivity license and may transport legally acquired foxes and coyotes
24 from the place of purchase to the controlled fox hunting preserve.

25 (3) Foxes and coyotes may not be imported into North Carolina for release into controlled fox hunting
26 preserves.

27 (4) The release of exotic wildlife into the controlled fox hunting preserves is specifically prohibited.

28 (5) The possession of exotic wildlife on controlled fox hunting preserves is specifically prohibited.

29 (6) Two foxes and coyotes permitted per 50 acres.

30

1 **15A NCAC 10H .1203 QUALITY OF FOXES AND COYOTES RELEASED**

2 All foxes and coyotes purchased or raised for release on controlled fox hunting preserves shall be healthy and free
3 from disease of any kind. An examination and inspection of the foxes and coyotes by the Wildlife Resources
4 Commission ~~may be conducted at any time.~~ shall be conducted at least twice a year. All dead foxes and coyotes,
5 except those killed by dogs during a hunt, or diseased foxes and coyotes found within the pen shall be submitted to a
6 North Carolina Department of Agriculture diagnostic lab for diagnosis. A copy of the diagnostic report shall be mailed
7 to the Wildlife Resources Commission. Possession of unhealthy or diseased foxes and coyotes shall be grounds for
8 revocation or denial of a controlled fox hunting preserve license. The Commission may quarantine any controlled fox
9 hunting preserve where contagious diseases are located.

10

1 **15A NCAC 10H .1204 RECORDS REQUIRED**

2 An accurate record including bill of sale for all foxes and coyotes released into the controlled fox hunting preserve
3 shall be maintained and available for inspection by officials of the North Carolina Wildlife Resources Commission at
4 all times. Failure to maintain accurate up to date records upon inspection will result in citation with repeat offenses
5 resulting in revocation of license.

6

EXHIBIT O
December 10, 2020



**Schedule for January 2021 Public Hearings for Proposed Changes to Wildlife,
Fisheries, and Game Land Rules**

Hearing Time: 7:00 p.m.

DATE	REGION	CITY	LOCATION
January 21, 2021 (Thursday)	All	Raleigh	<i>Virtual</i>