



AGENDA

N.C. WILDLIFE RESOURCES COMMISSION

April 25, 2019, 9:00 a.m.

1751 Varsity Drive

NCWRC Conference Room, 5th Floor

Raleigh, North Carolina

CALL TO ORDER - *Chairman John Coley*

This meeting is being recorded as a public record and is audio streaming live at www.ncwildlife.org. As a courtesy to others please turn off all cell phones during the meeting.

PLEDGE OF ALLEGIANCE – *Commissioner Joe Budd*

INVOCATION - *Commissioner Garry Spence*

RECOGNITION OF VISITORS – *Chairman John Coley*

MANDATORY ETHICS INQUIRY - North Carolina General Statute §163A-159(e) 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 John Coley*

APPROVAL OF FEBRUARY 21, 2019 MINUTES – Take action on the February 21, 2019 Wildlife Resources Commission meeting minutes as written in the exhibit and distributed to members (**EXHIBIT A**)

APPROVAL OF MARCH 21, 2019 SPECIAL MEETING MINUTES – Take action on the March 21, 2019 Wildlife Resources Commission special meeting minutes as written in the exhibit and distributed to members (**EXHIBIT B**)

ADMINISTRATION

Financial Status Report - Receive a financial status report on the Wildlife Operating Fund and Wildlife Endowment Fund –*Melissa Earp, Finance Office Chief* (**EXHIBIT C**)

2019-2020 Endowment Fund Annual Interest Allocation Report- Receive a financial status report and vote on the allocation of interest from the Endowment Fund for 2019-2020 - *Melissa Earp* (**EXHIBIT D**)

COMMITTEE REPORTS

Joint Committee on Delineation of Fishing Waters Report – March 21, 2019, Raleigh, NC –
Commissioner John Stone

Land Use and Access Committee Report – *Tom Berry, Chair*

Habitat, Nongame, and Endangered Species Committee Report – *Mark Craig, Chair*

Finance Committee Report – *Landon Zimmer, Chair*

Small Game and Wild Turkey Committee Report – *Garry Spence, Chair*

Migratory Birds and Waterfowl Committee Report – *Richard Edwards, Chair*

Committee of the Whole Report March 21, 2019 – *Chairman John Coley*

Committee of the Whole Report April 24, 2019 – *Chairman Coley*

AGENCY SPOTLIGHT – COASTAL PRESCRIBED FIRE PROGRAM - *Casey Phillips, Recovery and Sustainment Program Forester*

LAND AND WATER ACCESS SECTION

Land Acquisitions and Property Matters

Phase II Land Acquisition – Consider final approval to proceed with acquisition of the following properties – *Jessie Birckhead, Land Acquisition and Grants Manager* (**E-1, E-2, E-3**)

- Little Cedar Mountain – Burke County (E-1)
- Rocky Swamp Tract – Halifax County (E-2)
- Rhems Depot NCDOT Tract – Craven County (E-3)

Other Property Matters – Consider two additional property matters – *Jessie Birckhead* (EXHIBITS F-1, F-2)

- Consider a request from staff to demolish one residence at the McKinney Lake Hatchery in Richmond County (F-1)
- Consider a request from staff to release and relocate an easement providing access to the Roberson Tract of Lower Roanoke River Game Land in Martin County (F-2)

WILDLIFE EDUCATION DIVISION UPDATE – Receive an update on the activities of the Wildlife Education Division – *Kris Smith, Wildlife Education Division Chief*

INLAND FISHERIES DIVISION

Fisheries Division Update - Receive an update on activities of the Inland Fisheries Division – *Todd Ewing, Aquatic Wildlife Diversity Supervisor*

Town of Wilkesboro Mountain Heritage Trout City Request – Consider designating the Town of Wilkesboro as a Mountain Heritage Trout City and recognizing the Public Mountain Trout Waters within Wilkesboro as Mountain Heritage Trout Waters – *Todd Ewing* (EXHIBIT G)

Town of North Wilkesboro – Mountain Heritage Trout City Request – Consider designating the Town of North Wilkesboro as a Mountain Heritage Trout City and recognizing the Public Mountain Trout Waters within North Wilkesboro as Mountain Heritage Trout Waters – *Todd Ewing* (EXHIBIT H)

WILDLIFE MANAGEMENT DIVISION

Wildlife Management Division Update – Receive an update on the activities of the Wildlife Management Division – *Dr. David Cobb, Research Director*

2019-2020 Webless Migratory Birds, Resident Canada Geese, Extended Falconry, and Waterfowl Seasons – Review U.S. Fish and Wildlife Service frameworks, receive public comments, and select the 2019-2020 season dates and bag limits for webless migratory birds, resident Canada geese, extended falconry, and waterfowl – *David Cobb* (EXHIBITS I-1, I-2, I-3, I-4)

Consider staff recommendations to establish a season for taking up to 6 migrant peregrine falcons for use in falconry in 2019 – *David Cobb* (EXHIBIT J)

Consider staff recommendations for final adoption of five Species Conservation Plans – *Dr. Sara Schweitzer, Wildlife Diversity Supervisor* (EXHIBITS K-1, K-2, K-3, K-4, K-5)

RULEMAKING NOTICES OF TEXT – PERIODIC REVIEW OF RULES

Game Bird Propagators – 15A NCAC 10H .0900 – Consider request to approve publishing Notice of Text in the *NC Register* for proposed amendments to 10H .0900 Rules and open the public comment period – *Daron Barnes, Section Manager, Regulated Activities Permits Section (EXHIBIT L)*

Furbearer Propagation – 15A NCAC 10H .1100 – Consider request to approve publishing Notice of Text in the *NC Register* for proposed amendments to 10H .1100 Rules and open the public comment period – *Daron Barnes (EXHIBIT M)*

Reptiles & Amphibians – 15A NCAC 10H .1300 – Consider request to approve publishing Notice of Text in the *NC Register* for proposed amendments to 10H .1300 Rules and open the public comment period – *Daron Barnes (EXHIBIT N)*

COMMENTS BY CHAIRMAN – *Chairman John Coley*

COMMENTS BY EXECUTIVE DIRECTOR – *Gordon Myers*

ADJOURN

EXHIBIT A
April 25, 2019



MINUTES
February 21, 2019
N.C. Wildlife Resources Commission Meeting
Raleigh, North Carolina

Chairman John Coley called the February 21, 2019 N.C. Wildlife Resources Commission meeting to order at 9:00 a.m. in the Commission Room at the agency's headquarters in Raleigh. Coley reminded everyone that the meeting is being audio streamed live and will be available at ncwildlife.org. He requested that everyone silence cell phones. Commissioner Hayden Rogers was absent.

Commissioner Tommy Fonville led the Pledge of Allegiance.

Commissioner Brian White gave the invocation.

COMMISSIONER ATTENDANCE

John Coley	Richard Edwards
Brian White	Wes Seegars
David Hoyle, Jr.	Nat Harris
Monty Crump	Joe Budd
Brad Stanback	Tommy Fonville
Ray Clifton	Landon Zimmer
John Stone	John Litton Clark
Mark Craig	Mike Johnson
Garry Spence	Tom Berry

VISITORS

Joe McClees – McClees Consulting

**SPECIAL RECOGNITION - NATIONAL WILD TURKEY FEDERATION WILDLIFE
LAW ENFORCEMENT OFFICER OF THE YEAR AWARD**

Executive Director Gordon Myers recognized District 4 Master Officer Mike Nunnery, recipient of the Wildlife Law Enforcement Officer of the Year award at the National Wild Turkey Federation 43rd National Convention in Nashville, Tennessee. Since 1973 the National Wild Turkey Federation has contributed to the restoration of wild turkeys through conservation leadership, sound science, and partnerships.

MANDATORY ETHICS INQUIRY

Chairman Coley welcomed guests present. Coley advised the Commission of the mandatory ethics inquiry as mandated in N.C. General Statute 163A-159(e). Commissioner Monty Crump recused himself from discussion and vote on **Exhibit F-6**, Almond/Buchanan Tracts in Anson, Richmond, and Montgomery counties, and **Exhibit F-9**, ALCOA High Rock Tract in Davie, Davidson, and Rowan counties. Commissioner David Hoyle, Jr. recused himself from discussion and vote on **Exhibit L**, Final Adoption of a water safety rule amendment to 15A NCAC 10F .0333 on Lake Wylie in Mecklenburg County.

DECEMBER 6, 2018 MEETING MINUTES

Upon a motion by Nat Harris and second by Wes Seegars, the Commission approved the December 6, 2018 Commission minutes as presented in **Exhibit A**, which is incorporated into the official record of this meeting.

ADMINISTRATION

Financial Status Report - Melissa Earp, Finance Office Chief, presented a status report in **Exhibit B** on the Wildlife Operating Fund and the Wildlife Endowment Fund. As of January 31, 2019, the Wildlife Operating Fund year-to-date revenues were \$41,471,998.94 and expenditures were \$45,882,844.50. The Endowment Fund balance as of January 31, 2019 was \$14,838,043.55. Earp noted that license sales are down as the State recovers from Hurricane Florence. As of December 31, 2018, the Endowment Fund balance was \$124,335,404.04. Expendable interest was \$30,461,108.46. Non-expendable interest was \$13,589,616.93. Fiscal year-to-date transfer of expendable interest into the operations fund was \$1,426,797.90. **Exhibit B** is incorporated into the official record of this meeting.

Portion of State Ethics Review of 2018 Statement of Economic Interest Read into Minutes – Pursuant to NCGS §163A-159(c), Betsy Haywood, Ethics Liaison, read into the Minutes a portion of the review by the State Ethics Commission of the 2018 Statement of Economic Interest for Commissioner Landon G. Zimmer, President Pro Tempore appointee.

COMMITTEE REPORTS

Joint Committee on Delineation of Fishing Waters Report – January 23, 2019, New Bern, NC - Commissioner John Stone reported that the organizational meeting of the Joint Committee on Delineation of Fishing Waters was held at 1:00 p.m. on January 23, 2019, at Craven County Community College in New Bern. Marine Fisheries Commissioners Rob Bizzell Pete Kornegay, Doug Cross and Wildlife Resources Commissioners John Stone, Monty Crump, and Tommy Fonville comprise the Joint Committee. Rob Bizzell and John Stone will create meeting agendas and gather documents. A website for the Joint Committee is being created on the WRC server, as a repository for documents and with links to inform everyone of the processes of the joint committee. Nancy Fish of DMF and Betsy Haywood of WRC will jointly compile meeting minutes. The next meeting will be held March 21, 2019 at 1:00 p.m., at Wildlife Resources Commission headquarters in Raleigh.

Habitat, Nongame and Endangered Species (HNGES) Committee Webinar Report – February 14, 2019 – Committee Chair Mark Craig reported the HNGES Committee held a webinar meeting on February 14, 2019 and discussed three topics: Thomas L. Quay Wildlife Diversity Award, public comments regarding five Conservation Plans, and an Alligator Management update by Alicia Davis and Dr. Sara Schweitzer, with discussion of potential alligator sanctuaries and alligator seasons.

Boating Safety Committee Report – Committee Chair Mike Johnson reported that the Boating Safety Committee met on February 20, 2019. Betsy Haywood, No-Wake Zone Coordinator, reviewed proposed Notice of Text to be published in the *NC Register*, to correct the description of the water safety rule for the Rocky Mount Millpond Dam from a no-wake zone to a safety zone; proposed Notice of Text for an amendment to create a no-wake zone within 50 yards of the shoreline of a peninsula on Lake James in McDowell County; and reviewed for final adoption an amendment for a no-wake zone near the shoreline of the Yachtsman on Lake Wylie Community in Mecklenburg County; and final adoption of a no-wake zone within the canals at the eastern end of the peninsula at Whichard’s Beach in Beaufort County. The Committee recommended approval of all water safety rule requests by the entire Commission.

Finance Committee Report – Committee Chair Landon Zimmer reported that the Finance Committee met on February 20, 2019. Finance Office Chief Melissa Earp provided the Committee financial status reports. Status reports and reference materials from each committee meeting will be archived on a committee webpage for Commission use. Earp discussed the return on investment from bond index funds and equity index funds for the period of July 1, 2018 through December 1, 2018. Director Myers discussed the request for an actuarial study for lifetime license holders. The churn rate for fishermen is about 30 percent and the churn rate for hunters is about 42 percent. Based on a 2.5 percent rate of return on the lifetime license it appears that the lifetime license financially is an appropriate option for the Commission to continue. Southwick and Associates will conduct a study based on data specific to North Carolina license holders. The Committee requested that staff study registration fees for canoes and kayaks. Staff was asked to conduct a study of game lands stewardship costs as well as a review of what other states are doing regarding non-motorized vessel registrations or fees, and to report to the Finance Committee at its next meeting. IT Director Janice Underwood discussed the Business Continuity Plan for the agency and provided information about how the agency would proceed in the event of a natural disaster or other event that would halt operations. The committee discussed cyber security, redundancy of databases, off-site server and storage and concluded that cyber security should be a topic for the next committee meeting in April. Additional discussion included looking at the option of an automatic license renewal option for annual license holders, and the challenges and complexities surrounding that issue.

Land Use and Access (LUAC) Committee Report – Committee Chair Tom Berry reported that the LUAC met on February 20, 2019. Land Acquisition and Grants Manager Jessie Birckhead provided an update about current land projects and reviewed the land status spreadsheet. The Committee evaluated and approved a total of five Phase I Land Acquisition Projects. Additionally, the Committee evaluated and endorsed nine Phase II Land Acquisition Projects. Staff was requested to include in the Phase II stewardship costs the one-time capital improvement costs. The Committee tabled discussion of a public utility easement request from a private landowner. Staff was requested to determine fair market value for any easement request presented to the Commission. The Committee reviewed and endorsed the request to demolish a well at Armstrong Fish Hatchery in McDowell County, and endorsed a change in the lease rate at the Bolivia Depot site in Brunswick County.

Migratory Birds and Waterfowl Committee Report – Committee Chair Richard Edwards reported that the Migratory Birds and Waterfowl Committee met briefly on February 20, 2019. Migratory Game Bird Biologist Doug Howell provided an update about changes in migratory bird hunting seasons for 2019-2020 and reviewed the Atlantic Flyway Technical Section’s February meeting. He noted the decrease in mallards and pintails. Wildlife Management Division Chief Dr. David Cobb gave a brief update about the visit to the Maritime Agricultural Wetland Restoration Program field sites in Canada in May 2019.

Fisheries Committee Report – Committee Chair Tommy Fonville reported that the Fisheries Committee met on February 20, 2019. Fisheries Supervisor Corey Oakley provided a draft Catfish Management Plan update. The draft plan will be released for public comment. Commissioner John Stone provided an update about the Joint Committee on Delineation of Fishing Waters meeting on January 23, 2019. The next meeting will be held in Raleigh on March 21, 2019. Inland Fisheries Division Chief Christian Waters reviewed staff efforts to provide salinity data for the joint committee meeting. Doug Howell presented a plan for the Lake Mattamuskeet Watershed. A request by Wilkesboro and North Wilkesboro to be added as Mountain Heritage Trout Waters cities will be presented to the Commission in April. A Central Southern Management Area Striped Bass Management update was given. A Division of Marine Fisheries supplement is being considered on February 22, 2019. Director Myers stated that implementation of the supplement in Joint Fishing Waters requires consensus with the Wildlife Resources Commission.

Committee of the Whole (COW) Report – Chairman John Coley reported that the COW met on February 20, 2019. Staff reviewed comments and proposed rules for fishing, wildlife and lands management, and law enforcement. Finance Office Chief Melissa Earp reviewed the fiscal note and proposed rule to establish license fees in rule and adjust fees by the Consumer Price Index for all Urban Consumers. Rules Coordinator Carrie Ruhlman reviewed proposed rule text for amendments to the rule for Wildlife Taken for Depredations and rule for Wildlife Captivity and Rehabilitation. Ruhlman presented a readoption schedule for 10A, 10D, 10E, 10G, 10I, 10J, and 10K Rules as part of the 2018 Periodic Review process. Aquatic Wildlife Diversity Supervisor Todd Ewing reviewed conservation plans for the Robust Redhorse, Brook Floater, and Neuse and Tar basins. Wildlife Diversity Program Coordinator Dr. Sara Schweitzer reviewed conservation plans for the Bog Turtle and Gopher Frog. Dr. Schweitzer and Conservation Biologist Alicia Davis gave an alligator management update.

Motion from the Committee of the Whole Regarding Twelve-Month Extension of Readoption Deadline for Rules under the Periodic Review: On a motion by Tom Berry and second by Nat Harris, the Commission voted to request permission from the Rules Review Commission to extend the deadline for 12 months for readoption of Rules 15A NCAC 10H .1201, .1202, .1203, .1204, .1205, .1206, and .1207, pertaining to controlled fox hunting preserves.

AGENCY SPOTLIGHT – HIGH AND DRY: NCWRC RESPONSE TO DERELICT AND ABANDONED VESSELS DURING HURRICANE FLORENCE

Captain David O’Neal and Sergeant Ron Ellington, District 4 Law Enforcement, gave a presentation highlighting NCWRC involvement and partnerships with other state and federal agencies in mitigation of environmental impacts and pollution from derelict vessels that were displaced after Hurricane Florence. A request from the U.S. Coast Guard was made to NCWRC Law Enforcement to be liaisons and provide customer service at the Unified Command Center in Fayetteville. Assessment teams contacted 362 vessel owners whose vessels were damaged or abandoned after the hurricane. Team members entered vessel information and condition, location coordinates, and noted environmentally sensitive areas where hazardous materials had to be removed from vessels to prevent further environmental damage. Challenges were weather conditions including Hurricane Michael which followed Florence, maintaining communications, having adequate manpower, and maintaining consistent and consolidated unified command as hazardous materials were removed and vessel disposition forms were signed. During the operation, 47 Wildlife Enforcement Officers spent 2,428 hours working with the Unified Command Center in Fayetteville and along the coast at an employee cost of approximately \$85,000. Today 99 vessels remain in the water. The General Assembly has appropriated \$50,000 to NCWRC for a study on tort claims and disasters with vessels.

WILDLIFE EDUCATION

Division Update – Wildlife Education Division Chief Kris Smith reported that the Pisgah Center for Wildlife Education created a Wildlife Expo for seven schools in January and February, teaching archery, fly casting, and a wildlife conservation game. More expos are scheduled for March. The Pisgah Center has partnered with Brevard Academy to form an elective fly-fishing class. The agency’s Diversity Outreach Specialist is working with District 6 Law Enforcement to provide boater education courses in Spanish. The first Hunter Education course in Spanish was offered last fall, with plans for a spring class. In 2018 Regional Education Staff reached over 16,000 instructors with more than 400 programs. With funding from a Wildlife and Sportfish Restoration multi-state conservation grant, Hunting Heritage Biologist “Deet” James is working on a pilot project for hunter education and retention with NCSU college students who have not been introduced to hunting experiences and with no one to mentor them. It is hoped that this program will be extended to other colleges and universities. Upcoming events include the Dixie Deer Classic in Raleigh, March 1 through 3, 2019, where an Outdoors Career Day is planned; a Getting Started Outdoors turkey hunting workshop for new recruits; Family Fishing Fiesta at Jordan Lake on April 27; and N.C. National Archery in the Schools Program (NASP) tournament February 22 through 23 in Winston-Salem.

INLAND FISHERIES

Division Update – Inland Fisheries Division Chief Christian Waters reported that a Carhartt Bass Masters College Series fishing tournament sponsored by Bass Pro Shops is being held on Lake Norman this week with 350 college teams participating. Also, a televised Major League Fishing Tournament is being held March 26 through 31 on Falls Lake, Jordan Lake, and Harris Lake reservoirs with 40 professionals participating. Waters announced that the Roanoke River Striped Bass harvest season begins March 1 through April 30, unless altered or closed by Proclamation. Hatchery supported trout waters are closed from March 1 until April 6 for stockings.

ADOPTION OF 2019-2020 INLAND FISHERIES RULES

Christian Waters presented in **Exhibit C-1** a summary of comments concerning the proposed changes to twenty inland fishing rules, received from statewide public hearings held in January 2019 and from the NCWRC internet portal and correspondence.

On a motion by Monty Crump and second by Brad Stanback, the Commission adopted 19 changes to Inland Fisheries rules for 2019-2020 presented in **Exhibit C-2**. After considering constituent feedback, the Commission did not vote to adopt F10 that would have removed the exception to the general statewide rule for crappie in B. Everett Jordan Reservoir by reducing the minimum size limit. The size limit remains 10 inches. **Exhibit C-2** except for F10 is incorporated into the official record of this meeting:

- F1) Designate Apalachia Reservoir in Cherokee County as Public Mountain Trout Waters, classify as Special Regulation Trout Waters, and establish a three-fish daily creel limit including only one trout greater than 14 inches.
15A NCAC 10C .0205 Public Mountain Trout Waters
15A NCAC 10C .0316 Trout
- F2) Modify the upper boundary of Delayed Harvest Trout Waters on Helton Creek in Ashe County removing approximately 1.0 mile from Public Mountain Trout Waters. The designated reach will be from the S.R. 1372 bridge to the North Fork New River.
15A NCAC 10C .0205 Public Mountain Trout Waters
- F3) Modify the upper boundary of Hatchery Supported Trout Waters on Big Laurel Creek in Madison County removing 4.7 miles from Public Mountain Trout Waters. The designated reach will be from Puncheon Fork to the S.R. 1318 [Big Laurel Rd.] bridge downstream of Bearpen Branch.
15A NCAC 10C .0205 Public Mountain Trout Waters
- F4) Modify the upper boundary of Hatchery Supported Trout Waters on Meadow Fork Creek in Madison County removing 1.0 mile from Public Mountain Trout Waters. The designated reach will be from Meadow Fork Campground to Spring Creek.
15A NCAC 10C .0205 Public Mountain Trout Waters
- F5) Modify the lower boundary of Delayed Harvest Trout Waters on East Fork French Broad River in Transylvania County removing 0.9 miles from Public Mountain Trout Waters. The designated reach will be from East Fork Baptist Church to the downstream S.R. 1107 bridge.
15A NCAC 10C .0205 Public Mountain Trout Waters
- F6) Modify the lower boundary of the upper Delayed Harvest Trout Waters section on the Watauga River in Watauga County removing approximately 0.4 miles from Public Mountain Trout Waters. The designated reach will be from the S.R. 1114 bridge to the Valle Crucis Community Park lower boundary.
15A NCAC 10C .0205 Public Mountain Trout Waters

- F7) Clarify the upper boundary of Hatchery Supported Trout Waters on Big Hungry River in Henderson County. The designated reach is from S.R. 1885 to the Green River. This proposal will not add or remove any Public Mountain Trout Waters.
15A NCAC 10C .0205 Public Mountain Trout Waters
- F8) Remove the closed harvest season of December 1 to March 31 for black bass at Sutton Lake. The minimum size limit is 14 inches, and the daily creel limit is five fish.
15A NCAC 10C .0305 Black Bass
- F9) Clarify that the exception to the general statewide rule for black bass establishing a 14-inch minimum size limit with no exception in the Albemarle Sound and its tributaries applies to all associated tributaries and canals of all tributary river systems.
15A NCAC 10C .0305 Black Bass
- F11) Establish an exception to the general statewide rule for crappie in the North Carolina portion of John H. Kerr Reservoir by implementing a 9-inch minimum size limit and a 25-fish daily creel limit.
15A NCAC 10C .0306 Crappie
- F12) Modify the general statewide rule for American Shad and Hickory Shad to establish a daily creel limit of 10 fish in combination, including no more than one American Shad. This proposal will not affect river systems where harvest of more than one American Shad is specifically allowed (Tar River, Cape Fear River, Pee Dee River, and their tributaries) or in select Piedmont reservoirs where no American Shad may be possessed.
15A NCAC 10C .0313 Shad (American and Hickory)
- F13) Modify the exception to the general statewide rule for Striped Bass and their hybrids in the portion of the Dan River downstream of the dam at Union Street in Danville, Virginia and in the North Carolina portion of John H. Kerr Reservoir by reducing the minimum size limit from 24 to 20 inches from October 1 to May 31. The daily creel limit would remain two in combination from October 1 to May 31. From June 1 to September 30, there is no minimum size limit and a four-fish daily creel limit.
15A NCAC 10C .0314 Striped Bass
- F14) Extend the upper boundary for the river herring (Alewife and Blueback Herring) harvest moratorium on the Neuse River upstream from Milburnie Dam, which has been removed, to Falls Lake Dam.
15A NCAC 10C .0401 Manner of Taking Nongame Fishes
15A NCAC 10C .0402 Taking Nongame Fishes for Bait and Personal Consumption
- F15) Remove the possession restriction for river herring (Alewife and Blueback Herring) in the Little Tennessee River Basin except for waters in and upstream of Lake Santeetlah and Cedar Cliff Lake.
15A NCAC 10C .0211 Possession of Certain Fishes
15A NCAC 10C .0402 Taking Nongame Fishes for Bait and Personal Consumption

- F16) Establish an exception to the general statewide rule for catfish in the Pee Dee River downstream of Blewett Falls Dam to the South Carolina state line and all tributaries by implementing a daily creel limit of five catfish in combination.
15A NCAC 10C .0401 Manner of Taking Nongame Fishes
- F17) Prohibit the possession or take of Grass Carp on the North Carolina portion of John H. Kerr Reservoir and Lake Norman except for scientific study by permit issued by the N.C. Wildlife Resources Commission.
15A NCAC 10C .0401 Manner of Taking Nongame Fishes
- F18) Clarify that the restriction on altering the appearance of nongame fishes subject to a size and/or creel limit such that the fish cannot be identified, measured, or counted applies only to species and associated locations with specific size and/or creel limits.
15A NCAC 10C .0401 Manner of Taking Nongame Fishes
15A NCAC 10C .0402 Taking Nongame Fishes for Bait and Personal Consumption
- F19) Extend the upper boundary for the use of bow nets as a special device on the Neuse River upstream from Milburnie Dam, which has been removed, to Falls Lake Dam.
15A NCAC 10C .0407 Permitted Special Devices and Open Seasons
- F20) Limit the use of archery equipment on Pee Dee River downstream of Blewett Falls Dam to the South Carolina state line and all tributaries for the take of catfish only.
15A NCAC 10C .0401 Manner of Taking Nongame Fishes

WILDLIFE MANAGEMENT

Division Update – Wildlife Management Division Chief Dr. David Cobb announced the recipients of the 2018 Wildlife Management Division Awards. Shauna Glover received the 2018 Support Staff of the Year award and John Isenhour received the 2018 Biologist of the Year award. Dr. Cobb reported that the total deer harvest was 143,190, down 11.5 percent statewide, but is up in the western part of the state. Coastal bear harvest was 2,138, down 5.6 percent. In the Piedmont 52 bears were harvested, down 10 percent. In the mountains 1,264 bears were harvested. Mountain harvest is up 16 percent that is being attributed to the poor hard mast this year.

ADOPTION OF 2019-2020 WILDLIFE MANAGEMENT RULES

Dr. Cobb presented **Exhibit D-1**, a summary of public comments concerning proposed changes to wildlife management rules received from statewide public hearings held in January 2019 and from the NCWRC internet portal and correspondence.

Six changes to Wildlife Management rules for 2019-2020 were presented in **Exhibit D-2**. Monty Crump made a motion, seconded by Landon Zimmer, for proposal H3 to be adopted for fox squirrel hunting in all 100 counties but to not extend the season past December 31. That motion did not pass. H3 was adopted as written, with Monty Crump, Landon Zimmer, Nat Harris, and Richard Edwards opposed:

- H3) Open fox squirrel hunting in all 100 counties (versus 27 counties currently open) and extend the season to close on January 31, instead of December 31.
15A NCAC 10B .0206

On a motion by John Stone and second by Mike Johnson, the Commission adopted the changes to Wildlife Management rules for 2019-2020. **Exhibit D-2**, including H3, is incorporated into the official record of this meeting:

- H1) Extend the regulated trapping season in and east of Hertford, Bertie, Martin, Pitt, Greene, Lenoir, Duplin, Pender, and New Hanover counties to begin on November 1, instead of December 1. Under this proposal the statewide trapping season would be November 1 through the last day in February.
15A NCAC 10B .0303
- H2) Extend rabbit hunting season by opening it on the Monday on or nearest October 15, instead of the Saturday before Thanksgiving and running through the last day in February.
15A NCAC 10B .0207
- H4) Implement as permanent rule, changes in the rule regulating importation of cervid carcass and carcass parts to prohibit importation from any location outside of North Carolina, except as specified.
15A NCAC 10B .0124
- H5) Modify the rule specifying allowed archery equipment to: a) define archery equipment, b) specify allowed uses for archery equipment utilizing an elastic string, c) add elk, alligators, and feral swine to broadhead and minimum pull requirements, and d) eliminate the prohibition of barbed arrowheads.
15A NCAC 10B .0116
- H6) Correct the *N.C. Administrative Code* to clarify the first segment of the bear season in Dare, Hyde, and Tyrrell counties is two weeks, beginning the second Saturday in November through the third Sunday thereafter.
15A NCAC 10B .0202

LAND AND WATER ACCESS

Section Update – Land and Water Access Section Chief Brian McRae reported that repairs are being made to game lands that were affected by the hurricanes. The on-line survey of disabled sportsmen received 1,400 comments with suggestions to improve their hunting experience. McRae gave an update about the October 2018 request for staff to obtain stakeholder opinions regarding hunting on game lands on Sundays. Staff is assembling a contract for facilitators to meet with stakeholders statewide to obtain opinions about Sunday hunting on game lands. Director Myers will email Requests for Proposals (RFP) to Commissioners. Staff will report the results of the statewide surveys at the October meeting of the Commission.

ADOPTION OF GAME LAND MANAGEMENT RULES FOR 2019-2020

Summary of Public Comments Pertaining to Proposed Changes in Game Land Rules - Brian McRae presented in **Exhibit E-1** a summary of public comments received from statewide district public hearings held in January 2019 and from the WRC internet and correspondence, pertaining to proposed changes to game land rules.

2019-2020 Game Land Management Rules – On a motion by Mark Craig and second by John Litton Clark, the Commission adopted 2019-2020 Game Land Rules presented in **Exhibit E-2**. **Exhibit E-2** is incorporated into the official record of this meeting:

- G1) Establish a December archery season on South Mountains Game Land and Buffalo Cove Game Land for antlered deer.
15A NCAC 10D .0103 Hunting on game lands
- G2) Establish the Conservative either-sex season on Buxton Woods Game Land.
15A NCAC 10D .0103 Hunting on game lands
- G3) Allow deer of either sex to be taken during the first open Saturday of the Deer with Visible Antlers Season at Cold Mountain Game Land.
15A NCAC 10D .0103 Hunting on game lands
- G4) Add Hyde County to the list of counties comprising Dare Game Land.
15A NCAC 10D .0103 Hunting on game lands
- G5) Change the designation of Dan River Game Land in Rockingham County from a Permit Only Area to a Three Days per Week Area with turkey and deer hunting by permit only.
15A NCAC 10D .0103 Hunting on game lands
- G6) Designate the Little Macedonia Tract of Green Swamp Game Land as a permit-only area for all hunting and trapping.
15A NCAC 10D .0103 Hunting on game lands
- G7) Allow the public to camp in designated camping areas during open hunting seasons on Johns River Game Land.
15A NCAC 10D .0103 Hunting on game lands
- G8) Allow camping within 100 yards of the Neuse River on the Turkey Quarter Creek Island Tract of Neuse River Game Lands.
15A NCAC 10D .0103 Hunting on game lands
- G9) Prohibit target shooting on the Perkins Game Land in Davie County.
15A NCAC 10D .0103 Hunting on game lands
- G10) Add Pender County to the list of counties comprising Whitehall Plantation Game Land.
15A NCAC 10D .0103 Hunting on game lands

- G11) Prohibit the pursuing or chasing of deer or bear with dogs for the purposes of training or hunting on the Long Ridge Tract of Whitehall Plantation Game Land.
15A NCAC 10D .0103 Hunting on game lands
- G12) Prohibit target shooting on White Oak River Game Land.
15A NCAC 10D .0103 Hunting on game lands
- G13) Prohibit target shooting on Bertie County Game Land, Brinkleyville Game Land, Chowan Swamp Game Land, Embro Game Land, Lower Fishing Creek Game Land, Roanoke River Wetlands Game Land, Sandy Creek Game Land, Shocco Creek Game Land, Tar River Game Land, Tillery Game Land, and Voice of America Game Land.
15A NCAC 10D .0103 Hunting on game lands
- G14) Clarify the definition of a “Six Days per Week Game Land” to indicate that hunting is allowed Monday through Saturday during open seasons.
15A NCAC 10D .0103 Hunting on game lands
- G15) Clarify bear sanctuary rules in the NCAC and update the county locations of existing bear sanctuaries. Additionally, Bombing Range Bear Sanctuary and part of Green Swamp Bear Sanctuary will be renamed Dare Bear Sanctuary and Juniper Creek Bear Sanctuary, respectively.
15A NCAC 10B .0202 Bear
15A NCAC 10D .0103 Hunting on game lands
15A NCAC 10D .0106 Bear Sanctuaries
- G16) Prohibit the use of gasoline powered motors on Ethridge Pond Public Fishing Area and Newbold Pond Public Fishing Area in Edgecombe County.
15A NCAC 10E .0104 Use of Areas Regulated

PROPERTY MATTERS

Phase II Land Acquisitions

On a motion by John Litton Clark and second by Tom Berry, the Commission gave final approval to proceed with acquisitions of the following seven properties presented in **Exhibits F-1, F-2, F-3, F-4, F-5, F-7, and F-8:**

- Duck Creek Wetlands Tract – Craven County (F-1)
- Salters Creek Tract – Carteret County (F-2)
- Truth Temple/Croasmun Tract – Ashe County (F-3)
- Roberts Estate Tract – Rockingham County (F-4)
- North Bend BAA Tract – Catawba County (F-5)
- Hubbard-Pinkerton Tract – Camden County (F-7)
- Corpening Tract – Burke County (F-8)

With Commissioner Monty Crump recused from discussion and action on **Exhibits F-6 and F-9**, on a motion by Mike Johnson and second by Tom Berry the Commission approved final acquisition of properties in **Exhibits F-6 and F-9**:

- Almond/Buchanan Tracts – Anson, Richmond, and Montgomery Counties (F-6)
- ALCOA High Rock Tract – Davie, Davidson, and Rowan Counties (F-9)

Exhibits F-1, F-2, F-3, F-4, F-5, F-6, F-7, F-8, and F-9 are incorporated into the official record of this meeting.

Permanent Utility Easement Request Tabled – Northwest River Marsh Game Land, Currituck County

The Commission tabled **Exhibit G**, a request from a property owner and Dominion Energy for a permanent utility easement at Northwest River Marsh Game Land in Currituck County.

Disposition of Well, Armstrong Fish Hatchery – McDowell County

On a motion by Tom Berry and second by Brian White, the Commission approved a staff request, presented in Exhibit H-1, to demolish a well and pump house structure at the Armstrong Fish Hatchery in McDowell County. **Exhibit H-1** is incorporated into the official record of this meeting.

Lease Rate Change Request, Bolivia Depot Site, Brunswick County

On a motion by Tom Berry and second by Brian White, the Commission approved, **Exhibit H-2**, a change in the lease rate at the Bolivia Depot site in Brunswick County for three years, with a rate increase of three percent or less per year. **Exhibit H-2** is incorporated into the official record of this meeting.

ADOPTION OF LAW ENFORCEMENT RULES

Summary of Public Comments on Proposed Changes to Law Enforcement Rules – Colonel Jon Evans, Law Enforcement Division Chief, presented in **Exhibit I-1** a summary of public comments concerning proposed changes to law enforcement rules received from statewide public hearings held in January 2019 and from the WRC internet portal and correspondence.

Changes in 2019-2020 Law Enforcement Division Rules – On a motion by Mike Johnson and second by Wes Seegars, the Commission approved proposed changes to two 2019-2020 Law Enforcement rules presented in **Exhibit I-2**, which is incorporated into the official record of this meeting:

E1) Updates the list of offense for which warning tickets are prohibited and removes the specific list of offenses for which warning tickets may be issued.

15A NCAC 10A .1001 - Particular Offenses

E2) Allows the Commission's Executive Director to determine the disposition of seized fish or wildlife and details the factors to be considered when determining disposition.

15A NCAC 10A .1501 - Summary Disposition

WATER SAFETY RULEMAKING

Local Water Safety Rule Technical Correction – City of Rocky Mount Millpond Dam Safety Zone – On a motion by Mike Johnson and second by John Litton Clark, the Commission approved proceeding with publishing Notice of Text in the *NC Register* with an open comment period and public hearing for a proposed amendment to 15A NCAC 10F .0370, to clarify descriptions and correctly designate the water safety rule in the waters around the Millpond Dam in Rocky Mount as a safety zone where entry is prohibited, rather than a no-wake zone where vessel speed is regulated. **Exhibit J, City of Rocky Mount Millpond Dam Safety Zone**, is incorporated into the official record of this meeting.

Local Water Safety Rule Application – Lake James in McDowell County – On a motion by Mike Johnson and second by Landon Zimmer, the Commission approved an application from McDowell County, presented in **Exhibit K**, to publish Notice of Text in the *NC Register* with an open comment period and public hearing for an amendment to 15A NCAC 10F .0339, for a no-wake zone within 50 yards of the shoreline of a peninsula at Old Wildlife Club Subdivision on Lake James in McDowell County. **Exhibit K** is incorporated into the official record of this meeting.

Local Water Safety Rule Final Adoption – Lake Wylie Marine Commission in Mecklenburg County – With Commissioner David Hoyle, Jr. recused, and upon a motion by Monty Crump and second by Joe Budd, the Commission adopted **Exhibit L**, an amendment to 15A NCAC 10F .0333 requested by the Lake Wylie Marine Commission, for a no-wake zone in the vicinity of the Yachtsman on Lake Wylie Community in Mecklenburg County. After review by the Rules Review Commission the earliest effective date of the rule is May 1, 2019. **Exhibit L** is incorporated into the official record of this meeting.

Local Water Safety Rule Final Adoption – Chocowinity Bay and Pamlico River in Beaufort County – On a motion by Monty Crump and second by Nat Harris, the Commission adopted **Exhibit M**, an amendment to 15A NCAC 10F .0303 requested by Beaufort County, for a no-wake zone in the canals at the eastern end of the peninsula between Chocowinity Bay and Pamlico River at Whichards Beach and Fork Point. The rule will be considered by the Rules Review Commission, with an earliest effective date of May 1, 2019. **Exhibit M** is incorporated into the official record of this meeting.

RULEMAKING NOTICES OF TEXT

Rulemaking for License Fee Changes – Melissa Earp, Finance Office Chief, presented **Exhibit N-1**, the Fiscal Note for proposed license fee changes that has been approved by the Office of State Budget and Management (OSBM).

On a motion by Landon Zimmer and second by Tommy Fonville, the Commission approved the Fiscal Note in **Exhibit N-1** and approved **Exhibit N-2**, to proceed with publishing Notice of Text in the *NC Register* with an open comment period and one public hearing for proposed amendments to 15A NCAC 10A .1601, to establish license fees in rule and adjust fees by the Consumer Price Index for All Urban Consumers (CPI-U). The effective date of this rule, if adopted, will be August 1, 2019.

The Table showing proposed License Fee adjustments based on the CPI-U is incorporated as **Attachment A**. **Exhibits N-1** and **N-2** are incorporated into the official record of this meeting.

Attachment A

CPI-U Fee Adjustments (6%)					
License Description	Current Fee	Proposed Fee	License Description	Current Fee	Proposed Fee
Resident Annual Combination Hunting & Inland Fishing	\$25	\$26.50	Short-Term Inland Fishing - Nonresident 10-Day	\$18	\$19.08
Resident Disabled Veteran & Totally Disabled Lifetime Combo Hunting & Fishing	\$10	\$10.60	Age 70 Resident Lifetime Inland Fishing	\$15	\$15.90
Annual Sportsman	\$50	\$53.01	Resident Disabled Veteran & Totally Disabled Lifetime Inland Fishing	\$10	\$10.60
Infant Lifetime Sportsman	\$200	\$212.00	Special Landholder & Guest Fishing	\$100	\$106.01
Youth Lifetime Sportsman	\$350	\$371.00	Special Trout	\$13	\$13.78
Adult Lifetime Sportsman	\$500	\$530.00	Mountain Heritage Trout Waters 3-Day Fishing	\$5	\$5.30
Nonresident Lifetime Sportsman	\$1,200	\$1,272.00	Resident Special Device	\$75	\$79.51
Age 70 Resident Lifetime Sportsman	\$15	\$15.90	Nonresident Special Device	\$500	\$530.05
Resident Disabled Veteran & Totally Disabled Lifetime Sportsman	\$100	\$106.00	Wildlife and Scientific Collection	\$5	\$5.30
Resident State Hunting	\$20	\$21.20	Captivity License	\$5	\$5.30
Lifetime Resident Comprehensive Hunting	\$250	\$265.00	Fur Dealer - Resident	\$60	\$63.61
Controlled Hunting Preserve	\$20	\$21.20	Fur Dealer - Nonresident	\$300	\$318.03
Resident Annual Comprehensive Hunting	\$36	\$38.16	Fur Dealer Station	\$120	\$127.21
Nonresident State Hunting - Season	\$80	\$84.81	Controlled Hunting Preserve Operator	\$50	\$53.01
Nonresident State Hunting - 10-Day	\$60	\$63.61	Gamebird Propagation	\$5	\$5.30
Resident Big Game Hunting	\$13	\$13.78	Furbearer Propagation	\$25	\$26.50
Nonresident Bear Hunting	\$225	\$238.52	Taxidermy	\$10	\$10.60
Bear Management Stamp	\$10	\$10.60	Annual Resident Unified Sportsman/Coastal Recreational Fishing	\$65	\$68.90
Nonresident Big Game Hunting - Season	\$80	\$84.81	Annual Resident Unified Inland/Coastal Recreational Fishing	\$40	\$42.40
Nonresident Big Game Hunting - 10-Day	\$60	\$63.61	Infant Lifetime Unified Sportsman/Coastal Recreational Fishing	\$275	\$291.50
Bonus Antlerless Deer	\$10	\$10.60	Youth Lifetime Unified Sportsman/Coastal Recreational Fishing	\$450	\$477.00
Game Land	\$15	\$15.90	Adult Lifetime Unified Sportsman/Coastal Recreational Fishing	\$675	\$715.50
Falconry	\$10	\$10.60	Nonresident Adult Lifetime Unified Sportsman/Coastal Recreational Fishing	\$1,550	\$1,643.00
Migratory Waterfowl Hunting	\$13	\$13.78	Resident Age 70 Lifetime Unified Sportsman/Coastal Recreational Fishing	\$30	\$31.80
Resident American Alligator License	\$250.00		Resident Disabled Veteran Lifetime Unified Sportsman/Coastal Recreational Fishing	\$110	\$116.60
Nonresident American Alligator License	\$500.00		Resident Totally Disabled Lifetime Unified Sportsman/Coastal Recreational Fishing	\$110	\$116.60
Resident Elk License	\$500.00		Resident Lifetime Unified Inland/Coastal Recreational Fishing	\$450	\$477.00
Nonresident Elk License	\$1,000.00		Annual Resident CRFL	\$15	\$15.90
Hunting and Fishing Guide License - Resident	\$15	\$15.90	Annual Nonresident CRFL	\$30	\$31.80
Hunting and Fishing Guide License - Nonresident	\$150	\$159.02	Ten-Day Resident CRFL	\$5	\$5.30
Resident State Trapping	\$30	\$31.80	Ten-Day Nonresident CRFL	\$10	\$10.60
Nonresident State Trapping	\$125	\$132.51	Infant Lifetime CRFL	\$100	\$106.00
Resident Annual Comprehensive Inland Fishing	\$25	\$26.50	Youth Lifetime CRFL	\$150	\$159.00
Resident State Inland Fishing	\$20	\$21.20	Resident Adult Lifetime CRFL	\$250	\$265.00
Lifetime Resident Comprehensive Inland Fishing	\$250	\$265.00	Nonresident Adult Lifetime CRFL	\$500	\$530.00
Nonresident State Inland Fishing	\$36	\$38.16	Resident Age 70 Lifetime CRFL	\$15	\$15.90
Short-Term Inland Fishing - Resident 10-Day	\$7	\$7.42	Resident Disabled Veteran CRFL	\$10	\$10.60
			Resident Totally Disabled CRFL	\$10	\$10.60

Rulemaking for Wildlife Taken for Depredations – On a motion by Tom Berry and second by Garry Spence, the Commission approved **Exhibit O**, presented by Rulemaking Coordinator Carrie Ruhlman to proceed with Notice of Text in the *NC Register* with an open comment period and one public hearing for proposed amendments to 15A NCAC 10B .0106, regarding wildlife taken for depredations. If adopted, the effective date of this rule will be August 1, 2019. The proposed rule changes will specifically address the following:

- Allow the Executive Director to designate staff to issue depredation permits for Special Concern species and alligators.
- Allow cities to submit their application for depredation permits to agency staff, not specifically the Executive Director.
- Specify the types of violations that would prohibit an individual from applying to become a Wildlife Damage Control Agent (WDCA) and establish a time frame on which those violations would impact an individual's ability to be approved as a WDCA.
- Modify the passing test score requirement from 85 percent to 80 percent.
- Allow agency staff, in addition to the Executive Director and agents, to authorize the use of bait for trapping under a depredation permit if necessary.
- Remove the requirement for Animal Control Officers (ACO) and those acting in the official capacity as an Animal Control Officer to obtain a depredation permit when taking wild animals exhibiting obvious signs of rabies, unprovoked aggression, or that are suspected to be rabid.

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

Rulemaking for Wildlife Captivity and Rehabilitation – Carrie Ruhlman presented in **Exhibit P-1** the Fiscal Note that has been approved by OSBM for proposed rules for holding wildlife in captivity and rehabilitation of wildlife. Upon a motion by Mark Craig and second by David Hoyle, Jr. the Commission approved the Fiscal Note, **Exhibit P-1**, and approved **Exhibit P-2** to proceed with Notice of Text in the *NC Register* with an open comment period and two public hearings, for proposed adoption of 15A NCAC 10H .1400 Rules for holding wildlife in captivity and rehabilitation of wildlife. The 10H .1400 Rules will replace current rules with a delayed effective date of January 1, 2020. These rules split rehabilitation and long-term captivity requirements, incorporate necessary definitions and provisions to be used throughout the subchapter, detail enforcement actions, and specify reporting requirements and form contents. The new Section will apply to all captivity licenses issued by the Commission as of January 1, 2020 and to those non-farmed cervid facilities issued a license prior to September 30, 2015. **Exhibits P-1 and P-2** are incorporated into the official record of this meeting.

2018 PERIODIC REVIEW OF RULES READOPTION SCHEDULE

On a motion by David Hoyle, Jr. and second by Nat Harris, the Commission approved the readoption schedule presented in **Exhibit Q** for 10A, 10D, 10E, 10G, 10I, 10J, and 10K Rules as part of the 2018 Periodic Review process. The 35 rules determined to be necessary with substantive public interest shall be readopted by the agency by December 31, 2024. **Exhibit Q** is incorporated into the official record of this meeting.

COMMENTS BY THE CHAIRMAN

Chairman Coley thanked agency staff and Commissioners for their efforts for the meetings.

OTHER COMMENTS

Vice Chairman David Hoyle, Jr. thanked Commissioners. He reiterated that the statewide public hearing process is designed to receive stakeholder feedback and to incorporate majority preferences when possible during the final adoption of proposed rules.

Commissioner Mark Craig noted that through the efforts of staff and the Land Use and Access Committee, more than 27 square miles of property recently has been added to the conservation lands of the State.

COMMENTS BY THE EXECUTIVE DIRECTOR

Executive Director Myers mentioned the spread of Chronic Wasting Disease (CWD) in Tennessee and noted that there are more than 190 positives in that state. In Mississippi two counties have had positive CWD detections. The agency is working on an updated CWD Response Plan and recently met with the N.C. Department of Agriculture regarding their plan for farmed cervids. An Action Team is working to unify the two plans for response to CWD.

ADJOURNMENT

The meeting was adjourned by Chairman Coley at 11:02 a.m.

All exhibits are incorporated into the official record of this meeting by reference and are filed with the minutes.

John Coley, Chairman

Date

Gordon Myers, Executive Director

Date

EXHIBIT B

April 25, 2019



MINUTES

March 21, 2019

**N.C. Wildlife Resources Commission
Special Meeting
Raleigh, North Carolina**

Chairman John Coley called the March 21, 2019 N.C. Wildlife Resources Commission Special Meeting to order at 11:00 a.m. in the Commission Room at the agency's headquarters in Raleigh. Coley reminded everyone that the meeting is being audio streamed live and will be available at www.ncwildlife.org. He requested that everyone silence cell phones. Commissioners Nat Harris, Richard Edwards, Joe Budd, Landon Zimmer, Hayden Rogers, Garry Spence, and Brad Stanback were absent.

WELCOME AND MANDATORY ETHICS INQUIRY

Chairman Coley welcomed guests present. Coley advised the Commission of the mandatory ethics inquiry as mandated in N.C. General Statute 163A-159(e).

COMMISSIONER ATTENDANCE

John Coley
Brian White
David Hoyle, Jr.
Mark Craig
Tom Berry
Mike Johnson

Monty Crump
Ray Clifton
Mark Craig
John Litton Clark
John Stone
Tommy Fonville

VISITORS

Jerry Schill - NC Fisheries Association
David Sneed – CCA NC

Henri McClees – NC Sporting Dog Association
Bob Brown – NC Wildlife Federation

CONSIDERATION OF PROCLAMATION TO SUSPEND HOOK-AND-LINE SEASON FOR STRIPED BASS IN JOINT AND INLAND FISHING WATERS OF THE CENTRAL SOUTHERN MANAGEMENT AREA (CSMA)

Executive Director Gordon Myers stated that two recent successful striped bass spawning events in the Tar-Pamlico and Neuse Rivers prompted the N.C. Marine Fisheries Commission (MFC) to adopt Supplement A to Amendment 1 of the N.C. Estuarine Striped Bass Fishery Management Plan. The goal is to protect these year classes to achieve sustainable harvest through science-based processes that conserve adequate spawning stock and maintain a broad age structure. Implementation of Supplement A would result in a no-possession requirement for striped bass in the Coastal Fishing Water sections of the Tar-Pamlico and Neuse rivers and in other joint and internal coastal waters of the CSMA, excluding joint and internal coastal fishing waters of the Cape Fear River and its tributaries.

Full implementation of the supplement specifying a no-possession limit in the CSMA in Joint Fishing Waters within the CSMA cannot occur without concurrent action of the WRC under 15A NCAC 10C .0107 and its companion MFC rule. On March 13, 2019, the MFC adopted a motion requesting the WRC adopt concurrent regulations for recreational harvest in Joint Fishing Waters. The MFC also adopted a motion directing the DMF director to issue a proclamation that prohibits the use of gill nets upstream of the ferry lines, dock to dock from the Bayview to Aurora Ferry on the Pamlico River and dock to dock from the Minnesott Beach to Cherry Branch Ferry on the Neuse River, within the CSMA.

Statutory authority under G.S. 113-132(d) empowers the MFC and WRC to make agreements concerning harmonious settlement of conflicts in the best interest of the conservation of marine, estuarine, and wildlife resources. In consideration of the comprehensive protective nature of both MFC actions, and with regard to potential law enforcement complications of no possession regulations in waters adjacent to Joint Waters, John Stone made a motion, seconded by Monty Crump, directing Executive Director Gordon Myers to issue a proclamation to suspend the hook-and-line season for striped bass in both joint and inland fishing waters of the CSMA, pending the development of Amendment 2 to the N.C. Estuarine Striped Bass Fishery Management Plan. With a roll call vote, the motion passed unanimously.

ADJOURNMENT

There being no further business, Chairman John Coley adjourned the meeting at 11:20 am.

All exhibits are incorporated into the official record of this meeting by reference and are filed with the minutes.

NC Wildlife Resources Commission Special Meeting
Minutes
March 21, 2019

John Coley, Chairman

Date

Gordon Myers, Executive Director

Date

NC Wildlife Resources Commission
 CAFR 52G (Statement of Revenues, Expenditures
 and Changes in Fund Balances) Governmental Funds
 As of March 31, 2019

EXHIBIT C
 April 25, 2019

	2018-19 YTD	2018-19 YTD	2018-19 YTD
	General	Capital Improvement	Endowment/ Permanent
REVENUES			
Federal funds	22,839,763.20	1,953,402.00	-
Local funds	3,316.71	-	-
Investment earnings	105,940.64	-	1,537,680.08
Sales and services	6,992,623.53	-	-
Rental and lease of property	50,165.20	-	-
Fees, licenses and fines	21,168,293.71	-	2,883,720.00
Contributions, gifts and grants	802,380.08	347,025.00	85,040.42
Miscellaneous	541,219.23	-	-
TOTAL REVENUES	52,503,702.30	2,300,427.00	4,506,440.50
EXPENDITURES			
Personal services	25,712,123.43	-	-
Employee benefits	10,800,868.36	-	-
Contracted personal services	6,309,595.57	155,256.88	-
Supplies and materials	5,481,405.77	322,738.67	-
Purchases for resale	121,901.66	-	-
Travel	362,897.65	-	-
Communication	546,305.80	33,470.26	-
Utilities	492,268.48	-	-
Data processing services	595,476.44	-	-
Other services	2,627,517.41	697.16	-
Claims and benefits	1,010,073.04	-	-
Other fixed charges	335,717.04	100.00	-
Capital outlay	3,256,260.25	2,924,359.71	-
Grants, state aid and subsidies	1,279,222.85	-	-
Insurance and bonding	45,693.53	-	-
Other expenditures	907,498.31	13,050.00	-
Unclassified/invalid accounts	46,420.37	-	-
Reimbursements	-556,607.16	-	-
TOTAL EXPENDITURES	59,374,638.80	3,449,672.68	-
EXCESS OF REVENUES OVER (UNDER) EXPENDITURES	-6,870,936.50	-1,149,245.68	4,506,440.50
OTHER FINANCING SOURCES (USES)	5,373,911.53	965,519.40	-1,569,797.90
Sale of capital assets	194,784.75	-	-
Insurance recoveries	60,000.00	-	-
Transfers in	31,675,467.32	1,303,134.30	-
Transfers out	-34,809,387.91	-337,614.90	-1,569,797.90
Appropriations	8,253,047.37	-	-
TOTAL OTHER FINANCING SOURCES (USES)	5,373,911.53	965,519.40	-1,569,797.90
EXCESS OF REVENUES AND OTHER SOURCES OVER (UNDER) EXPENDITURES AND OTHER USES	-1,497,024.97	-183,726.28	2,936,642.60
FUND BALANCE - JULY 1, As previously stated	14,837,589.29	3,986,758.85	123,569,426.52
FUND BALANCE - JUNE 30	13,340,564.32	3,803,032.57	126,506,069.12

**NORTH CAROLINA WILDLIFE RESOURCES COMMISSION
 WILDLIFE ENDOWMENT FUND
 FUND BALANCES AS OF March 31, 2019**

BOND INDEX FUND (BIF)	\$107,428,794.10
EQUITY INDEX FUND (EIF)	22,347,977.63
SHORT TERM INVESTMENT FUND (STIF)	454,412.20
TOTAL WILDLIFE ENDOWMENT FUND BALANCE AS OF 3/31/19	<u>\$ 130,231,183.93</u>

INTEREST INCOME WITHIN FUNDS	EXPENDABLE	NON-EXPENDABLE
ADULT LICENSE SALES	\$27,539,502.35	
INFANT LICENSE SALES		\$12,571,352.16
YOUTH LICENSE SALES		1,135,739.64
CONTRIBUTIONS	1,876,072.62	
WILDLIFE DIVERSITY	821.28	
MAGAZINE SALES	1,455,982.80	
	<u>\$ 30,872,379.05</u>	<u>\$ 13,707,091.80</u>

EXPENDABLE INTEREST TRANSFERRED TO OPERATIONS FISCAL YTD
\$1,569,797.90
<u>\$ 1,569,797.90</u>

EXHIBIT D

April 25, 2019



North Carolina Wildlife Resources Commission

Gordon Myers, Executive Director

2019-2020 Allocation of Endowment Fund Investment Returns

	Amount of Expendable Interest Earned Calendar Year 2018
Adult Licenses	\$2,724,893.79
Magazine Subscriptions	122,287.73
Contributions - General	72,650.85
Contributions – Diversity	<u>550.44</u>
Total	<u><u>\$2,920,382.81</u></u>

The formula for determining the amount of interest available to support *Wildlife in North Carolina* magazine was passed in a motion by the Commission on May 18, 2007. The motion allocated 100 percent of the interest earned from magazine lifetime subscriptions to the magazine budget.

2019-2020 Magazine Allocation - **\$122,287.73**

Exhibit E-1

April 25, 2019

North Carolina Wildlife Resources Commission Land Acquisition Investigation Form

Phase II: FINAL ACQUISITION DETAILS

Tract Name: Little Cedar Mountain Tract

WRC Action/Approval to Pursue (Date): December 5, 2018

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

Donation from Foothills Conservancy

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

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	\$7,200
Total Projected Revenue	\$0

Exhibit E-1

April 25, 2019

North Carolina Wildlife Resources Commission
Land Acquisition Investigation Form

Phase II: COSTS AND REVENUE WORKSHEET

Estimated Five Year Stewardship Costs and Revenue Projections: Little Cedar Mountain Tract

Estimated Stewardship Costs					
Activity	Quantity	Unit	Expense Type	Unit Cost	Total Cost
Boundary Establishment	4,800	ft	One-time	\$1.25	\$7,200
TOTAL					\$7,200

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:	Paul Thompson
Date First Presented to Commission:	5-Dec-18
Tract Name:	Little Cedar Mountain
County:	Burke
Acreege:	(+/-) 95
Tax Value:	N/A
Property Owner/Representative:	Tom Kenney-Foothills Conservancy
Phone:	828-437-9930
Email Address:	tkenney@foothillsconservancy.org
Address:	Morganton, NC 28680

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 type="checkbox"/>	CWMTF
<input 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:

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

Stewardship Considerations:

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

Funding Considerations:

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

Reviewed Appraisal & Purchase Requirements?

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

Recommendation:

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

Additional Comments:

Foothills Conservancy has secured funding for acquisition of the Little Cedar Mtn Tract (LCMT) and would like to donate this tract to WRC. The LCMT adjoins the Burkemont Mtn and Carswell NFWF tracts that were recently conveyed to the WRC. The LCMT also adjoins the current South Mtns GL to the north with access to this tract from current GL parking area off of Denton Ave.

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

Tract Name:	Little Cedar Mountain
County:	Burke

Resources Assessment and Biological Benefits (brief):

Acquisition of the Little Cedar Mountain Tract (LCMT) would solidify WRC ownership in that portion of the South Mtn Game Land just south of Morganton. Access to the tract is provided by current GL parking area via Denton Ave (SR 1983). The LCMT is adjacent the Black Fox Tract of South Mountains Game Land and also adjacent to the Carswell and Burkemont Mountain NFWF tracts soon to be conveyed to WRC.

The tract is situated at the head of Stacy Creek and provides protection for the Henry Fork River drainage. The tract is predominately composed of Appalachian Oak Forest with the remainder in Appalachian Cove Forest. Management objectives will include restoring or maintaining the oak and cove forest priority wildlife habitats that are located on the tract. Common wildlife species found on the tract include wild turkey, white-tailed deer, raccoon, and gray squirrel. Priority species likely found on the tract as either permanent residents or transients include: Whip-poor-will (*Caprimulgus vociferous*), Eastern box turtle (*Terapene carolina*), Eastern wood-peewee (*Contopus virens*), and hooded warbler (*Setophaga citrina*).

Public recreational opportunities will include hunting, hiking, bird watching, photography, and general nature study.

Tract Name	Little Cedar Mountain Tract
Date	November 5, 2018
Staff Completing Form	Paul Thompson

Species	0.222
	Terrestrial
Overall Biodiversity	2
SGCN Species	2
Game Species	2
	Wetland
Overall Biodiversity	0
SGCN Species	0
Game Species	0
	Aquatic
Overall Biodiversity	0
SGCN Species	0
Game Species	0

Comments
The tract has moderate diversity for terrestrial species but lacks any wetland or aquatic habitat.

Habitat	0.611
Size	0
Quality	2
Diversity	2
Rare/Important	1
Connectivity	3
Buffer	3

Comments
The tract will connect with future NFWF tracts and current South Mtns GL. It will create a good buffer to adjoining lands.

Public Access	0.222
Hunting/Viewing	2
Fishing	0
Boating	0

Comments
Access for hunting/viewing are good but there are no fishing or boating opportunities.

Wildlife Uses	0.467
Hunting	3
Viewing	3
Fishing	0
Boating	0
Education	1

Comments
Hunting/viewing opportunities are great but there are no fishing or boating opportunities.

Other Values	0.444
Timber Harvest	2
Local Economy	1
Quality of Life	1

Comments
It appears there has been a timber harvest within the past 15 year and has potential to produce and manage timber. There is some opportunity to provide benefit to local economy or quality of life.

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

Comments
Several old logging roads exist on the property. There is no issue with multiple use and adjoining landowners. The tract is in close proximity to Morganton.

Restoration/Mitigation Potential	0.417
Species Restoration	2
Habitat Restoration	2
Access Improvement	1
Threat Mitigation	0

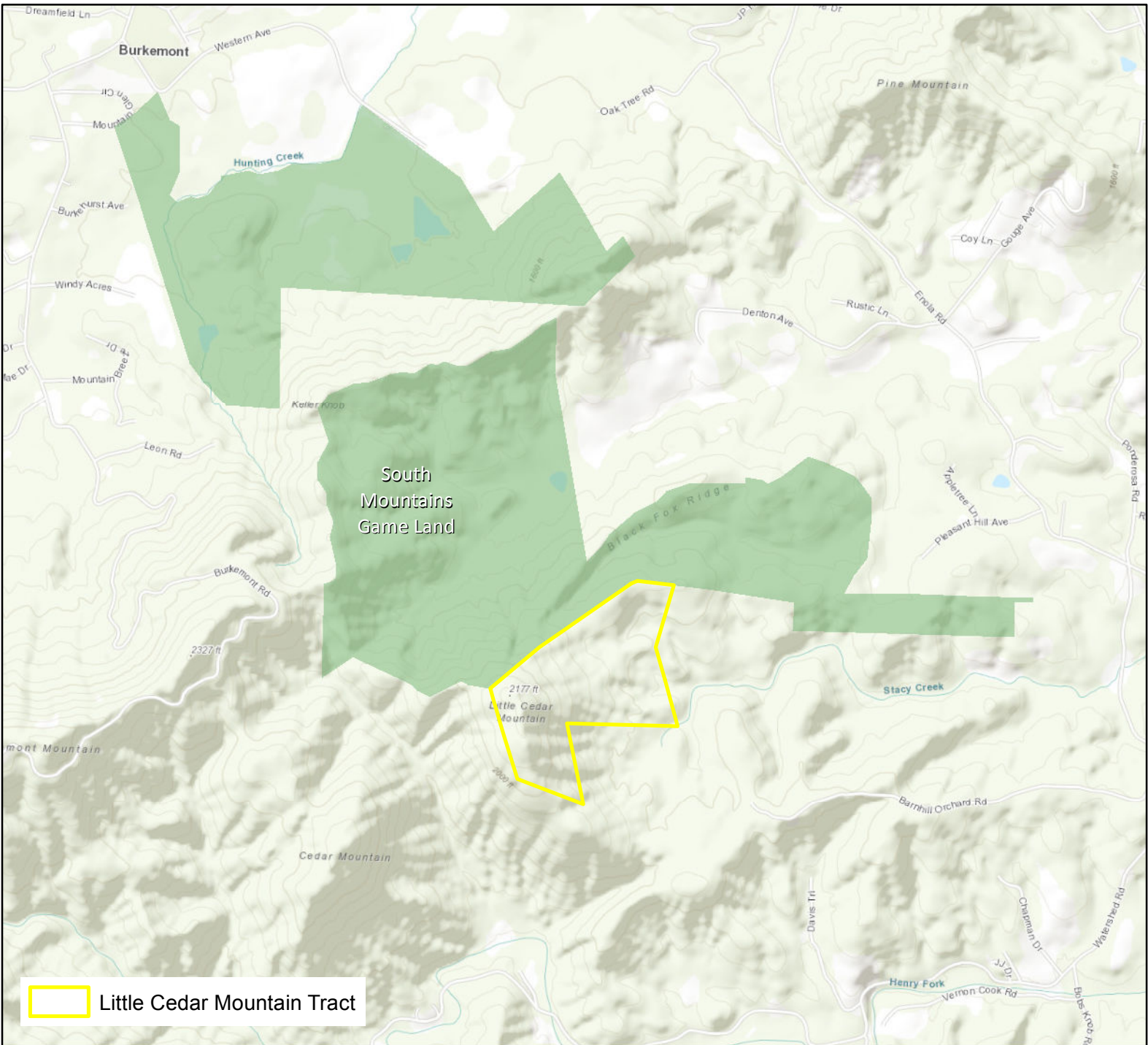
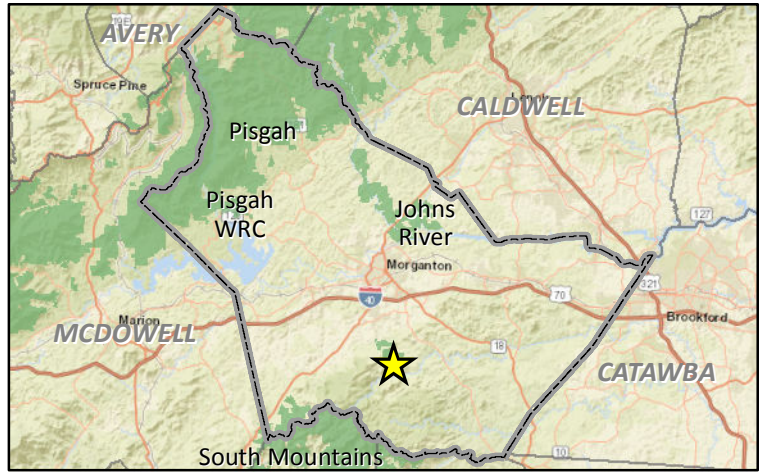
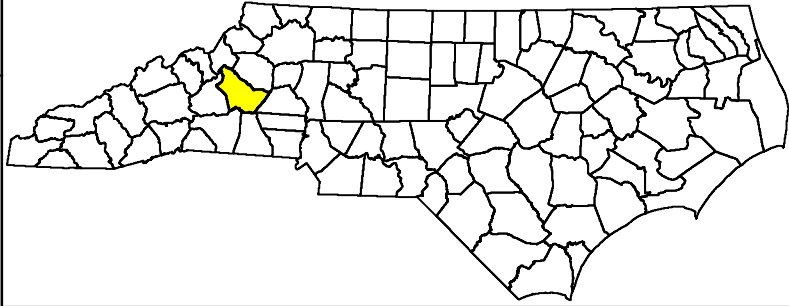
Comments
The tract may have some habitat restoration potential and may offer some potential for access improvement.

Threats	0.000
Number	0
Severity	0
Imminence	0
Manageability	0
Management Cost	0

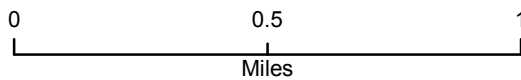
Comments
No known threats.

Overall Score	3.183
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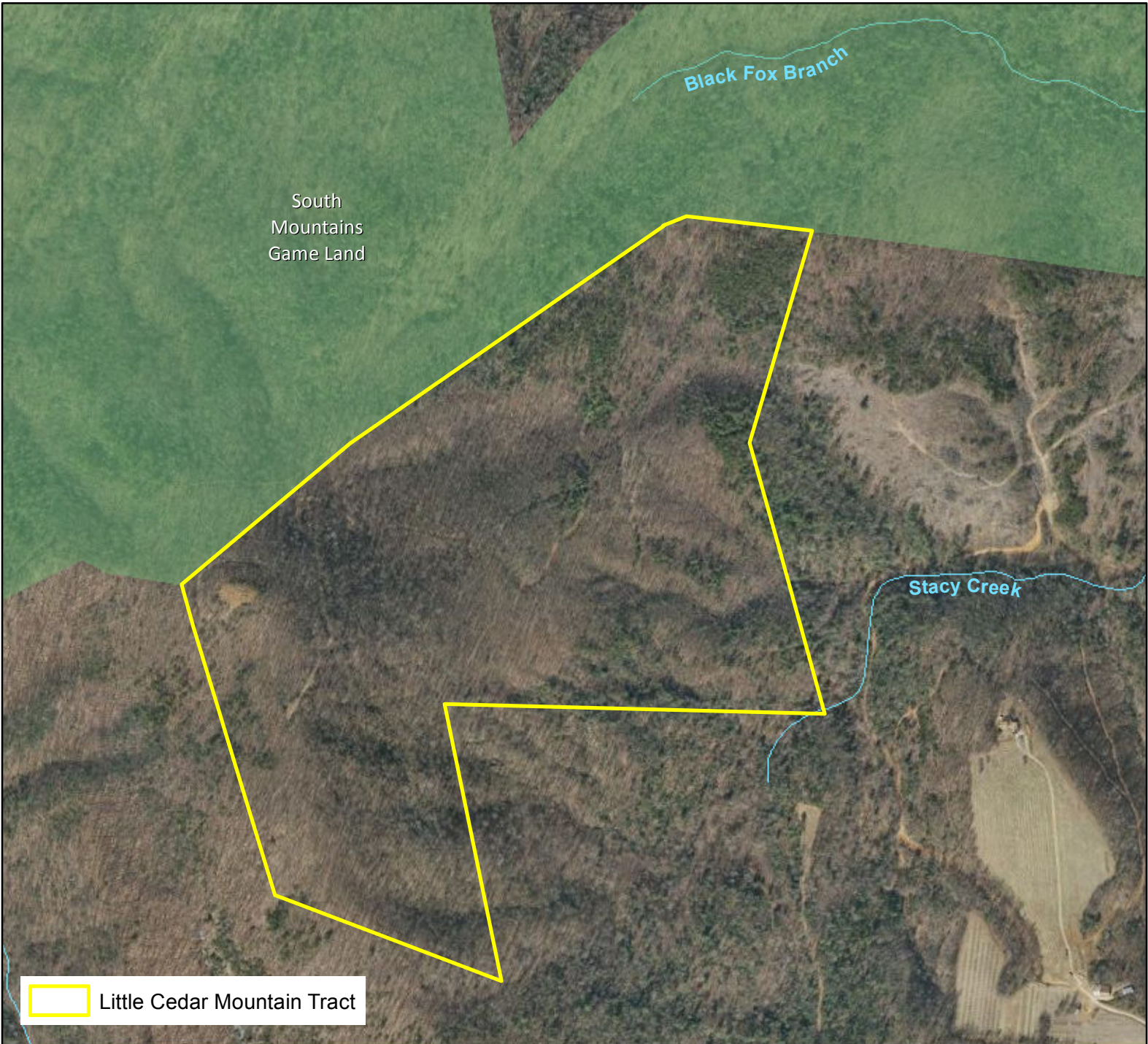
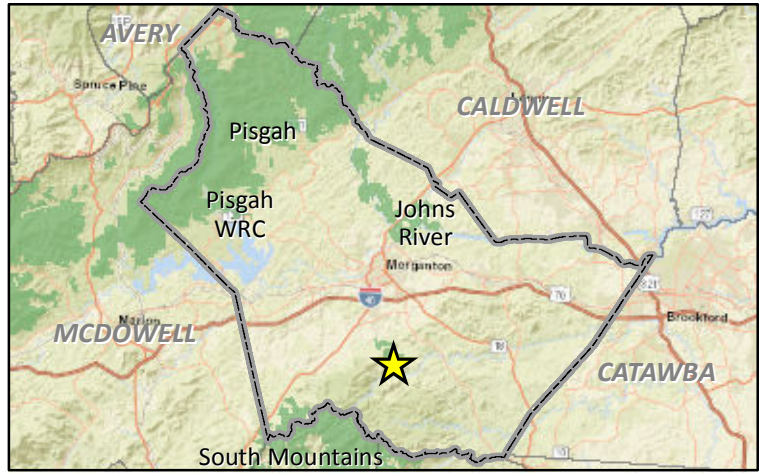
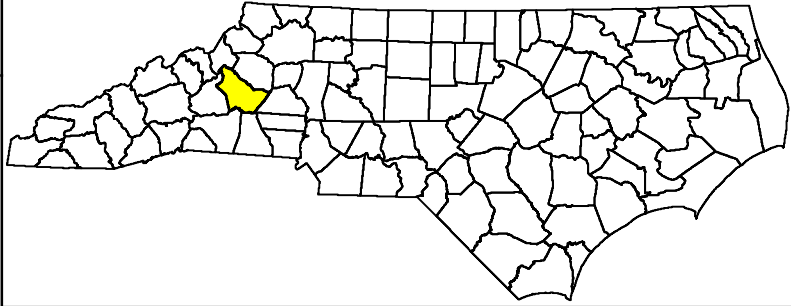
Little Cedar Mountain Tract Burke County 96 Acres




November 27, 2018



Little Cedar Mountain Tract
Burke County
96 Acres



 Little Cedar Mountain Tract



November 27, 2018

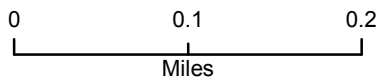


Exhibit E-2

April 25, 2019

North Carolina Wildlife Resources Commission Land Acquisition Investigation Form

Phase II: FINAL ACQUISITION DETAILS

Tract Name: Rocky Swamp

WRC Action/Approval to Pursue (Date): October 5, 2017

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

Clean Water Management Trust Fund Grant	\$592,414
WRC Agency Funds	\$31,086
Wildlife Restoration Funds	\$1,747,500
TOTAL COST	\$2,371,000

Acquisition Plan Includes Bargain Sale? Yes No N/A

If Yes, Explain Details:

Total Cost Based on Appraisal? Yes* No N/A

*Note that tract is being acquired for \$40,000 above appraised value based on State Property Office negotiations. Property list price was \$2,700,000.

If Yes, Describe in Table:

Requested By	Appraiser	Effective Date	Appraised Value
WRC	Moody (land) Bell (timber)	November 2017	\$2,330,000 (total land + timber)

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	\$21,400
Total Projected Revenue	\$0

Exhibit E-2

April 25, 2019

North Carolina Wildlife Resources Commission Land Acquisition Investigation Form

Phase II: COSTS AND REVENUE WORKSHEET

Estimated Five Year Stewardship Costs and Revenue Projections: Rocky Swamp

Estimated Stewardship Costs					
Activity	Quantity	Unit	Expense Type	Unit Cost	Total Cost
Boundary Establishment	13	Mile	One-time	\$300	\$3,900
Parking Area Establishment	3	Ea.	One-time	\$2,500	\$7,500
Install Gates	5	Ea.	One-time	\$1,000	\$5,000
Maintain Roads/Trails	2	Mile	Recurring	\$2,500	\$5,000
TOTAL					\$21,400

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:	Chris Dawes
Date First Presented to Commission:	June, 2017
Tract Name:	Rocky Swamp South
County:	Halifax
Acreage:	1343.6 (Three combined parcels to be sold as one)
Tax Value:	UNK
Property Owner/Representative:	Spruce Creek Land & Timber LLC / (Mott & Shay, Inc. Real Estate)
Phone:	1-800-533-3754 (Greg Mott: 252-308-7020)
Email Address:	greg.mott@mottshay.com
Address:	1123 Roanoke Ave. (P.O. Box 1645, Roanoke Rapids, NC 27870)

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 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 (overwrite this cell)
<input type="checkbox"/>	Other (overwrite this cell)

Owner Interest:

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

Tax Value:

2017	Year Assessed
<input checked="" type="checkbox"/>	PUV?

Stewardship Considerations:

<input type="checkbox"/>	Source:
<input type="checkbox"/>	Match:

Funding Considerations:

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

Recommendation:

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

Additional Comments:

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

Tract Name: Rocky Swamp South
County: Halifax

Resources Assessment and Biological Benefits (brief):

This large available property (three combined parcels, 1,343 total acres) lies in Halifax County directly to the southwest of Rocky Swamp tract of the Brinkleyville Game Land. (Acquisition of these parcels would increase the size of the Brinkleyville Game Land by 74% from 1,819 acres to 3,162 acres.) Currently, under management by Spruce Creek Land and Timber LLC, the property has an extensive timber production history, very similar to that which occurred on the nearby acreage the WRC acquired in 2007-2008 from International Paper.

The three parcels (~837 ac., ~237 ac., and ~269 ac.) are being sold together and subdivision is not being considered by the landowner. The property is listed at \$2,750,000.00. There is one modern structure (uninhabited house) on the northern end of the property, near NC Hwy 561. The sale announcement from the realtor indicates that there are over 6.5 miles of well-maintained gated roads/paths. The main creek is ~1.91 miles of frontage on Rocky Swamp. The other tributaries total ~5.81 miles, with Smith Branch being the largest. There is also significant acreage of floodplain with interspersed beaver swamps and wetlands. The riparian areas are mostly intact and buffered, while the majority of the uplands are either recently clearcut and/or planted back in young loblolly pine plantations. Older pine stands are mostly pine pulpwood or C-N-S, and there are some stands of pine sawtimber. Except for the bottomland hardwood riparian buffers, there is only a small percentage of acreage of mature upland timber (mixed hardwood/pine). Almost all of the uplands (non-hardwood) will require intense timber management, mostly pine thinnings for the next few decades. A large percentage of this property will be in need of prescribed fire and burning could be accomplished easily.

The hunting opportunities on this property are extensive and it would provide excellent deer and turkey hunting, as well as small game (particularly for rabbits), and some waterfowl along Rocky Swamp. Water resources are unlikely to provide much fishing interest.

Rocky Swamp represents a Tier 1 priority area within the Tar-Pamlico River basin due to the occurrence of at least five rare freshwater mussel species and one crayfish species. Specifically, the following rare species occur on or near this tract on Rocky Swamp: Dwarf Wedgemussel (*Alasmidonta heterodon*, Federal and State Endangered), Atlantic Pigtoe (*Fusconaia masoni*, Proposed for Federal listing and State Endangered), Triangle Floater (*Alasmidonta undulata*, State Threatened), Notched Rainbow (*Villosa constricta*, State Special Concern), Northern Lance (*Elliptio fisheriana*, State Significantly Rare), and Carolina Spiny Crayfish (*Orconectes carolinensis*, State Special Concern). In addition, Rocky Swamp represents the easternmost population of Dwarf Wedgemussel within the Tar River Basin. This population is currently isolated from other populations, has a low probability of natural recolonization (if extirpated), and potentially contains unique genetic diversity that will be highly valuable for future management related to populations augmentations. These concerns prompted the need for beaver management within Rocky Swamp, and the addition of this tract to the Brinkleyville Game Land is critical to the long-term management of Dwarf Wedgemussel in North Carolina. Acquisition of the tract will allow the Agency to manage the beaver population within a larger section of Rocky Swamp and help to protect aquatic species from land development or timber harvest activities that lack appropriate BMPs (e.g. excessive sedimentation).

Grant potential would seem very likely, particularly for water quality and aquatic species protection. Three-hundred foot buffers on Rocky Swamp, two-hundred foot buffers on intermittent streams, and the area in the 100-year floodplain outside these buffers were measured and total ~337 acres (25.1% of the property).

For the WRC to acquire such large acreage contiguous parcels adjacent to an existing Game Land is a rare opportunity. This tract is a very high priority for acquisition and addition to the Brinkleyville Game Land, as it is unlikely that a tract of this size adjacent to existing Game Lands and with such significant aquatic resources and species will ever be available again. Acquisition of this property will support increased connectivity of protected lands between Game Lands and Medoc Mountain State Park. The most significant current threat to terrestrial wildlife in this area is the further conversion of mature hardwood and mixed hardwood/pine forests into loblolly pine plantations, and potential sprawling future development. Ensuring that forest stands managed for wildlife habitat are restored and maintained in this area will help support many (SGCN) species on the local landscape.

Tract Name	Rock Swamp South
Date	September 12, 2017
Staff Completing Form	C. Baranski, D. Cox, C. Dawes, and A. Mynatt

Species	0.852
	Terrestrial
Overall Biodiversity	3
SGCN Species	3
Game Species	3
	Wetland
Overall Biodiversity	2
SGCN Species	2
Game Species	2
	Aquatic
Overall Biodiversity	3
SGCN Species	3
Game Species	2

Habitat	0.889
Size	2
Quality	2
Diversity	3
Rare/Important	3
Connectivity	3
Buffer	3

Public Access	0.556
Hunting/Viewing	3
Fishing	2
Boating	0

Wildlife Uses	0.600
Hunting	3
Viewing	3
Fishing	1
Boating	0
Education	2

Other Values	0.778
Timber Harvest	3
Local Economy	2
Quality of Life	2

Feasibility & Logistics	0.933
Existing Infrastructure	3
Compatibility of Multiple Uses on Tract	3
Compatibility with Adjoining Land	3
Inholding/Corridor	3
Proximity to Users	2

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

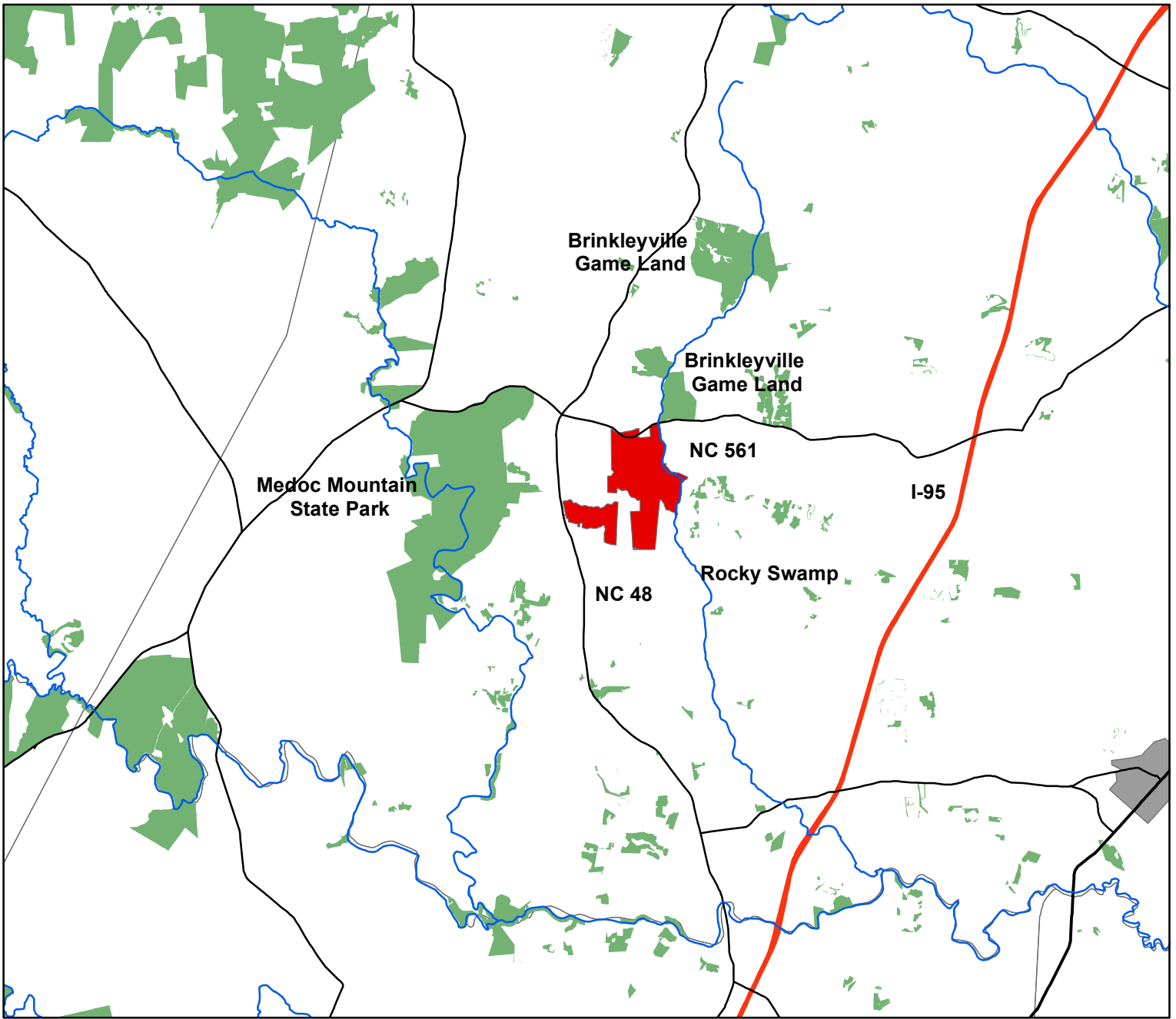
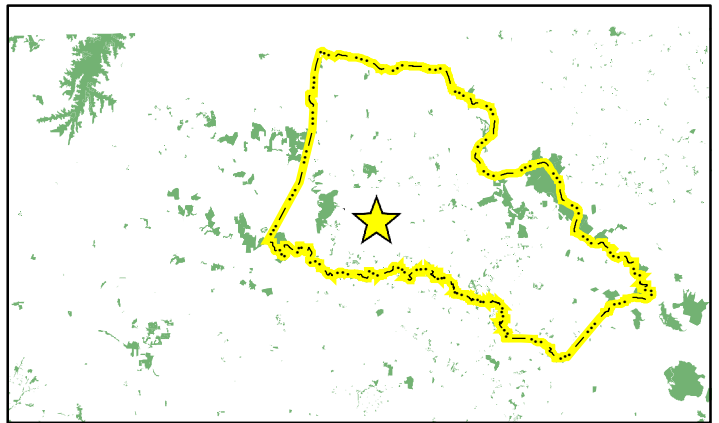
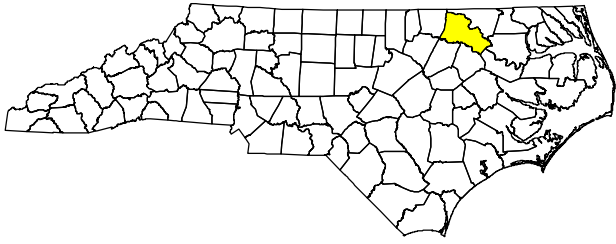
Threats	0.133
Number	1
Severity	0
Imminence	0
Manageability	0
Management Cost	1

Overall Score	5.474
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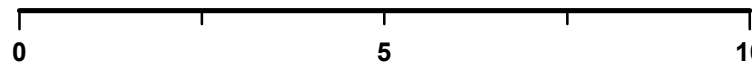
Comments

Some potentially occurring SGCN: Rafinesque Big-eared Bat, Tri-colored Bat, Southeastern Bat, Yellow Bat, Little Brown Bat, Northern Long-eared Bat, Hermit Thrush, Acadian Flycatcher, Northern Bobwhite, American Kestrel, Loggerhead Shrike, Prairie Warbler, Barn Owl, Brown-headed Nuthatch, Worm-eating Warbler, Rusty Blackbird, Swainson's Warbler, Red-headed Woodpecker, Louisiana Waterthrush, Prothonotary Warbler, Yellow-throated Warbler, Kentucky Warbler, Spotted Turtle, Box Turtle, Northern Two-lined Salamander, Scarlet Kingsnake

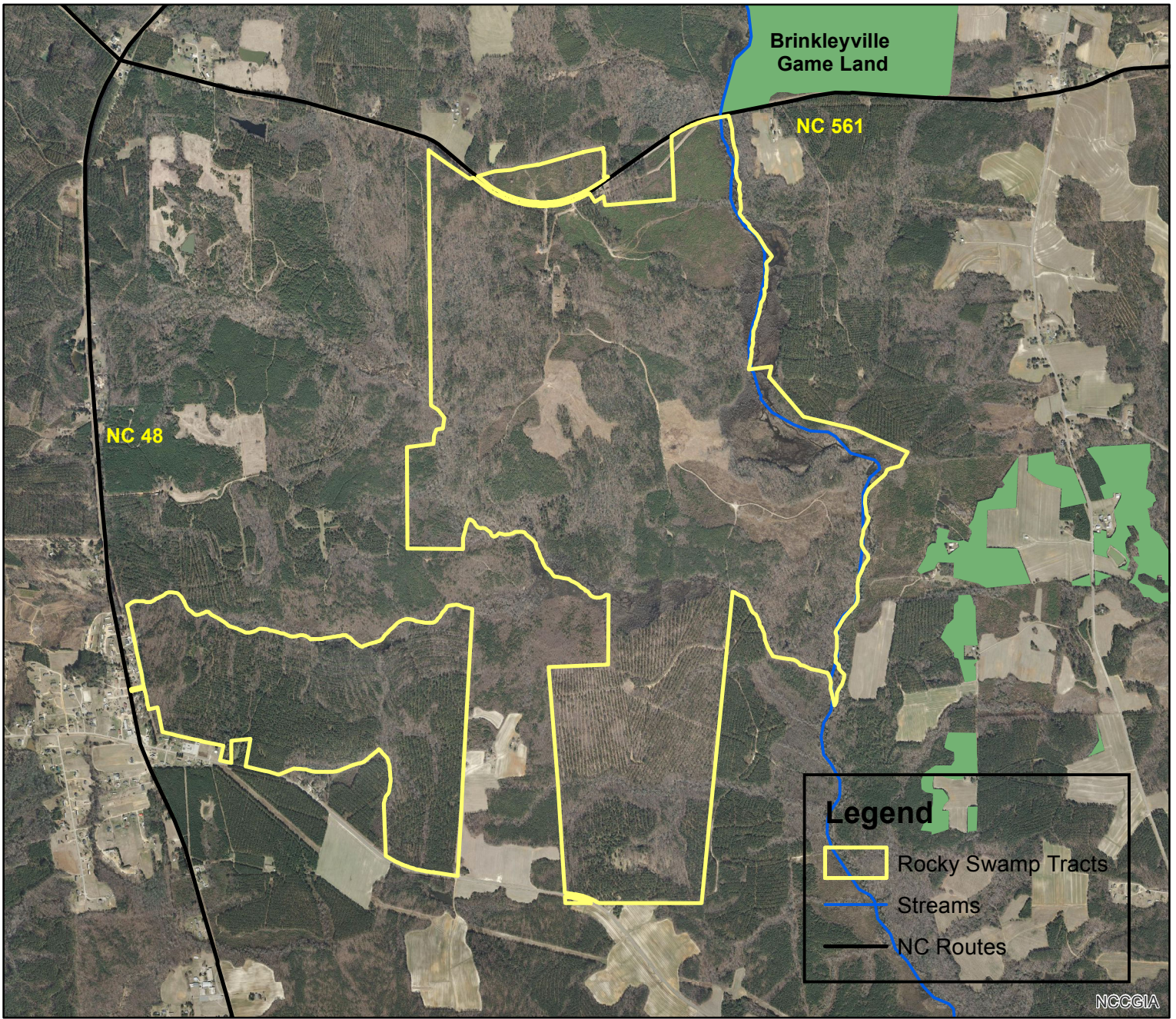
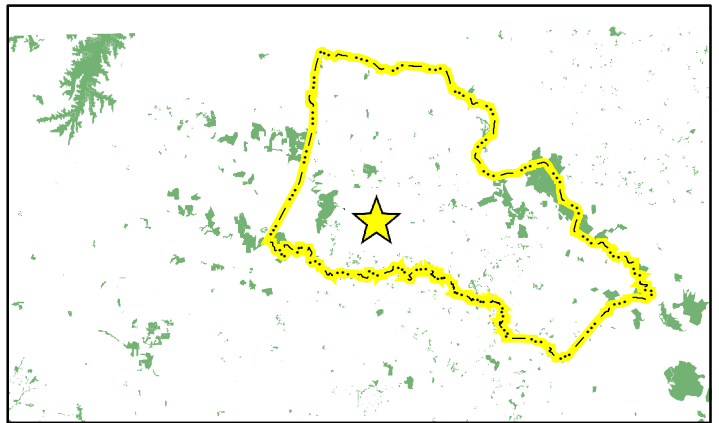
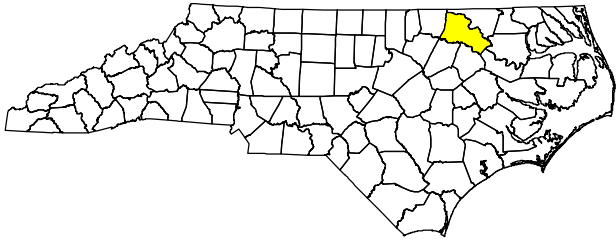
**Rocky Swamp Tract
Brinkleyville Game Land
Halifax County
1,343 Acres**



October 5, 2017



**Rocky Swamp Tract
Brinkleyville Game Land
Halifax County
1,343 Acres**



October 5, 2017

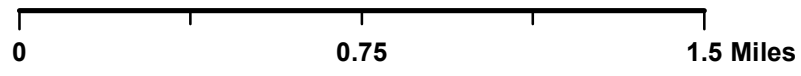


Exhibit E-3

April 25, 2019

North Carolina Wildlife Resources Commission Land Acquisition Investigation Form

Phase II: FINAL ACQUISITION DETAILS

Tract Name: Rhems Depot NCDOT Tract

WRC Action/Approval to Pursue (Date): N/A (Reallocation)

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

The NC Department of Transportation will transfer ownership of this parcel to the NCWRC at no cost. This transfer was approved by the NC Board of Transportation on April 4th, 2019.

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

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	\$14,100
Total Projected Revenue	\$0

Exhibit E-3

April 25, 2019

North Carolina Wildlife Resources Commission Land Acquisition Investigation Form

Phase II: COSTS AND REVENUE WORKSHEET

Estimated Five Year Stewardship Costs and Revenue Projections: Rhems Depot NCDOT Tract

Estimated Stewardship Costs					
Activity	Quantity	Unit	Expense Type	Unit Cost	Total Cost
Driveway Establishment	200	ft	One-time	\$10	\$2,000
Extend Yard Fencing	170	ft	One-time	\$30	\$5,100
Construct Parking Area	1	Ea.	One-time	\$5,000	\$5,000
Maintain Parking Area	4	Years	Recurring	\$500	\$2,000
TOTAL					\$14,100

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:	Brent Wilson
Date First Presented to Commission:	25-Apr-19
Tract Name:	Rhems Depot NCDOT
County:	Craven
Acreage:	0.24
Tax Value:	Purchased in 2008 for \$4,005 for 0.68 acre tract
Property Owner/Representative:	NCDOT
Phone:	
Email Address:	
Address:	PO Box 1587, Greenville, NC 27835

Primary Purpose:

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

Program Potential:

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

Type of Acquisition:

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

Type of Parcel:

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

Grant Potential:

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

Owner Interest:

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

Tax Value:

<input type="checkbox"/>	2008	Year Assessed
<input type="checkbox"/>		PUV?

Stewardship Considerations:

<input type="checkbox"/>	n/a	Source:
<input type="checkbox"/>		Match:

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

Recommendation:

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

Additional Comments:

The Rhems Depot NCDOT tract is a 0.24 acre parcel that abuts the NCWRC Rhems Depot property that currently exists as a vacant lot. It is the remainder of a larger parcel acquired for highway construction that lies outside of the NCDOT right-of-way. As a property transfer between state agencies there will be no acquisition cost. Transfer was approved by the NC Board of Transportation on April 4th, 2019.

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

Tract Name:	NCDOT Bender
County:	Craven

Resources Assessment and Biological Benefits (brief):

The acquisition is desired to increase parking, storage facilities and generation of a loop driveway to resolve the current safety issue of having to stop in the 55 MPH speed limit road to back into the existing driveway, due to insufficient turn around space. The site is cleared upland and maintained as open land, so suitable for desired development. It is mapped as flood zone X, so located outside of the 500 year flood plain.

Tract Name	Rhems Depot NCDOT
Date	April 15, 2019
Staff Completing Form	Brent Wilson

Species	0.000
	Terrestrial
Overall Biodiversity	0
SGCN Species	0
Game Species	0
	Wetland
Overall Biodiversity	0
SGCN Species	0
Game Species	0
	Aquatic
Overall Biodiversity	0
SGCN Species	0
Game Species	0

Comments
Species: N/A

Habitat	0.000
Size	0
Quality	0
Diversity	0
Rare/Important	0
Connectivity	0
Buffer	0

Comments
Habitat: N/A

Public Access	0.000
Hunting/Viewing	0
Fishing	0
Boating	0

Comments
Public Access: N/A

Wildlife Uses	0.000
Hunting	0
Viewing	0
Fishing	0
Boating	0
Education	0

Comments
Wildlife Uses: N/A

Other Values	0.000
Timber Harvest	0
Local Economy	0
Quality of Life	0

Comments
Other Values: N/A

Feasibility & Logistics	0.200
Existing Infrastructure	0
Compatibility of Multiple Uses on Tract	0
Compatibility with Adjoining Land	3
Inholding/Corridor	0
Proximity to Users	0

Comments
Feasibility and Logistics: The site is compatible for expansion of depot facilities.

Restoration/Mitigation Potential	0.250
Species Restoration	0
Habitat Restoration	0
Access Improvement	3
Threat Mitigation	0

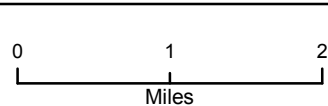
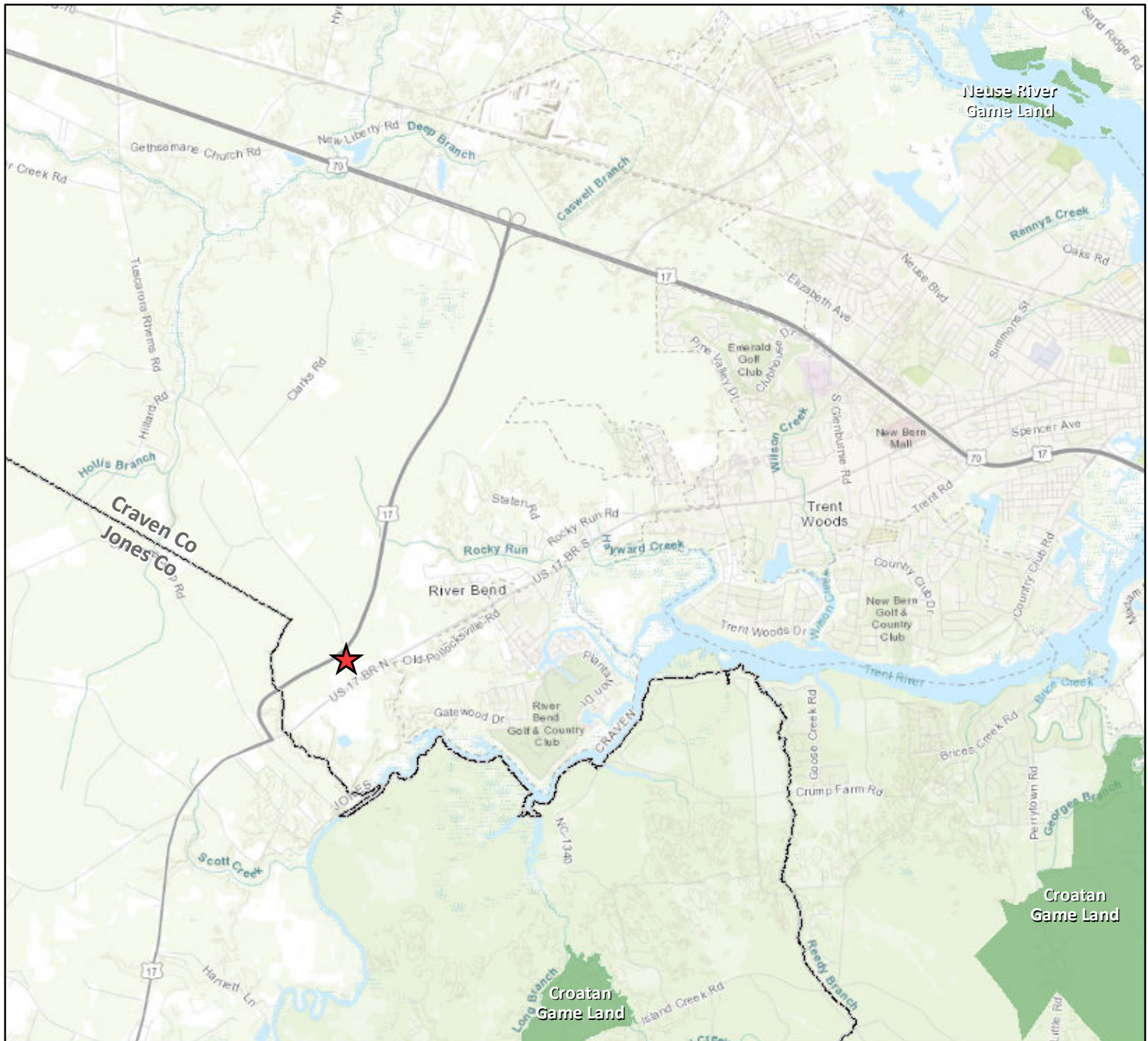
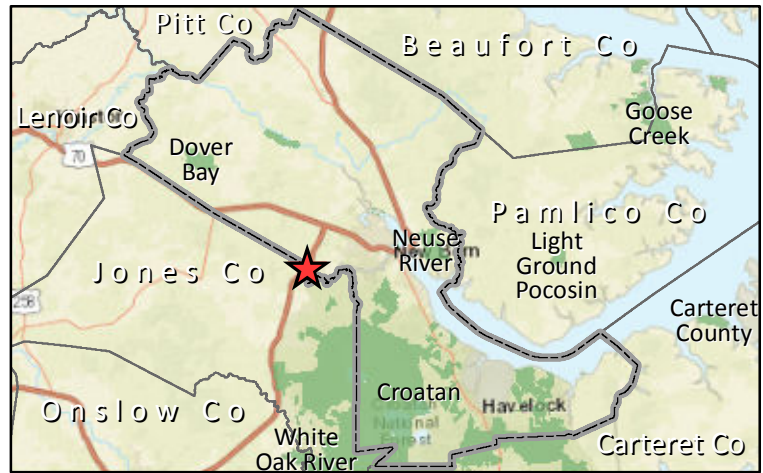
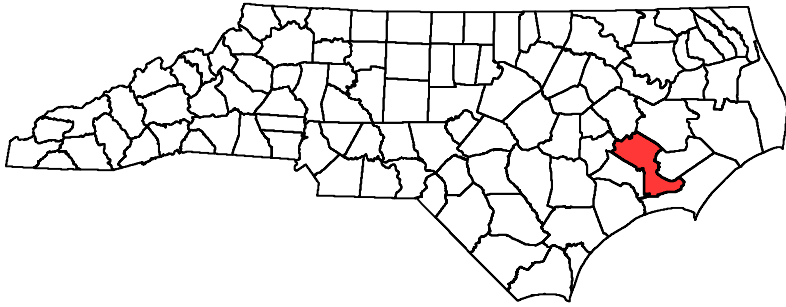
Comments
Restoration/Mitigation Potential: N/A

Threats	0.000
Number	0
Severity	0
Imminence	0
Manageability	0
Management Cost	0

Comments
Threats: N/A

Overall Score	0.450
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**NCDOT Tract
Craven County
0.25 acres**



**NCDOT Tract
Craven County
0.25 acres**

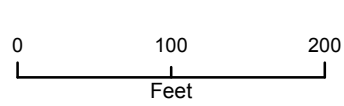
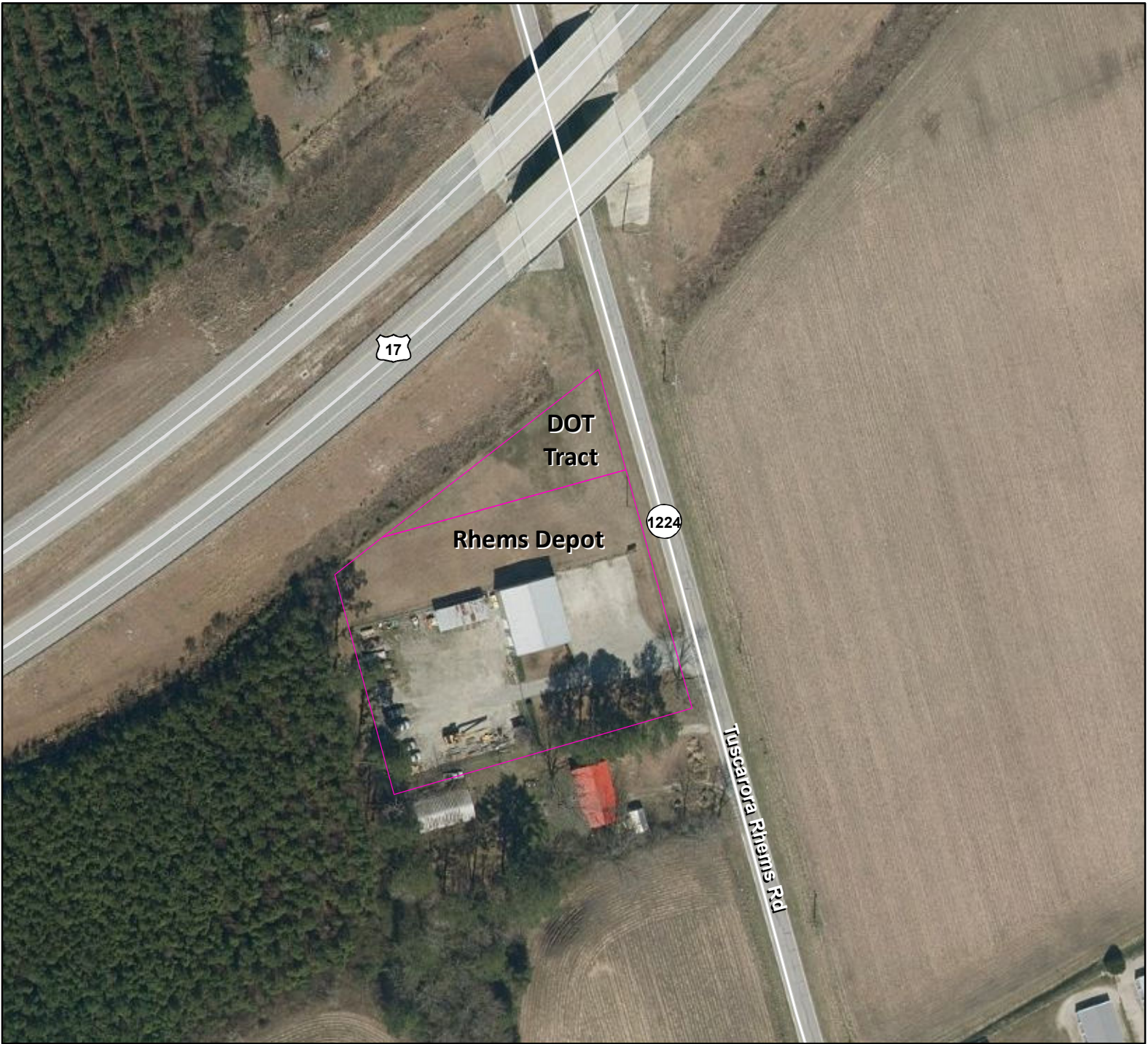
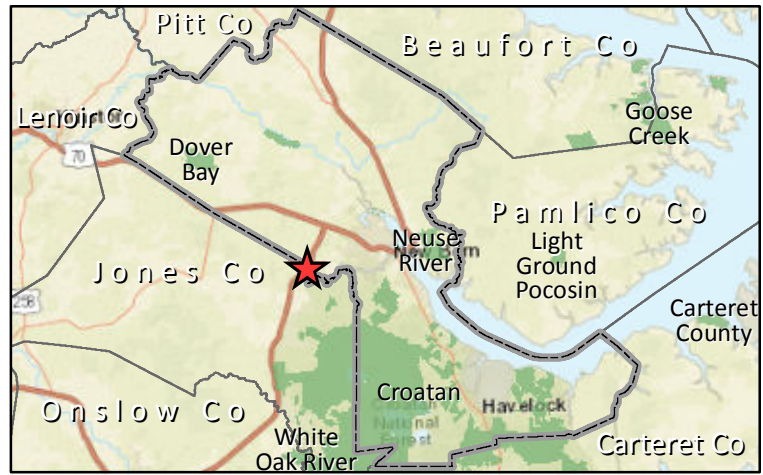
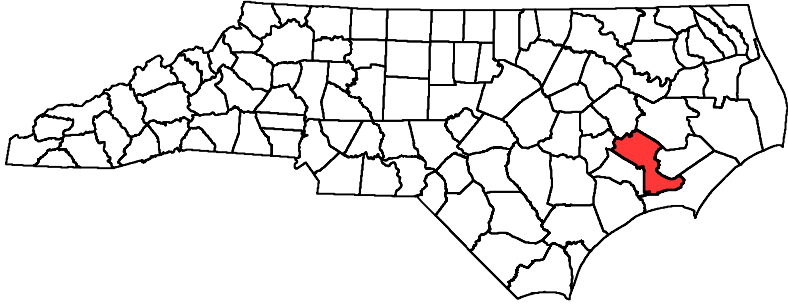


EXHIBIT F-1

April 25, 2019



North Carolina Wildlife Resources Commission

April 25, 2019

MEMORANDUM

TO: Brian McRae, Section Chief
Land and Water Access

FROM: Jessie Birckhead, Land Acquisition and Grants Manager
Land and Water Access

SUBJECT: Request to demolish residence – McKinney Lake Fish Hatchery, Richmond County

One residence at the McKinney Lake Fish Hatchery is in poor condition. The residence was acquired in 2015 as part of a land purchase that filled in a hole in our land ownership at McKinney Lake. An inspection was completed in 2015 and detailed the poor condition of the building elements and they have only deteriorated further over the past 3 years. The State Construction Office's Facility Condition Assessment Program visited the residence in Fall 2018 and reported that it was uninhabitable.

Based on these safety concerns, staff request approval to demolish this residence. If approved, staff will work with the State Property Office to follow state-mandated procedures for demolition of the structure. Plans are in place for staff to address requirements regarding removal of the asbestos flooring, and, once flooring is removed, the Hoffman Fire & Rescue Department will burn the structure down as training exercise.

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

EXHIBIT F-2

April 25, 2019



North Carolina Wildlife Resources Commission

April 25, 2019

MEMORANDUM

TO: Brian McRae, Section Chief
Land and Water Access

FROM: Jessie Birckhead, Land Acquisition and Grants Manager
Land and Water Access

SUBJECT: Easement Release and Relocation Request – Lower Roanoke River Game Land,
Martin County

The 146-acre Roberson tract of Lower Roanoke River Game Land was acquired in 1997 with a one-half mile long easement skirting the edge of the property belonging to the seller, Mr. Roberson, from View Nicholson Road (SR 1421). This easement was intended to provide public and administrative access. However, a portion of the easement was never developed as Mr. Roberson allowed the WRC to utilize an existing farm path which had been the traditional access route to the state-acquired tract. Another landowner, Mr. Wynne, who has a residence in an inholding lot has the same deeded access as the State. But, Mr. Wynne utilized the same existing farm path through the Roberson Farm to access his lot. In 2016, Mr. Roberson decided that he no longer wanted Mr. Wynne to use the traditional access route through his farm. Mr. Roberson excluded Mr. Wynne from the traditional access route by installing gates. Mr. Roberson's efforts to exclude Mr. Wynne complicated the WRC's need to provide public access. As a result, the WRC staff worked with Mr. Wynne to develop the deeded access. In developing the access, all parties agreed it made more sense to slightly modify the existing route to utilize existing farm path infrastructure to the extent possible, which requires generation of a new deed to accurately reflect those changes and a release of the old easement route. All parties have agreed to this approach and the public and WRC staff are accessing the property using the new route. Staff recommend approval of this easement release and relocation request.

Land and Water Access

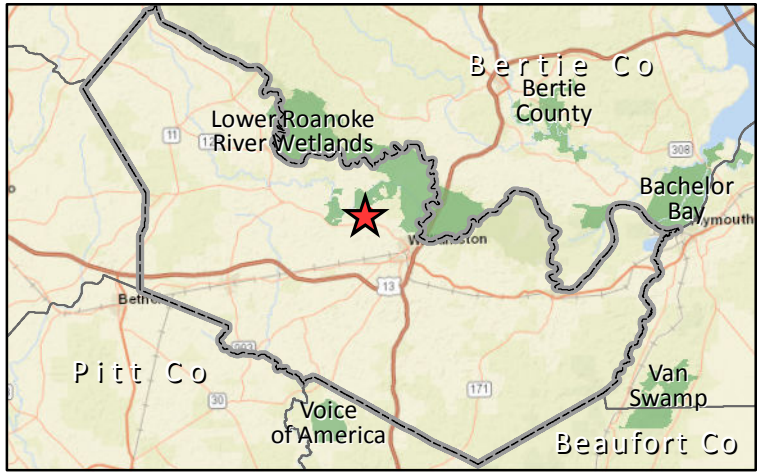
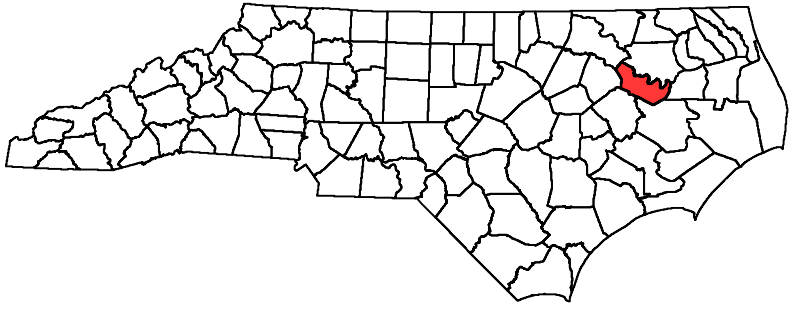
Mailing Address: 1720 Mail Service Center, Raleigh, N.C. 27699-1720

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

Phone: 919-707-0150

Fax: 919-707-0162

Roberson Tract Martin County 30' Easement Release & Relocation



NORTH CAROLINA
Wildlife
RESOURCES COMMISSION

- New Easement
- Old Easement
- Unaltered Easement

0 250 500
Feet

N
▲
April 15, 2019

EXHIBIT G

April 25, 2019




North Carolina Wildlife Resources Commission

Gordon S. Myers, Executive Director

MEMORANDUM

TO: M. Kyle Briggs, Chief Deputy Director

FROM: Christian T. Waters, Inland Fisheries Division Chief 

DATE: April 16, 2019

SUBJECT: Request from Town of Wilkesboro to participate in the Mountain Heritage Trout Waters Program

Staff recommends that the Wildlife Resources Commission (Commission) recognize the Town of Wilkesboro as a Mountain Heritage Trout City and incorporate the Hatchery Supported Trout Waters section of Cub Creek into Mountain Heritage Trout Waters. The Town Council of the Town of Wilkesboro unanimously voted to request this designation at its meeting on November 5, 2018 (see attached).

The entire reach of Cub Creek is located within Cub Creek Park and is accessible via various walking trails. Designated public parking is provided at multiple locations within the Park.

The Town of Wilkesboro meets the criteria established by the Commission for participation in the Mountain Heritage Trout Waters Program. The reach of Cub Creek in the Town is designated Public Mountain Trout Waters. The Town of Wilkesboro currently provides unrestricted public access to these waters. Finally, the Town of Wilkesboro has formally requested to participate in the program and is willing to enter into a Memorandum of Agreement (MOA). A draft MOA and Mountain Heritage Trout Waters brochure for Wilkesboro and Town of North Wilkesboro is attached.



TOWN OF WILKESBORO

"Where the Mountains Begin"

P.O. Box 1056 • 203 West Main Street

Wilkesboro, North Carolina 28697

www.wilkesboronc.org

Phone (336) 838-3951 • Fax (336) 838-7616

TOWN COUNCIL MEETING

Monday, November 5, 2018

MINUTES

The Mayor and Town Council Members of the Town of Wilkesboro met for the first meeting of the month at 5:30 p.m. on Monday, November 5, 2018 in the lobby of Wilkesboro Town Hall located at 203 West Main Street, Wilkesboro, North Carolina.

Members present were Mayor Mike Inscore, Town Council Members: Nellie Archibald, Russ Ferree, Jimmy Hayes and Gary Johnson; Town Manager Kenneth Noland, Town Attorney John S. Willardson and Town Clerk James K. Byrd.

Other town staff present included: Police Captain Tommy Rhodes, Police Captain Jason Delbert, Planning and Community Development Director Andrew Carlton, Assistant Town Manager/Finance Director Bob Urness, Public Works Director Brian Severt, Utility Director Sam Call, Water Plant Supervisor/ORC Alan Parker, Town Planner Christina Walsh and Wastewater Plant Supervisor/ORC Dustin Colburn.

Guests included those indicated on the attached Visitor Sign in Log.

Mayor Mike Inscore welcomed everyone in attendance and called the meeting to order at 5:31 pm thanking everyone for coming to the meeting.

Mayor Inscore opened the meeting with a moment of silence.

Mayor Inscore requested Councilmember Archibald lead everyone in the Pledge of Allegiance to the Flag.

Attorney John Willardson read a statement asking any Board Member to identify themselves if they felt they potentially believe they may be considered to have a conflict of interest with any item on the Agenda.

No member raised an issue regarding a conflict with any item.

Manager Noland requested Council consider adding a request to call for a Public Hearing regarding the Old Jail Site to the Consent Agenda. He further requested Council consider

tabling the appointment of all Board members except placing Greg Minton on the Zoning Board of Adjustment as an in-town member with a term expiring June 2019.

Mr. Noland read the items for consideration on the Consent Agenda as follows:

- a. Minutes of October 1 & 23, 2018,
- b. Call for Public Hearings:
 - Rezone property located at 303 S. Cherry Street,
 - Old Jail Conveyance,
- c. Temporary Street Closing,
- d. Board Appointment,
- e. Tax Releases

Councilman Johnson made a motion to approve the consent agenda as modified and presented. By a vote of 4 – 0, the motion passed.

Manager Noland informed all several town departments recently were recognized by the NC Department of Labor for their efforts in workplace safety. The following departments were presented a certificate for their milestone of not having lost a day of work due to an on the job injury:

• Public Works	1 year	Brian Severt
• Parks & Recreation	11 years	Cliff Gardner
• Waste Water	12 years	Dustin Colburn
• Water Treatment	14 years	Alan Parker
• Administration	14 years	Jim Byrd

Mayor Inscore thanked all employees for assisting to keep insurance costs down.

Mayor Inscore requested Bill Bumgarner, Chair of the ABC Board and Bob Urness address Council regarding an ABC Store Development Presentation. Mr. Bumgarner read a statement requesting the ABC Board to have the ability to consider building a permanent site and partnership with the town. He noted they are a component unit of the town and profit goes, in part, back to the town as well as other governmental agencies. Mr. Urness distributed financial information and reviewed the material.

- Councilman Johnson indicated his desire for the Resolution to be modified to indicate this site is a proposal only, in order that the town will not be liable to build the ABC store on the site being studied this evening.
- Mayor Inscore questioned the size of the proposed building with an answer of approximately 5400 square feet.
- Discussion was held regarding the billboard adjacent to the site. Manager Noland indicated he would contact the owner about the possibility of its acquisition.
- Councilman Johnson questioned the right in/right out drive and the need for North Carolina Department of Transportation (NCDOT) approval in written

form. Discussion was conducted regarding the need for vegetation to be removed on and near this site.

- Councilmember Archibald noted her willingness of being ready to go with the plans as presented and expressed that this was a good idea.
- Councilman Ferree noted that he would like to see a more updated preliminary plan and wants wording to say preliminary site plan.
- Brian Severt was requested to offer input and noted he is the Public Works Director for the Town and his desire to see an elevation plan as well as a desire not to move a lot of dirt. He recommended the removal of trees and undergrowth as being the most important task at this time. He noted Town staff has the ability to perform this work for a cost savings. He noted this could be an attractive site.
- Derrick Goddard with Blue Ridge Environmental was requested to offer input and noted limiting earth moving would be advantageous. He noted the need for a grading plan.
- Councilman Hayes expressed his opinion that he is not in favor of spending a large amount of money and desires site plans to be developed prior to moving forward.
- Councilman Johnson noted funds would not be wasted by preparing the site.
- Mayor Inscore requested Mr. Bumgarner prepare site plan documents.
- Manager Noland expressed a desire for clear direction from Council as to what is desired.
- Mr. Bumgarner recommended the town pay for the plan development of this information and if approved, the ABC would reimburse the town for this cost.
- Councilman Johnson noted the drawing presented is inadequate and his desire to see a footprint and set back lines prior to proceeding.
- Mayor Inscore questioned the amount of dirt that would need to be moved.
- Mr. Bumgarner recommended clearing trees and presenting grading plans back to Council.
- Manager Noland recommended ABC Board to do the work and if council does not approve, they would reimburse ABC for costs.

Mayor Inscore requested Derick Goddard address Council regarding the Stream Restoration Grant Proposal. Mr. Goddard noted this would be a headwaters project behind the dog park. The cost would be approximately \$200,000 with a 50 percent matching grant. The application is due January 1, 2019 and a resolution would be needed as well as a non-conflict of interest statement. Mayor Inscore noted the matching town portion could be with in-kind work. Councilman Johnson questioned how this would connect to Cherry Street. Mr. Goddard indicated this was unknown at this time, possibly with a rock dust trail and a slope.

A motion was made to approve the resolution and conflict of interest statement by Councilmember Archibald. By a vote of 4 – 0, the motion passed.

MHTW Request

Mayor Inscore requested Director Carlton to address Council regarding a Mountain Heritage Trout Program. Mr. Carlton reminded Council of the annual April and October

Kids Fishing Days and the success it has received. He noted there is a new three (3) day fishing license for the price of \$5.00 to any individual who does not desire to purchase an annual fishing license, giving them the opportunity to fish for three (3) days.

Councilman Johnson made a motion to approve the request. By a vote of 4 - 0, the motion passed.

Mayor Inscore requested Other Business.

Director Carlton and Town Planner Christina Walsh presented several proposed Christmas Budgets and informed Council of the December 1 event. Mr. Carlton informed Council his department was unaware of the need to budget for this last year when budget planning was being considered however, he believes his department will be able to absorb the cost. Distributed were several ideas for activities for this event.

Mayor Inscore requested recommendation from each Councilmember:

- Archibald – spent up to \$5,000,
- Johnson – go with it, liked the DJ idea,
- Hayes – did not want to shortcut kids, liked the DJ idea,
- Ferree – option 3 (see attachment),
- Inscore – up to \$6,000.

No Other Business was presented.

Mayor Inscore requested Public Comment. None were offered.

Motion to Adjourn the meeting was offered by Councilman Hayes. By a vote of 4 - 0, the motion passed.

Mayor Inscore adjourned the meeting at 7:25.



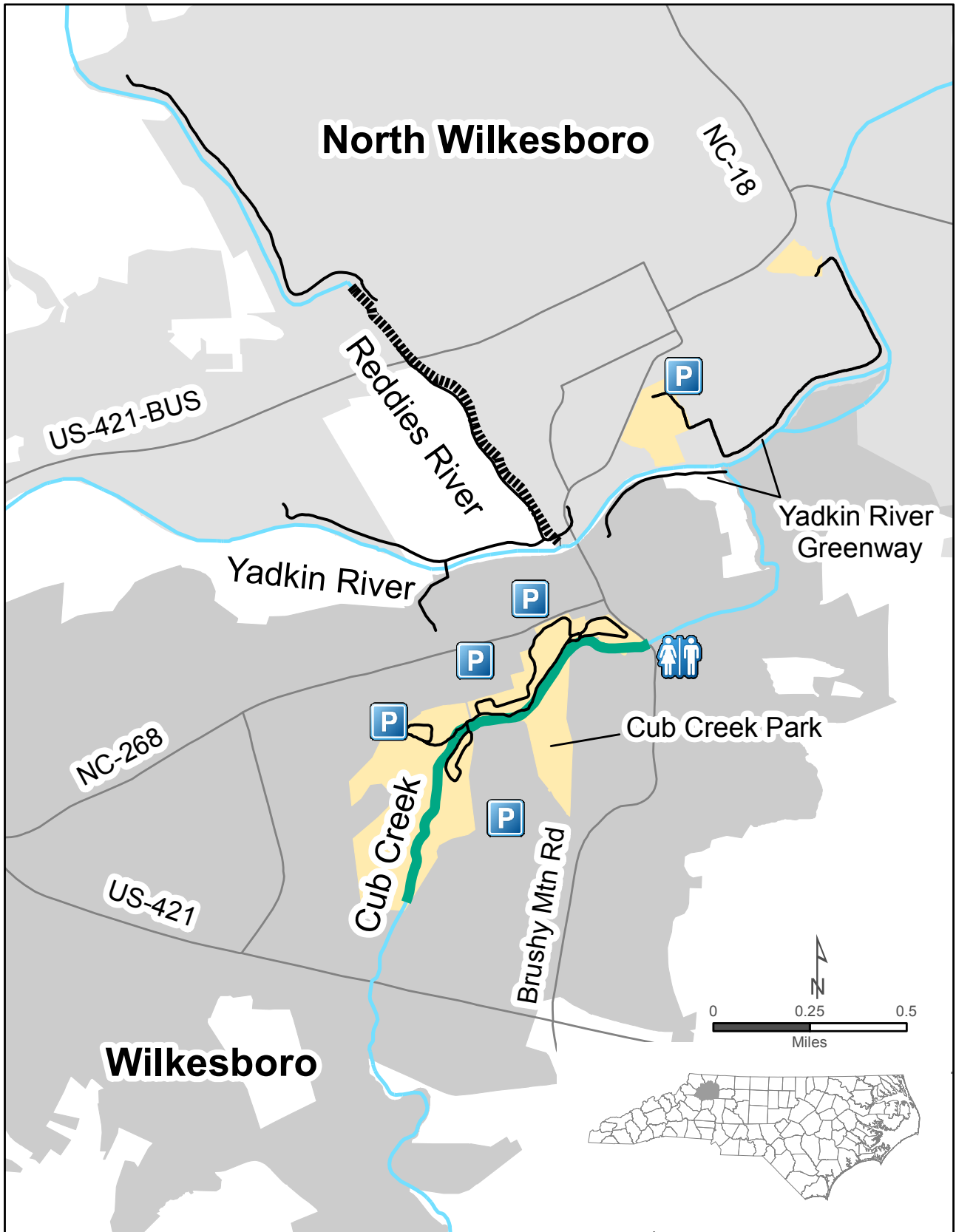
Respectfully submitted by:

James K. Byrd

 James K. Byrd
 Town Clerk

Mike Inscore

 Mike Inscore
 Mayor



North Wilkesboro

NC-18

US-421-BUS

Reddies River

P

Yadkin River Greenway

Yadkin River

P

P



Cub Creek Park

NC-268

P

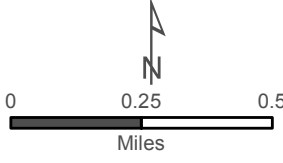
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Cub Creek

Brushy Mtn Rd

US-421

Wilkesboro



MEMORANDUM OF AGREEMENT

between

TOWN OF WILKESBORO

and the

NORTH CAROLINA WILDLIFE RESOURCES COMMISSION

for recognition as a

MOUNTAIN HERITAGE TROUT CITY

THIS AGREEMENT, made and entered into this ____ day of _____, by and between the Town of Wilkesboro, North Carolina, hereinafter called the **Town**, and the North Carolina Wildlife Resources Commission, hereinafter called the **Commission**;

WITNESSETH:

Whereas, the **Commission** is authorized to conduct a program of fishery management for the benefit of the citizens of North Carolina; and

Whereas, the **Commission** is authorized to establish and implement a Mountain Heritage Trout Waters Program; and

Whereas, it is desirable for the **Town** to participate in the Mountain Heritage Trout Waters Program in order to promote the goals of said Program;

Now, therefore, in consideration of the mutual advantages likely to result from this agreement and the respective obligations assumed herein,

THE COMMISSION AGREES:

1. To provide technical assistance required to execute the specified fisheries management activities for this agreement;
2. To delineate an agreed segment of Cub Creek within which the Mountain Heritage Trout Waters fishing license will be valid;
3. To incorporate the specific segment of Cub Creek into rule or regulation consistent with other Designated Public Mountain Trout Waters;

4. To design a **Town**-specific brochure to inform the public of the existence and elements of the Mountain Heritage Trout Waters program;
5. To formally recognize the **Town** as a Mountain Heritage Trout City.

THE TOWN AGREES:

1. To secure unrestricted public access through lease agreement, easement, or other means to the agreed segment of Cub Creek;
2. To permit ingress, egress and regress to **Commission** personnel engaged in executing the recommended fishery management activities;
3. To reproduce and distribute the **Town**-specific brochures to inform the public of the existence and elements of the Mountain Heritage Trout Waters program;

IT IS MUTUALLY AGREED:

1. That this Agreement shall become effective as soon as signed by both parties and the program shall continue in effect until rescinded;
2. That nothing in this Agreement shall obligate either party to any conditions not specially stated herein.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement the day and year first written above.

Approved and agreed to:

Town Official

Christian T. Waters
Chief, Inland Fisheries Division
North Carolina Wildlife Resources Commission

Date

Date



Write your fishing license number and valid dates on the line above

The license is valid for a 3-day period and costs \$5 for residents and non-residents age 16 and older. The license is valid only for waters that are designated as Mountain Heritage Trout Waters.

Mountain Heritage Trout Waters are managed by the N.C. Wildlife Resources Commission. Since 1947, the N.C. Wildlife Resources Commission has been dedicated to the wise use, conservation and management of the state's fish and wildlife resources. For more information on the agency or fishing in the state's public, inland waters, call the agency's Inland Fisheries Division, 919-707-0220, or visit the website, www.ncwildlife.org.

NC MOUNTAIN HERITAGE TROUT CITY



WILKESBORO & NORTH WILKESBORO, N.C.



PROVIDING QUALITY TROUT FISHING OPPORTUNITIES IN BEAUTIFUL, SCENIC WESTERN NORTH CAROLINA

Mountain Heritage Trout Waters provide quality fishing opportunities in popular tourist destinations in western North Carolina. The N.C. Wildlife Resources Commission, which sells the Mountain Heritage Trout Waters license, gives anglers two quick and easy ways to purchase a license:

- By phone: 888-248-6834. Hours of operation are: 8 a.m.-5 p.m., Monday-Friday (from May through September, Monday-Sunday).
- Online: www.ncwildlife.org. Click on the "Purchase License" link on the top left side of the page. Print out the fishing license and keep it on your person when fishing in a Mountain Heritage Trout Water.

PROMOTING THE BEAUTY, DIVERSITY AND HISTORICAL SIGNIFICANCE OF NORTH CAROLINA'S TROUT STREAMS

Mountain Heritage Trout Waters encourage trout fishing as a heritage tourism activity in western North Carolina and are located in participating cities and towns that provide public access to waters running through or adjacent to the city or town.



FISHING REGULATIONS

Fishing regulations for Mountain Heritage Trout Waters, such as daily creel limits, minimum size limits and lure restrictions, are established by the N.C. Wildlife Resources Commission.

The 1-mile section of Cub Creek is classified as the Wilkesboro Mountain Heritage Trout Water and is a Hatchery Supported Trout Water with the following regulations:

Open season: 7 a.m. on the first Saturday in April until the last day of February.

- No bait or lure restriction
- No size limit restriction
- Seven (7) trout per day creel limit

Closed to fishing: March 1 until the first Saturday in April

The 1 mile-section of Reddies River is classified as the North Wilkesboro Mountain Heritage Trout Water and is a Delayed Harvest Trout Water with the following regulations:

From Oct. 1 until the first Saturday in June:

- No trout may be harvested or possessed;
- Fishing is restricted to artificial lures having one single hook;
- Natural bait may not be used or possessed.

From 6 a.m. until 12 p.m. (noon) on the first Saturday in June:

- Fishing is restricted to youths under 18 years old;
- No bait or lure restriction;
- No size limit restriction;
- Seven (7) trout per day creel limit.

From 12 p.m. (noon) on the first Saturday in June until Sept. 30:

- Fishing open to all anglers;
- No bait or lure restriction;
- No size limit restriction;
- Seven (7) trout per day creel limit.

WILKESBORO MOUNTAIN HERITAGE TROUT WATER - CUB CREEK NORTH WILKESBORO MOUNTAIN HERITAGE TROUT WATER - REDDIES RIVER

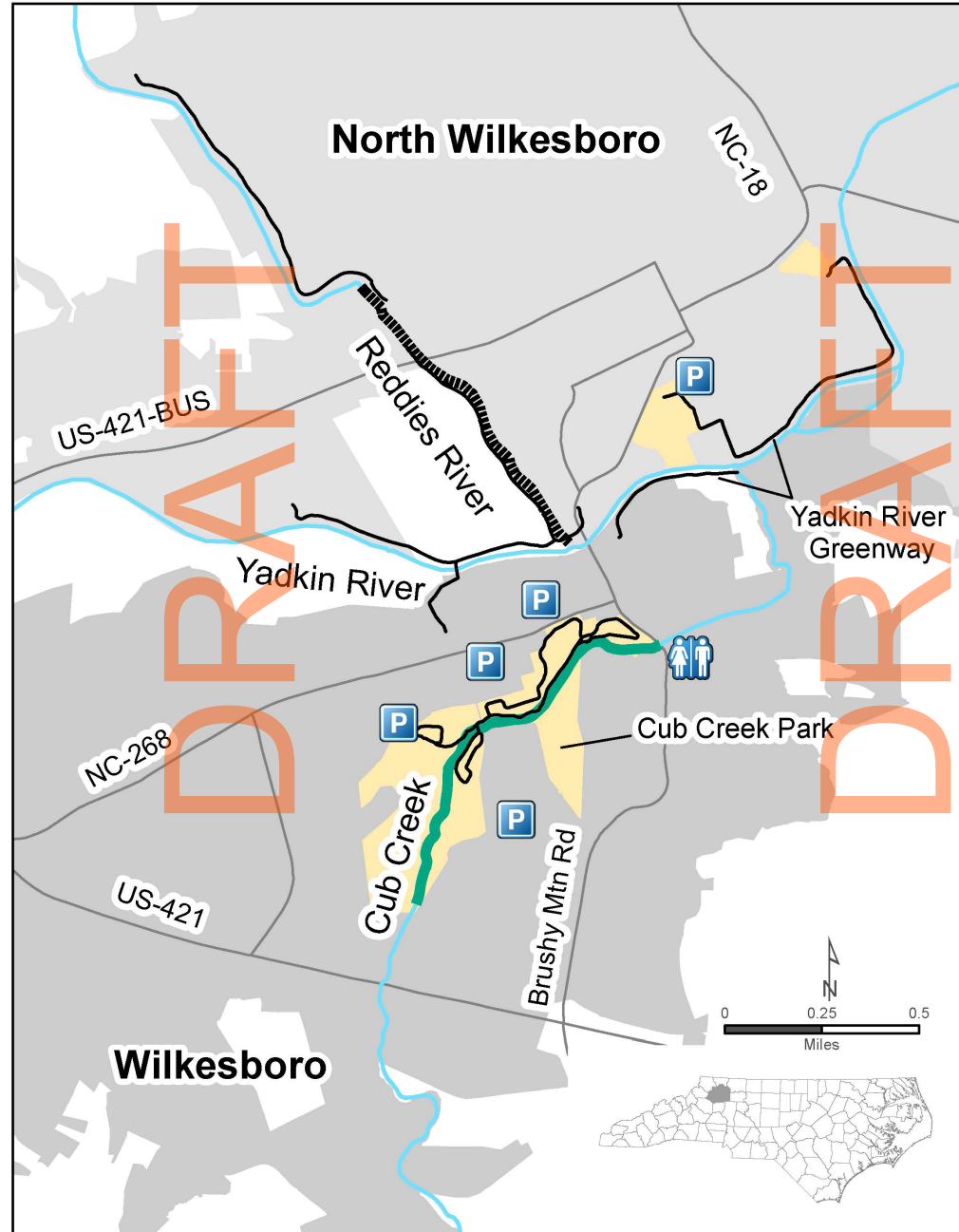


EXHIBIT H

April 25, 2019




North Carolina Wildlife Resources Commission

Gordon S. Myers, Executive Director

MEMORANDUM

TO: M. Kyle Briggs, Chief Deputy Director

FROM: Christian T. Waters, Inland Fisheries Division Chief 

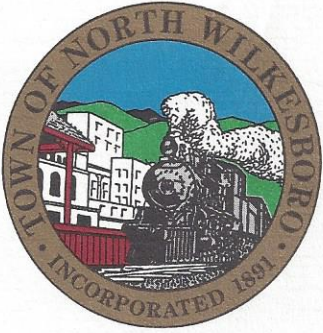
DATE: April 16, 2019

SUBJECT: Request from Town of North Wilkesboro to participate in the Mountain Heritage Trout Waters Program

Staff recommends that the Wildlife Resources Commission (Commission) recognize the Town of North Wilkesboro as a Mountain Heritage Trout City and incorporate the Delayed Harvest Trout Waters section of the Reddies River into Mountain Heritage Trout Waters. The Town of North Wilkesboro Board unanimously adopted a resolution requesting this designation at its meeting on November 13, 2018 (see attached).

The entire reach of the Reddies River is accessible via the Yadkin River Greenway. Several sets of angler steps are located along the reach to facilitate anglers entering and exiting the river. Designated public parking is provided at multiple locations within the Town and in conjunction with the Greenway.

The Town of North Wilkesboro meets the criteria established by the Commission for participation in the Mountain Heritage Trout Waters Program. The reach of the Reddies River in and adjacent to the Town is designated Public Mountain Trout Waters. The Town of North Wilkesboro currently provides unrestricted public access to these waters. Finally, the Town of North Wilkesboro has formally requested to participate in the program and is willing to enter into a Memorandum of Agreement (MOA). A draft MOA and Mountain Heritage Trout Waters brochure for Wilkesboro and Town of North Wilkesboro is attached.



TOWN OF NORTH WILKESBORO

Post Office Box 218
North Wilkesboro, North Carolina 28659
Bus. (336) 667-7129
Fax (336) 838-1779

November 15, 2018

NC Wildlife Resources Commission
Robert L. Curry
Inland Fisheries Division
1701 Mail Service Center
Raleigh, NC 27699-1700

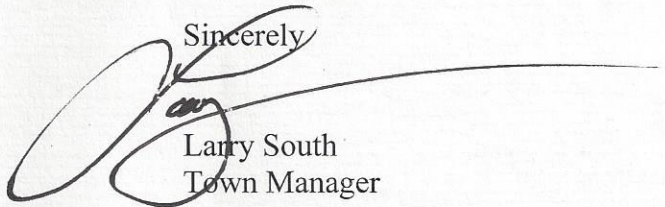
Re: Mountain Heritage Trout Program

Dear Mr. Curry:

Please find enclosed an executed copy of the resolution unanimously adopted by the North Wilkesboro Town Board on 13 November 2018.

We appreciate the opportunity to participate in this great program. Please let me know if you need anything further.

Sincerely,


Larry South
Town Manager

Cc: Andrew Carlton
Town of Wilkesboro

MEMORANDUM OF AGREEMENT

between

TOWN OF NORTH WILKESBORO

and the

NORTH CAROLINA WILDLIFE RESOURCES COMMISSION

for recognition as a

MOUNTAIN HERITAGE TROUT CITY

THIS AGREEMENT, made and entered into this 14 day of November, by and between the Town of North Wilkesboro, North Carolina, hereinafter called the **City**, and the North Carolina Wildlife Resources Commission, hereinafter called the **Commission**;

WITNESSETH:

Whereas, the **Commission** is authorized to conduct a program of fishery management for the benefit of the citizens of North Carolina; and

Whereas, the **Commission** is authorized to establish and implement a Mountain Heritage Trout Waters Program; and

Whereas, it is desirable for the **City** to participate in the Mountain Heritage Trout Waters Program in order to promote the goals of said Program;

Now, therefore, in consideration of the mutual advantages likely to result from this agreement and the respective obligations assumed herein,

THE COMMISSION AGREES:

1. To provide technical assistance required to execute the specified fisheries management activities for this agreement;
2. To delineate an agreed segment of the Reddies River within which the Mountain Heritage Trout Waters fishing license will be valid;
3. To incorporate the specific segment of the Reddies River into rule or regulation consistent with other Designated Public Mountain Trout Waters;

4. To design a **City**-specific brochure to inform the public of the existence and elements of the Mountain Heritage Trout Waters program;
5. To formally recognize the **City** as a Mountain Heritage Trout City.

THE CITY AGREES:

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3. To reproduce and distribute the **City**-specific brochures to inform the public of the existence and elements of the Mountain Heritage Trout Waters program;

IT IS MUTUALLY AGREED:

1. That this Agreement shall become effective as soon as signed by both parties and the program shall continue in effect until rescinded;
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IN WITNESS WHEREOF, the parties hereto have executed this Agreement the day and year first written above.

Approved and agreed to:

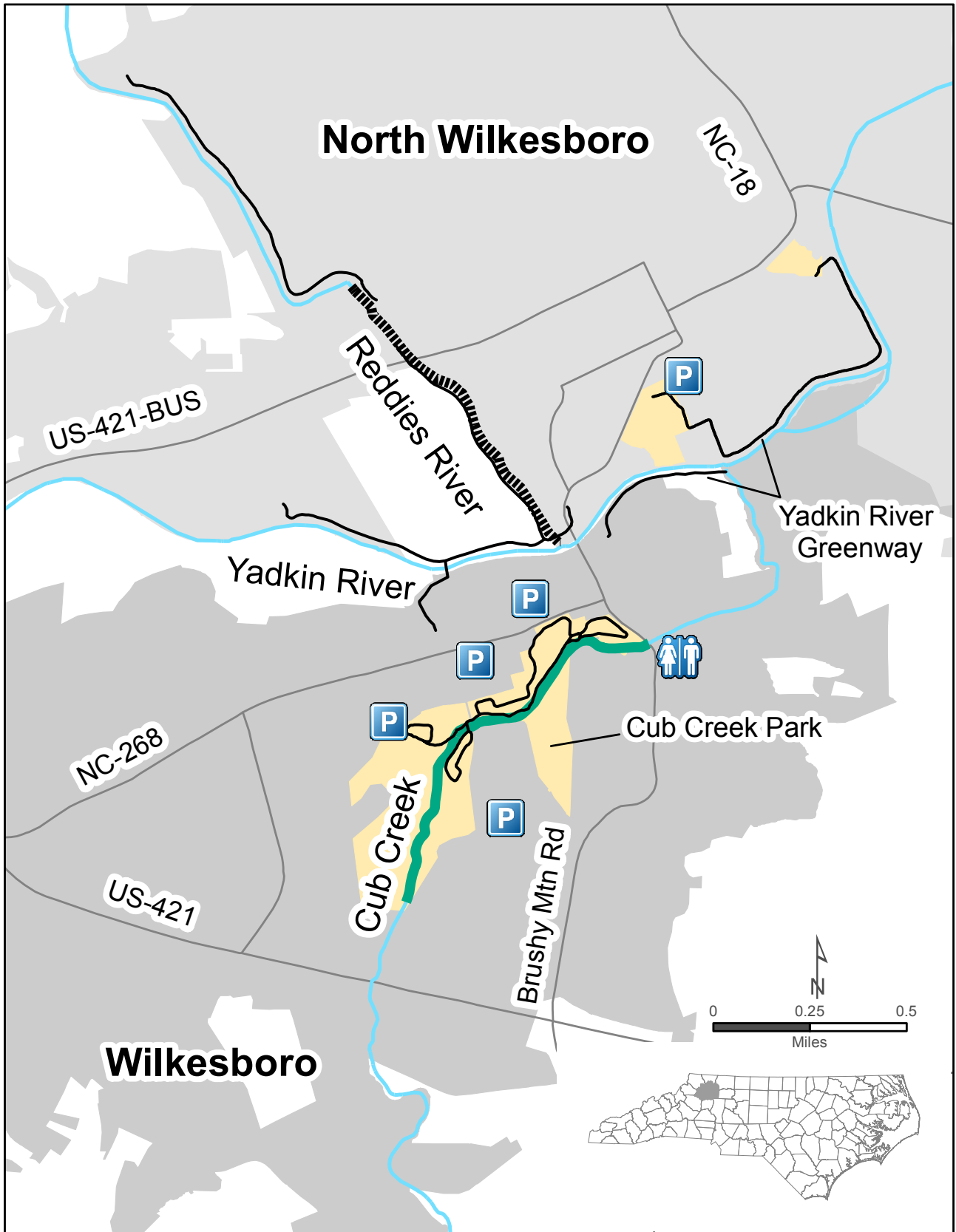

Town Manager

Robert L. Curry
Chief, Inland Fisheries Division
North Carolina Wildlife Resources Commission

11-14-18

Date

Date



MEMORANDUM OF AGREEMENT

between

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and the

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Approved and agreed to:

Town Official

Christian T. Waters
Chief, Inland Fisheries Division
North Carolina Wildlife Resources Commission

Date

Date



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NC MOUNTAIN HERITAGE TROUT CITY



WILKESBORO & NORTH WILKESBORO, N.C.



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FISHING REGULATIONS

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- No size limit restriction
- Seven (7) trout per day creel limit

Closed to fishing: March 1 until the first Saturday in April

The 1 mile-section of Reddies River is classified as the North Wilkesboro Mountain Heritage Trout Water and is a Delayed Harvest Trout Water with the following regulations:

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- Natural bait may not be used or possessed.

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- No size limit restriction;
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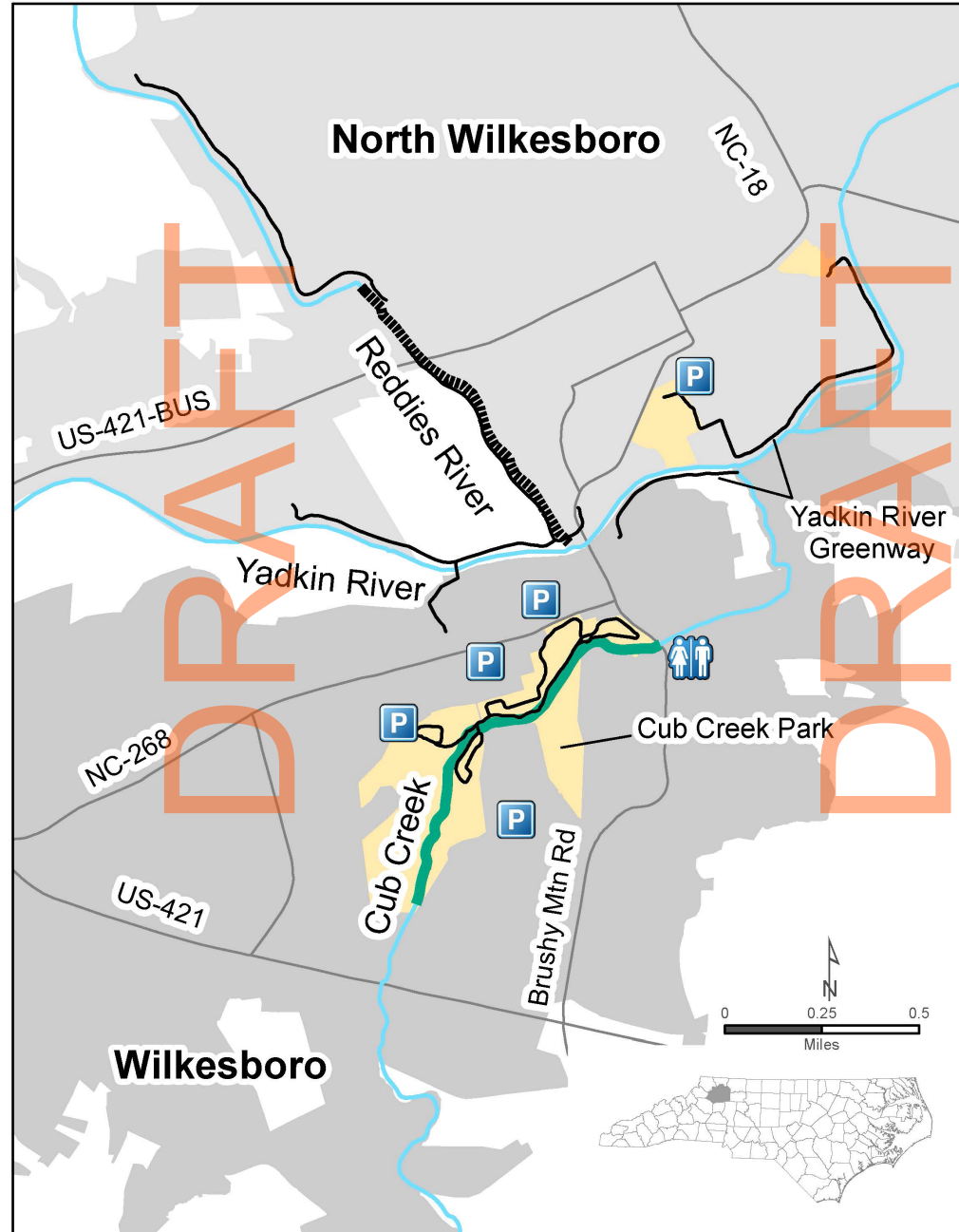


EXHIBIT I-1

April 25, 2019



Anticipated Final Regulations Frameworks for 2019–20 Hunting Seasons on Certain Migratory Game Birds

Special September Teal Season

Outside Dates: Between September 1 and September 30, an open season on all species of teal may be selected by the following States in areas delineated by State regulations:

Atlantic Flyway: Delaware, Florida, Georgia, Maryland, North Carolina, South Carolina, and Virginia.

Hunting Seasons and Daily Bag Limits: Not to exceed 16 consecutive hunting days in the Atlantic, Mississippi, and Central Flyways. The daily bag limit is 6 teal.

Waterfowl

Atlantic Flyway

Ducks, Mergansers, and Coots

Outside Dates: Between the Saturday nearest September 24 (September 21) and January 31.

Hunting Seasons and Duck Limits: 60 days. The daily bag limit is 6 ducks, including no more than 2 mallards (no more than 1 of which can be a female mallard), 2 black ducks, 1 pintail, 1 mottled duck, 1 fulvous whistling duck, 3 wood ducks, 2 redheads, 2 scaup, 2 canvasbacks, 4 scoters, 4 eiders, and 4 long-tailed ducks.

Closures: The season on harlequin ducks is closed.

Merganser Limits: The daily bag limit of mergansers is 5, only 2 of which may be hooded mergansers. In States that include mergansers in the duck bag limit, the daily limit is the same as the duck bag limit, only 2 of which may be hooded mergansers.

Coot Limits: The daily bag limit is 15 coots.

Zoning and Split Seasons: Delaware, Florida, Georgia, Maryland, North Carolina, Rhode Island, South Carolina, Virginia, and West Virginia may split their seasons into three segments; Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, and Vermont may select hunting seasons by zones and may split their seasons into two segments in each zone.

Scoters, Eiders, and Long-tailed Ducks

Special Sea Duck Seasons:

Connecticut, Delaware, Georgia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, Rhode Island, South Carolina, and Virginia may select a Special Sea Duck Season in designated Special Sea Duck Areas. If a Special Sea Duck Season is selected, scoters, eiders, and long-tailed ducks may be taken in the designated Special Sea Duck Area(s) only during the Special Sea Duck Season dates; scoters, eiders, and long-tailed ducks may be taken outside of Special Sea Duck Area(s) during the regular duck season, in accordance with the frameworks for ducks, mergansers, and coots specified above.

Outside Dates: Between September 15 and January 31.

Special Sea Duck Seasons and Daily Bag Limits: 60 consecutive hunting days, or 60 days that are concurrent with the regular duck season, with a daily bag limit of 5, of the listed sea duck species, including no more than 4 scoters, 4 eiders, and 4 long-tailed ducks. Within the special sea duck areas, during the regular duck season in the Atlantic Flyway, States may choose to allow the above sea duck limits in addition to the limits applying to other ducks during the regular season. In all other areas, sea ducks may be taken only during the regular open season for ducks and are part of the regular duck season daily bag (not to exceed 4 scoters, 4 eiders, and 4 long-tailed ducks) and possession limits.

Special Sea Duck Areas: In all coastal waters and all waters of rivers and streams seaward from the first upstream bridge in Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, and New York; in New Jersey, all coastal waters seaward from the International Regulations for Preventing Collisions at Sea (COLREGS) Demarcation Lines shown on National Oceanic and Atmospheric Administration (NOAA) Nautical Charts and further described in 33 CFR 80.165, 80.501, 80.502, and 80.503; in any waters of the Atlantic Ocean and in any tidal

waters of any bay that are separated by at least 1 mile of open water from any shore, island, and emergent vegetation in South Carolina and Georgia; and in any waters of the Atlantic Ocean and in any tidal waters of any bay that are separated by at least 800 yards of open water from any shore, island, and emergent vegetation in Delaware, Maryland, North Carolina, and Virginia; and provided that any such areas have been described, delineated, and designated as special sea duck hunting areas under the hunting regulations adopted by the respective States.

Canada Geese

Special Early Canada Goose Seasons:

A Canada goose season of up to 15 days during September 1–15 may be selected for the Eastern Unit of Maryland. Seasons not to exceed 30 days during September 1–30 may be selected for Connecticut, Florida, Georgia, New Jersey, New York (Long Island Zone only), North Carolina, Rhode Island, and South Carolina. Seasons may not exceed 25 days during September 1–25 in the remainder of the Flyway. Areas open to the hunting of Canada geese must be described, delineated, and designated as such in each State's hunting regulations.

Daily Bag Limits: Not to exceed 15 Canada geese.

Shooting Hours: One-half hour before sunrise to sunset, except that during any special early Canada goose season, shooting hours may extend to one-half hour after sunset if all other waterfowl seasons are closed in the specific applicable area.

Regular Canada Goose Seasons

Season Lengths, Outside Dates, and Limits: Specific regulations for Canada geese are shown below by State. These seasons may also include white-fronted geese in an aggregate daily bag limit. Unless specified otherwise, seasons may be split into two segments.

North Carolina

RP Zone: An 80-day season may be held between October 1 and March 10, with a 5-bird daily bag limit. The season may be split into 3 segments.

Northeast Hunt Unit: A 14-day season may be held between the Saturday prior to December 25 (December 21) and January 31, with a 1-bird daily bag limit.

Light Geese

Season Lengths, Outside Dates, and Limits: States may select a 107-day season between October 1 and March 10, with a 25-bird daily bag limit and no possession limit. States may split their seasons into three segments.

Brant

Season Lengths, Outside Dates, and Limits: States may select a 30-day season between the Saturday nearest September 24 (September 21) and January 31, with a 2-bird daily bag limit. States may split their seasons into two segments.

Tundra Swans

In portions of the Atlantic Flyway (North Carolina and Virginia) and the Central Flyway (North Dakota, South Dakota [east of the Missouri River], and that portion of Montana in the Central Flyway), an open season for taking a limited number of tundra swans may be selected. Permits will be issued by the States that authorize the take of no more than 1 tundra swan per permit. A second permit may be issued to hunters from unused permits remaining after the first drawing. The States must obtain harvest and hunter participation data. These seasons are also subject to the following conditions:

In the Atlantic Flyway

- The season may be 90 days, between October 1 and January 31.
- In North Carolina, no more than 6,115 permits may be issued.
- In Virginia, no more than 801 permits may be issued.
- In Delaware, no more than 84 permits may be issued.

Common Moorhens and Purple Gallinules

Outside Dates: Between September 1 and the last Sunday in January (January 26) in the Atlantic, Mississippi, and Central Flyways. States in the Pacific Flyway have been allowed to select their hunting seasons between the outside dates for the season on ducks, mergansers, and coots; therefore, frameworks for common moorhens and purple gallinules are included with the

duck, merganser, and coot frameworks.

Hunting Seasons and Daily Bag Limits: Seasons may not exceed 70 days in the Atlantic, Mississippi, and Central Flyways. Seasons may be split into 2 segments. The daily bag limit is 15 common moorhens and purple gallinules, singly or in the aggregate of the two species.

Zoning: Seasons may be selected by zones established for duck hunting.

Rails

Outside Dates: States included herein may select seasons between September 1 and the last Sunday in January (January 26) on clapper, king, sora, and Virginia rails.

Hunting Seasons: Seasons may not exceed 70 days and may be split into 2 segments.

Daily Bag Limits

Clapper and King Rails: In Connecticut, Delaware, Maryland, New Jersey, and Rhode Island, 10, singly or in the aggregate of the two species. In Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Texas, and Virginia, 15, singly or in the aggregate of the two species.

Sora and Virginia Rails: In the Atlantic, Mississippi, and Central Flyways and the Pacific Flyway portions of Colorado, Montana, New Mexico, and Wyoming, 25 rails, singly or in the aggregate of the two species. The season is closed in the remainder of the Pacific Flyway.

Snipe

Outside Dates: Between September 1 and February 28, except in Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, Vermont, and Virginia, where the season must end no later than January 31.

Hunting Seasons and Daily Bag Limits: Seasons may not exceed 107 days and may be split into two segments. The daily bag limit is 8 snipe.

Zoning: Seasons may be selected by zones established for duck hunting.

American Woodcock

Outside Dates: States in the Eastern Management Region may select hunting seasons between October 1 and January 31. States in the Central Management Region may select

hunting seasons between the Saturday nearest September 22 (September 21) and January 31.

Hunting Seasons and Daily Bag Limits: Seasons may not exceed 45 days in the Eastern and Central Regions. The daily bag limit is 3. Seasons may be split into two segments.

Zoning: New Jersey may select seasons in each of two zones. The season in each zone may not exceed 36 days.

Doves

Outside Dates: Between September 1 and January 31 in the Eastern Management Unit, and between September 1 and January 15 in the Central and Western Management Units, except as otherwise provided, States may select hunting seasons and daily bag limits as follows:

Eastern Management Unit

Hunting Seasons and Daily Bag Limits: Not more than 90 days, with a daily bag limit of 15 mourning and white-winged doves in the aggregate.

Zoning and Split Seasons: States may select hunting seasons in each of two zones. The season within each zone may be split into not more than three periods. Regulations for bag and possession limits, season length, and shooting hours must be uniform within specific hunting zones.

Special Falconry Regulations

In accordance with 50 CFR 21.29, falconry is a permitted means of taking migratory game birds in any State except for Hawaii. States may select an extended season for taking migratory game birds in accordance with the following:

Extended Seasons: For all hunting methods combined, the combined length of the extended season, regular season, and any special or experimental seasons must not exceed 107 days for any species or group of species in a geographical area. Each extended season may be divided into a maximum of 3 segments.

Framework Dates: Seasons must fall between September 1 and March 10.

Daily Bag Limits: Falconry daily bag limits for all permitted migratory game birds must not exceed 3 birds, singly or in the aggregate, during extended falconry seasons, any special or

experimental seasons, and regular hunting seasons in all States, including those that do not select an extended falconry season.

Regular Seasons: General hunting regulations, including seasons and hunting hours, apply to falconry. Regular season bag limits do not apply to falconry. The falconry bag limit is not in addition to gun limits.

EXHIBIT I-2

April 25, 2019



2019-20 Migratory Game Bird Season Options Response to internet question

GB1. Dove Gun Season Dates (includes mourning dove and white-winged dove)

Frameworks: 90 days, no more than 3 season segments

Earliest opening date: September 1st

Latest closing date: January 31st

The proposed 2019-20 season dates for doves are: **September 2nd – October 5th,
November 16th – November 30th, December 9th – January 31st.**

Do you agree with the proposed dates listed above?

- Yes (51 responses)
- No (9 responses)

Additional Comments (optional). Comments are limited to 250 characters.

GB2. Woodcock Gun Season Dates

Frameworks: 45 days, no more than 2 season segments

Earliest opening date: October 1st

Latest closing date: January 31st

The proposed 2019-20 season dates for woodcock are: **December 7th – January 28th.**

Do you agree with the proposed dates listed above?

- Yes (17 responses)
- No (4 responses)

Additional Comments (optional). Comments are limited to 250 characters.

GB3. Snipe Gun Season Dates

Frameworks: 107 days, no more than 2 season segments

Earliest opening date: September 1st

Latest closing date: February 28th

The proposed 2019-20 season dates for snipe are: **October 28th – February 28th.**

Do you agree with the proposed dates listed above?

- Yes (15 responses)
- No (1 response)

Additional Comments (optional). Comments are limited to 250 characters.

GB4. Rails, Gallinules and Moorhens Gun Season Dates

Frameworks: 70 days, no more than 2 season segments

Earliest opening date: September 1st

Latest closing date: January 26th

The proposed 2019-20 season dates for rails, gallinules and moorhens are: **September 7th – November 27th.**

Do you agree with the proposed dates listed above?

- Yes (17 response)
- No (1 responses)

Additional Comments (optional). Comments are limited to 250 characters.

GB5. September Teal Season Dates

Frameworks: 16 consecutive hunting days

Earliest opening date: September 1st

Latest closing date: September 30th

The proposed 2019-20 season dates for September teal are: **September 12th – September 30th.**

Do you agree with the proposed dates listed above?

- Yes (43 responses)
- No (5 responses)

Additional Comments (optional). Comments are limited to 250 characters.

GB6. General Duck Season Dates

Frameworks: 60 days, no more than 3 season segments

Earliest opening date: September 21st

Latest Closing date: January 31st

Beginning in 2019-20, the federal frameworks now allow the general duck season ending date to be extended to January 31st. Please choose one of the options below for dates for the general duck season.

Option 1: October 2nd – October 5th, November 9th – December 2nd, December 21st – January 31st.

Option 2: October 2nd – October 5th, November 16th – December 2nd, December 14th – January 31st.

- Option 1 (34 responses)
- Option 2 (82 responses)

Additional Comments (optional). Comments are limited to 250 characters.

GB7. Special Sea Duck Season Dates (In Special Sea Duck Area only)

Frameworks: 60 consecutive hunting days or must be set concurrently with the general duck season

Earliest opening date: September 15th

Latest Closing date: January 31st

The proposed 2019-20 season dates for the Special Sea Duck season (in Special Sea Duck Area only) are: **November 23rd – January 31st**.

Do you agree with the proposed dates listed above?

- Yes (32 responses)
- No (6 responses)

Additional Comments (optional). Comments are limited to 250 characters.

GB8. Canada Goose Season Dates (also includes white-fronted geese) – Resident Population (RP) Zone

Frameworks: 80 days, no more than 3 season segments

Earliest opening date: October 1st

Closing date: March 10th

Please choose one of the options below for proposed 2019-20 season dates for Canada geese (also includes white-fronted geese) in the Resident Population Zone.

Option 1: **October 2nd – October 12th, November 9th – December 7th, December 21st – February 8th**.

Option 2: **October 2nd – October 12th, November 16th – December 7th, December 14th – February 8th**.

- Option 1 (13 responses)
- Option 2 (44 responses)

Additional Comments (optional). Comments are limited to 250 characters.

GB9. Northeast Hunt Zone Canada Goose Season Dates (also includes white-fronted geese)

Frameworks: 14 days

Earliest opening date: December 21st

Closing date: January 31st

The proposed 2019-20 season dates for Canada geese (also includes white-fronted geese) in the Northeast Hunt Zone are: **January 16th – January 31st.**

Do you agree with the proposed dates listed above?

- Yes (29 responses)
- No (8 responses)

Additional Comments (optional). Comments are limited to 250 characters.

GB10. Light Goose Regular Season Dates (includes snow geese and Ross's geese)

Frameworks: 107 days, no more than 3 season segments

Earliest opening date: October 1st

Closing date: March 10th

The proposed 2019-20 season dates for the regular light goose season are: **October 8th – February 8th.**

Do you agree with the proposed dates listed above?

- Yes (24 responses)
- No (3 responses)

Additional Comments (optional). Comments are limited to 250 characters.

GB11. Light Goose Conservation Order Season Dates (includes snow geese and Ross's geese)

Frameworks: Must occur when no other waterfowl seasons are open.

The proposed 2019-20 season dates for the Light Goose Conservation Order season are: **February 10th – March 31st.**

Do you agree with the proposed dates listed above?

- Yes (22 responses)
- No (2 responses)

Additional Comments (optional). Comments are limited to 250 characters.

GB12. Brant Season Dates

Frameworks: 30 days, no more than 2 season segments
Earliest opening date: September 21st
Closing date: January 31st

The proposed 2019-20 season dates for brant are: **December 28th – January 31st.**

Do you agree with the proposed dates listed above?

- Yes (25 responses)
- No (2 responses)

Additional Comments (optional). Comments are limited to 250 characters.

GB13. Tundra Swan Season Dates

Frameworks: 90 days, permit only (6,115 permits)

Earliest opening date: October 1st

Closing date: January 31st

The proposed 2019-20 season dates for tundra swan are: **November 9th – January 31st.**

Do you agree with the proposed dates listed above?

- Yes (38 responses)
- No (3 responses)

Additional Comments (optional). Comments are limited to 250 characters.

GB14. Youth Waterfowl Day(s)

Two special youth duck hunting days are allowed. Guidelines for selecting youth days include:

1. The day(s) can occur up to 14 days before or after any regular hunting season for ducks, mergansers, and coots or in the closed portion between season segments.
2. The day must occur on any non-school day. In North Carolina, this includes Saturdays and any statewide holidays.

The proposed 2019-20 Youth Waterfowl Days are: **February 1st and February 8th.**

Do you agree with the proposed dates listed above?

- Yes (38 responses)
- No (10 responses)

Additional Comments (optional). Comments are limited to 250 characters.

GB15. Veterans/Military Waterfowl Day(s)

Recent federal legislation (NATURAL RESOURCES MANAGEMENT ACT) allows for two special duck hunting days for veterans and members of the Armed Forces on active duty. Guidelines for selecting veteran and active duty military days include:

1. The day(s) can occur up to 14 days before or after any regular hunting season for ducks, mergansers, and coots or in the closed portion between season segments.
2. There can be no more than 2 special veteran/military waterfowl days and no more than 2 special youth waterfowl days (4 total special days).
3. Special veterans/military waterfowl days can be held concurrently with the special youth waterfowl days.

The proposed 2019-20 Veterans/Military Waterfowl Days are: **February 1st and February 8th.**

Do you agree with the proposed dates listed above?

- Yes (31 responses)
- No (18 responses)

Additional Comments (optional). Comments are limited to 250 characters.

GB16. Extended Falconry Season Dates for Doves

Guidelines for extended falconry seasons include:

1. The season must fall between September 1st and March 10th.
2. Total available falconry days (including gun season) must not exceed 107 days.

The proposed 2019-20 extended falconry season dates for doves are: **October 12th – October 26th.**

Do you agree with the proposed dates listed above?

- Yes (11 responses)
- No (0 responses)

Additional Comments (optional). Comments are limited to 250 characters.

GB17. Extended Falconry Season Dates for Woodcock

Guidelines for extended falconry seasons include:

1. The season must fall between September 1st and March 10th.
2. Total available falconry days (including gun season) must not exceed 107 days.

The proposed 2019-20 extended falconry season dates for woodcock are: **November 2nd – November 30th and February 1st – February 29th.**

Do you agree with the proposed dates listed above?

- Yes (10 responses)
- No (2 responses)

Additional Comments (optional). Comments are limited to 250 characters.

GB18. Extended Falconry Season Dates for Rails, Gallinules and Moorhens

Guidelines for extended falconry seasons include:

1. The season must fall between September 1st and March 10th.
2. Total available falconry days (including gun season) must not exceed 107 days

The proposed 2019-20 extended falconry season dates for rails, gallinules and moorhens are: **November 30th – January 4th.**

Do you agree with the proposed dates listed above?

- Yes (9 responses)
- No (1 response)

Additional Comments (optional). Comments are limited to 250 characters.

GB19. Extended Falconry Season Dates for Ducks

Guidelines for extended falconry seasons include:

1. The season must fall between September 1st and March 10th.
2. Days allocated to the gun season + extended falconry days may not exceed 107 days

The proposed 2019-20 extended falconry season dates for ducks are: **October 21st – November 2nd, Feb 1st – February 15th.**

Do you agree with the proposed dates listed above?

- Yes (8 responses)
- No (2 responses)

Additional Comments (optional). Comments are limited to 250 characters.

GB20. Additional comment(s)

Use this space to provide any additional comment(s) regarding hunting seasons or issues relating to migratory game bird species.

- (16 responses)

Summary of Online Public Responses to 2019-20 Migratory Game Bird Season Date Proposals by District

<i>Proposal</i>	<i>District 1</i>	<i>District 2</i>	<i>District 3</i>	<i>District 4</i>	<i>District 5</i>	<i>District 6</i>	<i>District 7</i>	<i>District 8</i>	<i>District 9</i>	<i>Out of State</i>
GB1	<u>Position Count</u> 1: No 3: Yes	<u>Position Count</u> 1: No 11: Yes	<u>Position Count</u> 1: No 9: Yes	<u>Position Count</u> 0: No 4: Yes	<u>Position Count</u> 2: No 5: Yes	<u>Position Count</u> 1: No 7: Yes	<u>Position Count</u> 0: No 1: Yes	<u>Position Count</u> 1: No 2: Yes	<u>Position Count</u> 1: No 4: Yes	<u>Position Count</u> 1: No 5: Yes
GB2	<u>Position Count</u> 1: No 2: Yes	<u>Position Count</u> 1: No 4: Yes	<u>Position Count</u> 0: No 3: Yes	<u>Position Count</u> 0: No 2: Yes	<u>Position Count</u> 0: No 2: Yes	<u>Position Count</u> 0: No 1: Yes	<u>Position Count</u> 0: No 0: Yes	<u>Position Count</u> 0: No 0: Yes	<u>Position Count</u> 2: No 2: Yes	<u>Position Count</u> 0: No 1: Yes
GB3	<u>Position Count</u> 0: No 2: Yes	<u>Position Count</u> 0: No 2: Yes	<u>Position Count</u> 0: No 3: Yes	<u>Position Count</u> 0: No 2: Yes	<u>Position Count</u> 0: No 2: Yes	<u>Position Count</u> 0: No 1: Yes	<u>Position Count</u> 0: No 0: Yes	<u>Position Count</u> 0: No 0: Yes	<u>Position Count</u> 1: No 2: Yes	<u>Position Count</u> 0: No 1: Yes
GB4	<u>Position Count</u> 0: No 3: Yes	<u>Position Count</u> 0: No 3: Yes	<u>Position Count</u> 0: No 3: Yes	<u>Position Count</u> 0: No 2: Yes	<u>Position Count</u> 0: No 2: Yes	<u>Position Count</u> 0: No 1: Yes	<u>Position Count</u> 0: No 0: Yes	<u>Position Count</u> 0: No 0: Yes	<u>Position Count</u> 1: No 2: Yes	<u>Position Count</u> 0: No 1: Yes
GB5	<u>Position Count</u> 1: No 4: Yes	<u>Position Count</u> 2: No 9: Yes	<u>Position Count</u> 0: No 6: Yes	<u>Position Count</u> 0: No 3: Yes	<u>Position Count</u> 2: No 3: Yes	<u>Position Count</u> 0: No 6: Yes	<u>Position Count</u> 0: No 1: Yes	<u>Position Count</u> 0: No 3: Yes	<u>Position Count</u> 0: No 2: Yes	<u>Position Count</u> 0: No 6: Yes
GB6	<u>Position Count</u> 9: Option 1 11: Option 2	<u>Position Count</u> 5: Option 1 12: Option 2	<u>Position Count</u> 2: Option 1 16: Option 2	<u>Position Count</u> 1: Option 1 6: Option 2	<u>Position Count</u> 2: Option 1 9: Option 2	<u>Position Count</u> 2: Option 1 14: Option 2	<u>Position Count</u> 1: Option 1 3: Option 2	<u>Position Count</u> 1: Option 1 3: Option 2	<u>Position Count</u> 1: Option 1 4: Option 2	<u>Position Count</u> 10: Option 1 4: Option 2
GB7	<u>Position Count</u> 0: No 5: Yes	<u>Position Count</u> 3: No 5: Yes	<u>Position Count</u> 1: No 4: Yes	<u>Position Count</u> 0: No 3: Yes	<u>Position Count</u> 0: No 3: Yes	<u>Position Count</u> 1: No 5: Yes	<u>Position Count</u> 0: No 1: Yes	<u>Position Count</u> 0: No 1: Yes	<u>Position Count</u> 1: No 1: Yes	<u>Position Count</u> 0: No 4: Yes
GB8	<u>Position Count</u> 2: Option 1 2: Option 2	<u>Position Count</u> 1: Option 1 9: Option 2	<u>Position Count</u> 2: Option 1 6: Option 2	<u>Position Count</u> 2: Option 1 4: Option 2	<u>Position Count</u> 1: Option 1 6: Option 2	<u>Position Count</u> 2: Option 1 6: Option 2	<u>Position Count</u> 0: Option 1 4: Option 2	<u>Position Count</u> 1: Option 1 2: Option 2	<u>Position Count</u> 1: Option 1 2: Option 2	<u>Position Count</u> 1: Option 1 3: Option 2
GB9	<u>Position Count</u> 2: No 6: Yes	<u>Position Count</u> 2: No 6: Yes	<u>Position Count</u> 0: No 3: Yes	<u>Position Count</u> 0: No 2: Yes	<u>Position Count</u> 1: No 3: Yes	<u>Position Count</u> 0: No 4: Yes	<u>Position Count</u> 0: No 0: Yes	<u>Position Count</u> 0: No 0: Yes	<u>Position Count</u> 0: No 1: Yes	<u>Position Count</u> 3: No 4: Yes
GB10	<u>Position Count</u> 0: No 3: Yes	<u>Position Count</u> 2: No 4: Yes	<u>Position Count</u> 0: No 4: Yes	<u>Position Count</u> 0: No 1: Yes	<u>Position Count</u> 0: No 4: Yes	<u>Position Count</u> 0: No 4: Yes	<u>Position Count</u> 0: No 0: Yes	<u>Position Count</u> 0: No 1: Yes	<u>Position Count</u> 1: No 0: Yes	<u>Position Count</u> 0: No 3: Yes
GB11	<u>Position Count</u> 0: No 3: Yes	<u>Position Count</u> 2: No 4: Yes	<u>Position Count</u> 0: No 3: Yes	<u>Position Count</u> 0: No 1: Yes	<u>Position Count</u> 0: No 4: Yes	<u>Position Count</u> 0: No 4: Yes	<u>Position Count</u> 0: No 0: Yes	<u>Position Count</u> 0: No 0: Yes	<u>Position Count</u> 0: No 0: Yes	<u>Position Count</u> 0: No 3: Yes

<i>Proposal</i>	<i>District 1</i>	<i>District 2</i>	<i>District 3</i>	<i>District 4</i>	<i>District 5</i>	<i>District 6</i>	<i>District 7</i>	<i>District 8</i>	<i>District 9</i>	<i>Out of State</i>
GB12	<u>Position Count</u> 0: No 4: Yes	<u>Position Count</u> 0: No 5: Yes	<u>Position Count</u> 0: No 3: Yes	<u>Position Count</u> 1: No 2: Yes	<u>Position Count</u> 1: No 2: Yes	<u>Position Count</u> 0: No 4: Yes	<u>Position Count</u> 0: No 0: Yes	<u>Position Count</u> 0: No 1: Yes	<u>Position Count</u> 0: No 0: Yes	<u>Position Count</u> 0: No 4: Yes
GB13	<u>Position Count</u> 0: No 6: Yes	<u>Position Count</u> 1: No 6: Yes	<u>Position Count</u> 0: No 3: Yes	<u>Position Count</u> 1: No 3: Yes	<u>Position Count</u> 0: No 4: Yes	<u>Position Count</u> 0: No 7: Yes	<u>Position Count</u> 0: No 1: Yes	<u>Position Count</u> 0: No 3: Yes	<u>Position Count</u> 1: No 0: Yes	<u>Position Count</u> 0: No 5: Yes
GB14	<u>Position Count</u> 1: No 4: Yes	<u>Position Count</u> 2: No 8: Yes	<u>Position Count</u> 1: No 4: Yes	<u>Position Count</u> 0: No 2: Yes	<u>Position Count</u> 2: No 4: Yes	<u>Position Count</u> 1: No 4: Yes	<u>Position Count</u> 0: No 2: Yes	<u>Position Count</u> 0: No 4: Yes	<u>Position Count</u> 1: No 1: Yes	<u>Position Count</u> 2: No 5: Yes
GB15	<u>Position Count</u> 6: No 2: Yes	<u>Position Count</u> 2: No 8: Yes	<u>Position Count</u> 2: No 4: Yes	<u>Position Count</u> 1: No 2: Yes	<u>Position Count</u> 2: No 4: Yes	<u>Position Count</u> 2: No 2: Yes	<u>Position Count</u> 0: No 2: Yes	<u>Position Count</u> 0: No 1: Yes	<u>Position Count</u> 1: No 3: Yes	<u>Position Count</u> 2: No 3: Yes
GB16	<u>Position Count</u> 0: No 3: Yes	<u>Position Count</u> 0: No 1: Yes	<u>Position Count</u> 0: No 2: Yes	<u>Position Count</u> 0: No 1: Yes	<u>Position Count</u> 0: No 2: Yes	<u>Position Count</u> 0: No 1: Yes	<u>Position Count</u> 0: No 0: Yes	<u>Position Count</u> 0: No 0: Yes	<u>Position Count</u> 0: No 0: Yes	<u>Position Count</u> 0: No 1: Yes
GB17	<u>Position Count</u> 0: No 3: Yes	<u>Position Count</u> 1: No 0: Yes	<u>Position Count</u> 0: No 2: Yes	<u>Position Count</u> 0: No 1: Yes	<u>Position Count</u> 0: No 2: Yes	<u>Position Count</u> 0: No 1: Yes	<u>Position Count</u> 0: No 0: Yes	<u>Position Count</u> 0: No 0: Yes	<u>Position Count</u> 1: No 0: Yes	<u>Position Count</u> 0: No 1: Yes
GB18	<u>Position Count</u> 0: No 3: Yes	<u>Position Count</u> 0: No 1: Yes	<u>Position Count</u> 0: No 1: Yes	<u>Position Count</u> 0: No 0: Yes	<u>Position Count</u> 0: No 2: Yes	<u>Position Count</u> 0: No 1: Yes	<u>Position Count</u> 0: No 0: Yes	<u>Position Count</u> 0: No 0: Yes	<u>Position Count</u> 1: No 0: Yes	<u>Position Count</u> 0: No 1: Yes
GB19	<u>Position Count</u> 0: No 3: Yes	<u>Position Count</u> 0: No 1: Yes	<u>Position Count</u> 0: No 1: Yes	<u>Position Count</u> 0: No 0: Yes	<u>Position Count</u> 1: No 1: Yes	<u>Position Count</u> 0: No 1: Yes	<u>Position Count</u> 0: No 0: Yes	<u>Position Count</u> 0: No 0: Yes	<u>Position Count</u> 1: No 0: Yes	<u>Position Count</u> 0: No 1: Yes
GB20	GB20 was an additional space left for individuals to submit comments unrelated to any Migratory Game Bird Season Date Proposal listed above. There were no positions, only additional comments which are provided in the comment report below.									

Summary of Online Public Comments on 2019-20 Migratory Game Bird Season Date Proposals

REG	DISTRICT	POSITION	ADDITIONAL COMMENTS (OPTIONAL)	COUNTY	NAME
GB1					
GB1	District 1	No	I'd like for thanksgiving day to January 31st and however many days in September was available after that.	Hyde	NEWMAN III, THOMAS E
GB1	District 2	No	Only have 2 seasons. Give us a very long 1st season then finish out the remaining season starting on Thanksgiving. Few hunters hunt dove al 3 seasons.	Onslow	ADAMS, DENNIS G
GB1	District 3	No	I prefer opening day of Dove Season to be on the Saturday prior to Labor Day, which allows (most) hunters to have 2 hunting days on this holiday weekend. So if Labor Day falls on Sept. 1 or 2, opening day would be Saturday, Aug 30 or 31, respectively. For all other Labor Day dates (Sept. 3, 4, 5, 6, 7), a Saturday opening date would fall in September (1, 2, 3, 4, 5), Alternatively, if Dove Season opening day must be no earlier than Sept. 1, then I propose that opening day be on Saturday, Sept.6 or 7 when Labor Day is on Sept. 1 or 2. I have observed through many years of dove hunting in NC (since 1958) that doves are generally present in abundance from about August 21-24 through about September 10-15 unless there has been an extreme weather event such as prolonged drought/excessive heat during mid to late summer or a hurricane within about up to 4 weeks prior to the first of September. I generally hunt doves in central, piedmont or eastern NC. Thank you for your consideration	Wake	WICKER, PHILLIP D
GB1	District 5	No	Go from sept 2nd to Nov16. No split. Keep it simple. By in large, hunters typically hunt only opening day, then maybe one other . When other seasons are in, dove hunting typically stops anyway	Rockingham	COBB, RONALD W
GB1	District 5	No	Opening date should be the Saturday before Labor day. Opening date should be August 31st	Orange	staples, chad v
GB1	District 6	Yes	This is fine for this year. Sometimes we don't get lucky enough to start on Saturday.	Rowan	PATTON, JONATHAN D
GB1	District 6	Yes	I support Sunday hunting for migratory, and non-migratory game birds.	Mecklenburg	BYRUM JR, CLIFFORD C
GB1	District 6	No	opening say should be Saturday 8/31 like normal years on labor day weekend.	Rowan	WHEELER, THOMAS P
GB1	District 8	No	I would like to see dove season always come in on Saturday even if that means it happening in August. This is a great way to get youth in the field since many of us do not hunt close to home, only getting to hunt in Monday makes that difficult.	Gaston	LEWIS, JEREMY W
GB1	District 9	Yes	I'm sure that you're using good scientific information.	Macon	KEENER, GRANT A
GB1	District 9	No	I would support limiting the season to 60 days, and not including January, to allow for greater population recovery.	Buncombe	Cannon, Luke
GB1	Out of State	No	The season would be better to start September 1	Out of State	Eliason I, Sean T
GB2					
GB2	District 1	No	It would be nice if you could just have January 31 as the last day. That way you could hunt woodcock if you wanted to in addition to waterfowl on the last day of duck season. You actually had the last day of woodcock season on the 31st a few years back but changed it.	Dare	SCARBOROUGH JR, HARVEY D
GB2	District 2	Yes	These are excellent dates for woodcock hunting in North Carolina.	Carteret	Cross, Ford
GB2	District 2	No	Our woodcock do not arrive here in numbers until late December so start the season as late as you can with staying in the 45 day frame work.	Onslow	ADAMS, DENNIS G
GB2	District 9	Yes	Please consider a split woodcock season, East/West of I-77. Most of our woodcock migration in the mountains is early in the year. By the time the regular season starts we have a had a freeze or snow and the birds have moved through.	Buncombe	MALLICOAT, ROBERT D
GB2	District 9	No	I would support limiting the season to 30 day to allow for greater population recovery.	Buncombe	Cannon, Luke

REG	DISTRICT	POSITION	ADDITIONAL COMMENTS (OPTIONAL)	COUNTY	NAME
GB2	District 9	No	The season should open on December 1st	Macon	KEENER, GRANT A
GB3					
GB3	District 2	Yes	I enjoy hunting snipe along with quail & woodcock. Snipe are a great game bird and good eating.	Onslow	ADAMS, DENNIS G
GB3	District 9	No	I would support limiting the season to 60 days, and not including January or February, to allow for greater population recovery.	Buncombe	Cannon, Luke
GB4					
GB4	District 2	Yes	Please ensure the season starts on the highest tide in September. I only hunt rails a couple of times a year and enjoy it greatly.	Onslow	ADAMS, DENNIS G
GB4	District 9	No	I would support limiting the season to 60 days, and not including January, to allow for greater population recovery.	Buncombe	Cannon, Luke
GB5					
GB5	District 1	No	it needs to be closed there are to many other ducks being killed and left to float	Dare	WIDMER JR, WALTER H
GB5	District 2	No	No duck season should run concurrent with deer seasons. Duck hunting interferes with deer hunting as duck hunters can, by navigal waterways, slide into a duck hole directly behind a deer hunters hunting spot and duck hunt without regard for the deer hunter. duck hunting requires equipment that lends it to be a cold weather sport. all duck hunt seasons should be jan.2-march1. this is a common problem in the southeastern part of our state. duck hunters have absolutely no regard for deer hunters. if an area can be reached by boat where duck hunters can leagally enter a body of water, they will go wherever the ducks are and don't care about the deer hunters who also got up early to have a peaceful, fulfilling morning in the field.	Pender	boone JR, william o
GB5	District 2	No	We have missed the teal flight by two weeeeks for the last 6 years. They have been moving through N.C. the last wo weeks and first two weeks in September. I have been hunting them every year since the experimental seasons and once the season got pushed later in to September, the hunting I had become poorer. Needs to start earliest as possible.	Pitt	Whitley, Scott
GB5	District 5	Yes	I see no mention of the East of Hwy 17 as a boundary, has this been considered for change?	Person	CATES, RICHARD C
GB5	District 5	No	Open the teal season state wide!!!!!!!!!!!!!! Ridiculous that anyone in 2/3rds of the state should have to drive 3-8 hours to hunt teal, when there are a bunch in our back yard!!!! The excuse that there would be a high mortality of other species is insulting to duck hunters. The majority of us have to ID waterfowl well with the current limits in place.	Granville	JARMAN III, WILLIAM H
GB5	District 5	No	This is only good for some locals at the coastal regions. We don't need this season !!	Rockingham	COBB, RONALD W
GB5	District 6	Yes	Currently, the Migratory Bird Treaty Act ("MBTA") includes language that allows individuals and entities to plant, grow, and leave unharvested commodity crops on large numbers of acres throughout the United States, under the guise of following a "normal" agricultural practice, but with the sole intent of attracting and concentrating large numbers of migratory waterfowl. The consequence of these unnatural practices has resulted in migratory waterfowl exhibiting unnatural migration habits, including delayed migration as well as historically shortened migration routes.	Stanly	THOMPSON, TAYLOR J
GB5	District 8	Yes	open the season across the state and not just down east.	Yancey	Jackson, Daniel
GB5	Out of State	Yes	Expand the teal season further west to 95	Out of State	STEPHENSON, BRADLEY W
GB6					
GB6	District 1	OPTION 1	This importance of extending the season farther into January is imperative	Dare	Oxnard, Colin

REG	DISTRICT	POSITION	ADDITIONAL COMMENTS (OPTIONAL)	COUNTY	NAME
GB6	District 1	OPTION 1	Take away the october season all together....and start the december season five days sooner	Dare	GILLAM, NOAH H
GB6	District 1	OPTION 1	A longer november season benefits us in North Carolina greatly. There is a good push of birds that time of year. December is usually the slowest hunting of the year.	Tyrrell	WINN III, WENDALL L
GB6	District 1	OPTION 1	More days in November is much better than more days in December. The few calendar migrating ducks that are still around in December are very stale and rarely decoy. More November days gives us a solid chance to harvest the plentiful early migrators before they move on- usually by December 1st. I would also like to see the October days moved back a week or two, or added to November days. Anymore early October is 85 degrees. Thanks	Camden	CANNON, WILLIAM B
GB6	District 1	OPTION 2	The birds are arriving later in the season. Last year was the worst season in many years. I would ask for consideration for a season from December to Jan. 31. My family has hunted on the Outer Bank since 1948. I am a 3rd generation hunter and believe the proposed seasons are not in the hunters interest. The ducks are arriving by the 1,000's in late January.	Dare	Nunemaker, Carlton
GB6	District 1	OPTION 2	I STRONGLY encourage the commission to extend the season to the latest allowable end date of January 31st. As the owner of a lodge and guide service in NC, the addition of these late season dates would have a significant positive impact on our business.	Hyde	ORR II, ROBERT C
GB6	District 1	OPTION 2	I very strongly support option 2!	Hyde	KOT, PHOEBE L
GB6	District 1	OPTION 2	Waterfowl hunting on Sunday will sell a lot more licenses in NC. And allow working residents to get out more than a few days a season.	Chowan	Chapleau, Alexander
GB6	District 2	OPTION 1	I would much rather have the season end on the last Saturday in January than the 31st. If the goal is to maximize hunter harvest and opportunity, increasing weekend opportunity is an easy way to do this. The paper "Effects of hunting season structure, weather and body condition on overwintering mallard Anas platyrhynchos survival" found some evidence of lower survival of their marked birds on weekends. This would suggest that increasing weekend opportunity can help to increase hunter harvest.	Pitt	FARLEY, EDWARD B
GB6	District 2	OPTION 1	Please open the October season at least a week, maybe even 2 weeks later. Plenty of wood ducks will still be around even for the mountain and piedmont boys, and we will see a lot more "other" birds in all the areas, especially in the coastal areas where the majority of hunters are hunting anyway. I've been doing this for over 50 seasons in NC, I understand the thinking of the Feds for having the special teal season but feel WRC's concern that hunters need to have an opportunity to shoot woodies before they leave the state is based on the premise that a lot of them will migrate in mid October before getting shot at. I know the woodie is our most killed bird but they are here longer than most want to believe. Opening the season later on Oct. will put more other migrating birds here in the state and will counteract any lose of woodies we might have. Time for this traditional/archaic way of thinking be brought up to speed. Times have changed. Thank you for allowing me to comment.	New Hanover	GIBSON JR, JAMES F
GB6	District 2	OPTION 1	Move October split one week later	Pitt	FARLEY, JOHN B

REG	DISTRICT	POSITION	ADDITIONAL COMMENTS (OPTIONAL)	COUNTY	NAME
GB6	District 2	OPTION 2	No duck season should run concurrent with deer seasons. Duck hunting interferes with deer hunting as duck hunters can, by navigal waterways, slide into a duck hole directly behind a deer hunters hunting spot and duck hunt without regard for the deer hunter. duck hunting requires equipment that lends it to be a cold weather sport. all duck hunt seasons should be jan.2-march1. this is a common problem in the southeastern part of our state. duck hunters have absolutely no regard for deer hunters. if an area can be reached by boat where duck hunters can leagally enter a body of water, they will go wherever the ducks are and don't care about the deer hunters who also got up early to have a peaceful, fulfilling morning in the field. moreover, duck seasons should most definitely not run concurrent with the white tail rut, when a hunter is most likely to tag the biggest buck they have ever seen in the field. No duck hunting during deer season-period, but especially from oct. 25-nov. 15	Pender	boone JR, william o
GB6	District 2	OPTION 2	This is a new brainer	Pitt	Whitley, Scott
GB6	District 2	OPTION 2	NC should get rid of the October season as a whole. This is not a good season to hunt ducks. As well if we were to drop the October dates, this could open up Sunday hunts during the 3d split. Since the majority of the people hunting can only hunt weekends. This would be better all around.	Onslow	SMITH, BRADLEY W
GB6	District 2	OPTION 2	I would rather have additional days in the later part of the season. With warmer trends earlier in the year it seems as if the ducks do not come in until later in the season. I would also like to add even though this is not listed as a decision possibly taking away a weekday and giving hunters the option for Sunday morning. With work and various other things the majority of hunters are limited to one day a week and given the wide uncertainty of weather those Saturdays are even limited.	Pitt	ROUSE, DAVID A
GB6	District 2	OPTION 2	An option for Sunday hunting should still be considered. Omit the days from the 1st and 2nd segments needed to allow for Sunday hunting in the 3rd segment. Most hunters are still weekend warriors and eliminating the option of using Sunday for a hunting day severely limits the actual days available to most working water fowlers.	Onslow	MILLIGAN, CHRISTOPHER N
GB6	District 3	OPTION 2	Would be in favor of Jan 31 closing, regardless of the day of the week	Wake	PAYNE SR, JOHN D
GB6	District 3	OPTION 2	Needs to be a later date , the ducks are showing up later and later every year. And public land impoundments need serious improvements so that hunters can actually take ducks in them. Sunday hunting needs to be allowed for ducks and if a rest day is absolutely necessary then it should be middle of the week since most hunters work weekdays. And maybe consider shell limits on public land to discourage sky busters. Thank you.	Johnston	FRANKS, CONNOR A
GB6	District 3	OPTION 2	I strongly support the waterfowl season stay open through January 31st.	Wake	ORR, JACOB P
GB6	District 3	OPTION 2	Til January 31st	Wake	ATWELL JR, JOHN T
GB6	District 3	OPTION 2	No need for September duck season! TAKE AWAY SEPTEMBER SEASON and extend into mid February when the ducks finally arrive!!!! This will be overlooked but is an awesome idea that many people would stand behind. Thanks	Nash	Carter, Colby B

REG	DISTRICT	POSITION	ADDITIONAL COMMENTS (OPTIONAL)	COUNTY	NAME
GB6	District 4	OPTION 2	I would like to you consider these possibilities. Move the first duck season to the second week of October. Seasonal temperatures are on the rise which can effect migration patterns. The 31st of January 2020 is a Friday so I hope that the Commission considers hunting on the last day for its hunting opportunity Gamelands.	Cumberland	VINENT JR, ANDRES A
GB6	District 4	OPTION 2	I choose this option because more school aged hunters may be able to hunt during their winter break. Again, the local municipal water bodies can become quickly populated with mallards following rains (for example when dry basins do not drain properly after rain and become wet basins). Typical migratory waterfowl seen here in the urban habitat include mallards, geese and mergansers, with mallards the most common duck. Population dynamics of recent years have seen an increase in mergansers here and fewer new broods of mallard ducklings and Branta sp. goslings but ample adult mallards and adult geese in the still waters with occasional mallard sightings in protected areas of slow flowing streams in the Morrisville/Cary area. (anecdotal observations over five or more years here)	Brunswick	GASSAWAY, DANIEL G
GB6	District 5	OPTION 2	Like Option #2, with warmer falls, we do not see many ducks before Thanksgiving. Later dates would be better for hunters. Also, don't think we need two youth hunts in February. One is enough! Give them one during the December split if they need two. They cripple way to many ducks. Hurts our population that late in the year! What about a senior hunt over 70 like a youth hunt in February?	Guilford	DECKER III, HENRY J
GB6	District 5	OPTION 2	It would be nice to cut the October season back to two days and adding the other 2 days to later season	Guilford	KRAMER, MARTIN M
GB6	District 5	OPTION 2	I think the October season should be cut down to only 2 days and add the other days to either 2nd or 3rd segment.	Guilford	HESTER, KEVIN B
GB6	District 5	OPTION 2	I like option 2 better, but do away with the Oct season and go from Nov 16 - January 31.	Rockingham	COBB, RONALD W
GB6	District 5	OPTION 2	The ducks in the area I hunt, have for years been here the most during the month of December. I wish the the split was not in December.	Granville	JARMAN III, WILLIAM H
GB6	District 6	OPTION 2	Start later end later it's as simple as that. The dates listed I chose the least worst. I would like to see the season start later and end later.	Rowan	PATCH, CRAIG A
GB6	District 6	OPTION 2	please give us Sunday waterfowl hunting why end on dec 2? it's a Tuesday	Rowan	WHEELER, THOMAS P
GB6	District 6	OPTION 2	I think option 2 is better because it will encompass most schools in the state's Christmas break providing more hunting opportunities for young hunters.	Moore	REGISTER, JESSE E
GB6	District 6	OPTION 2	Currently, the Migratory Bird Treaty Act ("MBTA") includes language that allows individuals and entities to plant, grow, and leave unharvested commodity crops on large numbers of acres throughout the United States, under the guise of following a "normal" agricultural practice, but with the sole intent of attracting and concentrating large numbers of migratory waterfowl. The consequence of these unnatural practices has resulted in migratory waterfowl exhibiting unnatural migration habits, including delayed migration as well as historically shortened migration routes.	Stanly	THOMPSON, TAYLOR J

REG	DISTRICT	POSITION	ADDITIONAL COMMENTS (OPTIONAL)	COUNTY	NAME
GB6	District 6	OPTION 2	Would greatly improve hunting opportunities and hopefully results.	Mecklenburg	ARENDALE IV, CHARLES R
GB6	District 7	OPTION 2	The later days in the season gives birds more time to migrate to our area, especially if it's a warm winter.	Forsyth	BODNER, ROBERT A
GB6	District 8	OPTION 2	Open up duck hunting on sundays!! Its time! Do away with first split to accommodate for the extra days.	Gaston	LEWIS, JEREMY W
GB6	District 9	OPTION 2	I actually do not support either of the above stated Options and resent them being framed as the only Positions Available. I would support limiting the season to 30 days, and not including January, to allow for greater population recovery.	Buncombe	Cannon, Luke
GB6	Out of State	OPTION 2	Recommend eliminating another week in November to allow more time, if Federal law allows, to go into February.	Out of State	HOLCOMBE JR, RALPH L
GB7					
GB7	District 2	No	No duck season should run concurrent with deer seasons. Duck hunting interferes with deer hunting as duck hunters can, by navigal waterways, slide into a duck hole directly behind a deer hunters hunting spot and duck hunt without regard for the deer hunter. duck hunting requires equipment that lends it to be a cold weather sport. all duck hunt seasons should be jan.2-march1. this is a common problem in the southeastern part of our state. duck hunters have absolutely no regard for deer hunters. if an area can be reached by boat where duck hunters can leagally enter a body of water, they will go wherever the ducks are and don't care about the deer hunters who also got up early to have a peaceful, fulfilling morning in the field.	Pender	boone JR, william o
GB7	District 2	No	Open it earlier, Nov 9 or 16th	Beaufort	HAWLEY, JOSEPH T
GB7	District 2	No	Way too late. What are y'all smoking? Is there anyway me there that knows when the birds are here? Unless y'all are anti hunting, the season needs to be earlier in November for sea ducks. They're all but gone by mid January	Pitt	Whitley, Scott
GB7	District 3	No	open sea duck Nov 9	Wake	LOWDERMILK, JOHN B
GB7	District 5	Yes	No split. Doesn't need to be confusing	Rockingham	COBB, RONALD W
GB7	District 6	Yes	Currently, the Migratory Bird Treaty Act ("MBTA") includes language that allows individuals and entities to plant, grow, and leave unharvested commodity crops on large numbers of acres throughout the United States, under the guise of following a "normal" agricultural practice, but with the sole intent of attracting and concentrating large numbers of migratory waterfowl. The consequence of these unnatural practices has resulted in migratory waterfowl exhibiting unnatural migration habits, including delayed migration as well as historically shortened migration routes.	Stanly	THOMPSON, TAYLOR J
GB7	District 9	No	I would support limiting the season to 30 days, and not including January, to allow for greater population recovery.	Buncombe	Cannon, Luke
GB8					

REG	DISTRICT	POSITION	ADDITIONAL COMMENTS (OPTIONAL)	COUNTY	NAME
GB8	District 2	OPTION2	No duck season should run concurrent with deer seasons. Duck hunting interferes with deer hunting as duck hunters can, by navigal waterways, slide into a duck hole directly behind a deer hunters hunting spot and duck hunt without regard for the deer hunter. duck hunting requires equipment that lends it to be a cold weather sport. all duck hunt seasons should be jan.2-march1. this is a common problem in the southeastern part of our state. duck hunters have absolutely no regard for deer hunters. if an area can be reached by boat where duck hunters can leagally enter a body of water, they will go wherever the ducks are and don't care about the deer hunters who also got up early to have a peaceful, fulfilling morning in the field. moreover, duck seasons should most definitely not run concurrent with the white tail rut, when a hunter is most likely to tag the biggest buck they have ever seen in the field. No duck hunting during deer season-period, but especially from oct. 25-nov. 15	Pender	boone JR, william o
GB8	District 2	OPTION2	Option 2 to stay more in line with option 2 of preferred duck season.	Pitt	ROUSE, DAVID A
GB8	District 3	OPTION 1	About time wake and durham counties are considered resident population..	Wake	CLEMMER, KEVIN C
GB8	District 4	OPTION 1	The geese in the the areas I hunt in south east North Carolina has steadily grown the last ten years. They are becoming a problem in the area. With the current regulations we cannot keep up with the population grown. Thank you for listening	Columbus	NOBLES, BRANDON P
GB8	District 4	OPTION2	Although both choices offer about the same number of days, I choose the option which would allow more school aged persons to have an opportunity to hunt the geese during their winter break. My observations limited to Wake County indicate that the Canada goose population should be culled due to their encroachment into residential housing areas and municipal water basins that should be free of waterfowl to limit the processing expenses in treating the water for consumption or other purposes. Geese can be observed on top of businesses, near sidewalks, in yards and streets and have acclimated to the surroundings to the point that they are quite passive when humans walk or bike close to them. Occasionally they will hiss or honk but usually carry on as if they are at home in the urban areas. Many residents are aware of the prohibition in harassing or disturbing them but feel as if they are doing them a favor by feeding the geese. In short, it appears holiday hunts could thin population #s.	Brunswick	GASSAWAY, DANIEL G
GB8	District 4	OPTION2	Keep these dates as close to the corresponding duck season. I understand that there is an 80 day season.	Cumberland	VINENT JR, ANDRES A
GB8	District 5	OPTION2	I would encourage extending the season through Feb	Person	CATES, RICHARD C
GB8	District 5	OPTION2	Too many resident Canada geese. Start October 12th and go straight to January 31st. Straight through.	Rockingham	COBB, RONALD W
GB8	District 6	OPTION2	Create a later longer season	Rowan	PATCH, CRAIG A
GB8	District 7	OPTION2	The Piedmont region needs an extended resident goose season.	Davie	BECK, BLAINE T
GB8	District 7	OPTION2	To coincidence with duck season	Forsyth	BODNER, ROBERT A
GB9					
GB9	District 1	No	Remove parts of Bertie County from the NHZ. The birds we shoot on the Chowan are the same birds that are in the area all summer.	Bertie	ROSE, JORDAN V

REG	DISTRICT	POSITION	ADDITIONAL COMMENTS (OPTIONAL)	COUNTY	NAME
GB9	District 1	No	I think it is stupid we have so many resident geese that need to be shot in the northeast hunt zone. Geese are being rounded up and gased by the state and depredation permits are issued, but you can not hunt them but in November when its hot and no one really goes. We do not have enough Canada geese migrating down here anymore for hunters to hurt. Let the hunter's shoot 3 geese a day during all projected duck season dates!! N.C. is not going to save the migratory geese, they are being shot by every other state above and below us!! Please consider this as a option at some point. Give the hunters a chance to help you keep the resident population under control. Again I do not believe the hunters will hardly kill a migratory goose if allowed to hunt them during normal duck seasons. I would be willing to submit any data you would need in order to help the mission. Thanks	Perquimans	HUNTER, PAUL A
GB9	District 2	No	No duck season should run concurrent with deer seasons. Duck hunting interferes with deer hunting as duck hunters can, by navigal waterways, slide into a duck hole directly behind a deer hunters hunting spot and duck hunt without regard for the deer hunter. duck hunting requires equipment that lends it to be a cold weather sport. all duck hunt seasons should be jan.2- march1. this is a common problem in the southeastern part of our state. duck hunters have absolutely no regard for deer hunters. if an area can be reached by boat where duck hunters can leagally enter a body of water, they will go wherever the ducks are and don't care about the deer hunters who also got up early to have a peaceful, fulfilling morning in the field. moreover, duck seasons should most definitely not run concurrent with the white tail rut, when a hunter is most likely to tag the biggest buck they have ever seen in the field. No duck hunting during deer season-period, but especially from oct. 25-nov. 15	Pender	boone JR, william o
GB9	District 2	No	I would prefer a season going from January 10th-January 25th.	Pitt	FARLEY, EDWARD B
GB9	District 9	Yes	Yes, However I would be in support of reducing the number of greater white-fronted geese taken within each season to allow for the population size to increase for future years.	Buncombe	Cannon, Luke
GB9	Out of State	No	I believe the time should be increase to a 30 day period in January.	Out of State	HOLCOMBE JR, RALPH L
GB9	Out of State	No	I think the goose season should be open longer	Out of State	TAFEL, JAMES C
GB9	Out of State	No	make goose season match duck season. we have been restricting this for years with no result	Out of State	WEBB SR, JOSEPH N
GB10					
GB10	District 2	No	No duck season should run concurrent with deer seasons. Duck hunting interferes with deer hunting as duck hunters can, by navigal waterways, slide into a duck hole directly behind a deer hunters hunting spot and duck hunt without regard for the deer hunter. duck hunting requires equipment that lends it to be a cold weather sport. all duck hunt seasons should be jan.2- march1. this is a common problem in the southeastern part of our state. duck hunters have absolutely no regard for deer hunters. if an area can be reached by boat where duck hunters can leagally enter a body of water, they will go wherever the ducks are and don't care about the deer hunters who also got up early to have a peaceful, fulfilling morning in the field. moreover, duck seasons should most definitely not run concurrent with the white tail rut, when a hunter is most likely to tag the biggest buck they have ever seen in the field. No duck hunting during deer season-period, but especially from oct. 25-nov. 15	Pender	boone JR, william o
GB10	District 2	No	Move it a month later. Few birds here in October. Are y'all paying a biologist for this info?	Pitt	Whitley, Scott
GB10	District 9	No	I would support limiting the season to 60 days, and not including January or February to allow for greater population recovery.	Buncombe	Cannon, Luke
GB11					

REG	DISTRICT	POSITION	ADDITIONAL COMMENTS (OPTIONAL)	COUNTY	NAME
GB11	District 2	No	No duck season should run concurrent with deer seasons. Duck hunting interferes with deer hunting as duck hunters can, by navigal waterways, slide into a duck hole directly behind a deer hunters hunting spot and duck hunt without regard for the deer hunter. duck hunting requires equipment that lends it to be a cold weather sport. all duck hunt seasons should be jan.2-march1. this is a common problem in the southeastern part of our state. duck hunters have absolutely no regard for deer hunters. if an area can be reached by boat where duck hunters can leagally enter a body of water, they will go wherever the ducks are and don't care about the deer hunters who also got up early to have a peaceful, fulfilling morning in the field. moreover, duck seasons should most definitely not run concurrent with the white tail rut, when a hunter is most likely to tag the biggest buck they have ever seen in the field. No duck hunting during deer season-period, but especially from oct. 25-nov. 15	Pender	boone JR, william o
GB11	District 2	No	Double taxation	Pitt	Whitley, Scott
GB12					
GB12	District 5	No	Let it follow regular duck season. They're no many brant that show up in North Carolina coastal areas anyway. The chances are too few to harvest one, even on a good year	Rockingham	COBB, RONALD W
GB13					
GB13	District 2	Yes	Need to be more permits issued!	Pitt	CASTLEBERRY, DAVID M
GB13	District 2	No	No duck season should run concurrent with deer seasons. Duck hunting interferes with deer hunting as duck hunters can, by navigal waterways, slide into a duck hole directly behind a deer hunters hunting spot and duck hunt without regard for the deer hunter. duck hunting requires equipment that lends it to be a cold weather sport. all duck hunt seasons should be jan.2-march1. this is a common problem in the southeastern part of our state. duck hunters have absolutely no regard for deer hunters. if an area can be reached by boat where duck hunters can leagally enter a body of water, they will go wherever the ducks are and don't care about the deer hunters who also got up early to have a peaceful, fulfilling morning in the field. moreover, duck seasons should most definitely not run concurrent with the white tail rut, when a hunter is most likely to tag the biggest buck they have ever seen in the field. No duck hunting during deer season-period, but especially from oct. 25-nov. 15	Pender	boone JR, william o
GB13	District 4	No	Extend it into feb as swans are not here in early November in numbers	Robeson	CAUDELL, ETHAN K
GB13	District 9	No	I would support limiting the season to 60 days, and not including January, to allow for greater population recovery.	Buncombe	Cannon, Luke
GB14					
GB14	District 1	No	I think one of the youth days should be the Saturday before the November season.	Bertie	HOGGARD, ANTHONY A
GB14	District 2	No	No duck season should run concurrent with deer seasons. Duck hunting interferes with deer hunting as duck hunters can, by navigal waterways, slide into a duck hole directly behind a deer hunters hunting spot and duck hunt without regard for the deer hunter. duck hunting requires equipment that lends it to be a cold weather sport. all duck hunt seasons should be jan.2-march1. this is a common problem in the southeastern part of our state. duck hunters have absolutely no regard for deer hunters. if an area can be reached by boat where duck hunters can leagally enter a body of water, they will go wherever the ducks are and don't care about the deer hunters who also got up early to have a peaceful, fulfilling morning in the field. moreover, duck seasons should most definitely not run concurrent with the white tail rut, when a hunter is most likely to tag the biggest buck they have ever seen in the field. No duck hunting during deer season-period, but especially from oct. 25-nov. 15	Pender	boone JR, william o

REG	DISTRICT	POSITION	ADDITIONAL COMMENTS (OPTIONAL)	COUNTY	NAME
GB14	District 2	No	Unfortunately, the 8th and 15th needs to be the dates. This would allow youth to hunt rested birds at a greater success rate. Instead of hunting hard hunted birds at the end of the season.	Onslow	SMITH, BRADLEY W
GB14	District 3	No	Youth days shall be on the front end of the duck season, typically warmer and before the ducks are gun and decoy shy... Wouldn't we desire a successful hunt this way, similar to youth turkey week!! Why is youth turkey week on the front end of the season?	Wake	CLEMMER, KEVIN C
GB14	District 5	No	Youth days should come between November and December. The general population can't hunt in February. The ducks are pairing up by that time. Also I disagree with the age change of what a youth is. If you can drive yourself to hunt you are not a youth. It should go back to 15 and under	Guilford	KRAMER, MARTIN M
GB14	District 5	No	I don't believe there should be 2 days set aside for youth hunts and I also think the age should be 15 or below. Anyone who can drive themselves to a hunt in my mind is not a youth.	Guilford	HESTER, KEVIN B
GB14	District 6	Yes	Only input I have on this is that it needs to be boldly stated that this season is for hunters 17 and under who are born before February 10, 2002. To many 18 year olds try to slip in on this even though it's in the rule book saying they don't understand.	Rowan	PATTON, JONATHAN D
GB14	District 6	No	Would prefer a December date and February 8	Moore	CAMERON, JAMES B
GB14	District 8	Yes	I agree with the dates proposed, however I think that allowing the youth to be able to hunt from 30 minutes before sunrise to 30 minutes after sunset would be great. This past season on the last day we did not see anything all day, then at sunset we started packing up our setup. Roughly 10 minutes after sunset the ducks started pouring into our spot, I mean 20 feet from us. It was a great experience for the boys to witness, but there was still plenty of light left and they could have harvested a few birds. Granted my boys are hooked regardless and they can not wait for the upcoming season. Thank you for your time, Corey Bonino Shelby, NC.	Cleveland	Bonino, Corey D
GB14	District 9	No	I would advocate for the Youth Waterfowl Days to be open for coots only.	Buncombe	Cannon, Luke
GB14	Out of State	No	Put one youth day earlier in the year, early December during the split, a Saturday, so that snow goose conservation season can start a week earlier in February	Out of State	STEPHENSON, BRADLEY W
GB14	Out of State	No	Recommend an early season date to have warmer weather for the kids and have a chance at Wood Ducks.	Out of State	HOLCOMBE JR, RALPH L
GB15					
GB15	District 1	No	I'm pro military and my father is retired military but I'm against adding additional days for more adults. More and more additional days for hunting is putting more pressure on the resource. Along the coast where I live is already WAY over pressured. Also, I was looking at the nchunt fish forum message board earlier and there was a discussion going on about this. 2 military members had commented and even they were opposed to it.	Dare	SCARBOROUGH JR, HARVEY D
GB15	District 1	No	I don't think that adults need a special extra day to hunt. Maybe for disabled veterans. If you give a day to military then you will have to extend that to first responders and policemen. Not a good idea in my opinion.	Hyde	NEWMAN III, THOMAS E
GB15	District 1	No	I have nothing but respect for our Veterans but special hunting days are unfair.	Bertie	ROSE, JORDAN V

REG	DISTRICT	POSITION	ADDITIONAL COMMENTS (OPTIONAL)	COUNTY	NAME
GB15	District 1	No	I do not believe Veterans/Military Days should occur on the same dates as Youth Days. Those days should be for youth only with no potential for "competition". If they are held on the same day, NCWRC posted waterfowl impoundments should be for youth only. Increasingly, the agency's popular impoundments at times are nearing overcrowding conditions on youth days. Allowing veterans and active duty military to also hunt NCWRC impoundments on these 2 special days would be a mistake in my opinion.	Perquimans	FULLER, LUKE W
GB15	District 1	No	I am very supportive of the addition of these hunt days. I DO NOT, however, think they should be combined with youth waterfowl days. All good hunting in Eastern NC and lodging is already booked with youth that weekend. By including veterans, you will take away from youth access. I suggest you work with NC legislators to allow these two hunts to be conducted on the Sundays following youth waterfowl days!	Hyde	ORR II, ROBERT C
GB15	District 2	Yes		Onslow	MILLIGAN, CHRISTOPHER N
GB15	District 2	Yes	This gives the vets a great chance to hunt with their kids. The dates however should be at least one week in total after the regular duck season ends.	Onslow	SMITH, BRADLEY W
GB15	District 2	Yes	Maybe a veteran would also consider taking a youth hunting.	New Hanover	GIBSON JR, JAMES F
GB15	District 2	Yes	This would be a very nice addition to hunting season for the Military.	Onslow	BRANNEN III, MICHAEL J
GB15	District 2	Yes	This will allow a veteran or active duty to hunt with a kid on these special days.	Onslow	ADAMS, DENNIS G
GB15	District 2	No	No duck season should run concurrent with deer seasons. Duck hunting interferes with deer hunting as duck hunters can, by navigal waterways, slide into a duck hole directly behind a deer hunters hunting spot and duck hunt without regard for the deer hunter. duck hunting requires equipment that lends it to be a cold weather sport. all duck hunt seasons should be jan.2-march1. this is a common problem in the southeastern part of our state. duck hunters have absolutely no regard for deer hunters. if an area can be reached by boat where duck hunters can leagally enter a body of water, they will go wherever the ducks are and don't care about the deer hunters who also got up early to have a peaceful, fulfilling morning in the field. moreover, duck seasons should most definitely not run concurrent with the white tail rut, when a hunter is most likely to tag the biggest buck they have ever seen in the field. No duck hunting during deer season-period, but especially from oct. 25-nov. 15	Pender	boone JR, william o
GB15	District 2	No	My concern is will enforcement be effective? If enforcement division can properly enforce I am for it. What is allowable proof of veterans status?	Pitt	FARLEY, JOHN B
GB15	District 3	Yes	As a combat veteran this would be greatly appreciated !	Johnston	FRANKS, CONNOR A
GB15	District 3	No	veteran/military personal already have opportunity to hunt 60 days during regular season no need to hand hold grown adults and give opportunity to be widely abused by other hunters who don't actually qualify and will give the game wardens a headache to try to enforce	Wake	LOWDERMILK, JOHN B

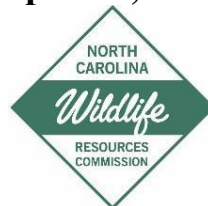
REG	DISTRICT	POSITION	ADDITIONAL COMMENTS (OPTIONAL)	COUNTY	NAME
GB15	District 4	Yes	<p>dates are fine, but as a retired and disabled veteran I see no need. But since it was established, and I am all about hunting opportunity, I guess it will go whether I see the need or not.</p> <p>Enforcement will be a challenge - how does one prove veteran status for this type of hunt? Retired veterans, who did 20+ years, have a retired veteran ID card. Some disabled veterans have a VA card. However most of the veterans out there have neither. A veteran is anyone who has served, whether honorably or dishonorably. Will the NCWRC require people to carry a DD214 (Discharge papers) if they don't have some other proof? Will the NCWRC annotate veteran status on the hunting license, after submission of proof of veteran status?</p> <p>I see a lot of instances of stolen valor on these dates.</p> <p>Enforcement will be a challenge - I wish you luck.</p>	Scotland	PATRICK, JOHN D
GB15	District 4	No	Hold separate days to not take away from youths chances of harvesting birds	Robeson	CAUDELL, ETHAN K
GB15	District 5	No	Haveing veterans days are fine but does not need to go into February.The ducks are pairing up and the general hunt can't go into February.The days should be taken between November and December	Guilford	KRAMER, MARTIN M
GB15	District 5	No	Youth only!!! Now I love our veterans, and they should never pay for a license	Rockingham	COBB, RONALD W
GB15	District 6	No	I believe the youth days should be youth only.	Moore	CAMERON, JAMES B
GB15	District 6	No	I'd like to see at least one Saturday dedicated to the youth. For the veterans I would suggest a Saturday and a weekday hunt.	Rowan	PATTON, JONATHAN D
GB15	District 9	No	I come from a military family, and non of us feel that it is necessary to have a "special day" in order to hunt. I believe this is a ludicrous and politically motivated/ corrupt proposal and hopefully no honorable Men or Women in service will support it.	Buncombe	Cannon, Luke
GB15	Out of State	No	Same as youth day, run them concurrent, but move one day to a Saturday during the split in early December, so that snow goose conservation season can start a week earlier in February	Out of State	STEPHENSON, BRADLEY W
GB15	Out of State	No	Recommend one of the days be an early season day for possible Wood Duck Hunting.	Out of State	HOLCOMBE JR, RALPH L
GB16					
GB16 Has No Additional Comments					
GB17					
GB17	District 2	No	Should hunt the same as gun season.	Onslow	ADAMS, DENNIS G
GB17	District 9	No	I do not support the hunting of Woodcock after December 31st.	Buncombe	Cannon, Luke
GB18					
GB18	District 9	No	I do not support a hunting extension.	Buncombe	Cannon, Luke
GB19					
GB19	District 9	No	I do not support the proposed extension.	Buncombe	Cannon, Luke
GB20					

REG	DISTRICT	POSITION	ADDITIONAL COMMENTS (OPTIONAL)	COUNTY	NAME
GB20	District 1	Migratory Game Bird Other	I believe the Wildlife Commission does a great job with our natural resources. The only thing that I believe needs to be changed is the Northeast Hunt Zone (Canada Geese). I believe it needs to be open during duck season dates with a limit of 1-3 per day. Hunter's can help with the over abundance of resident geese and I believe will not harvest many if any migratory geese. If we need to gas or use deprecation permits then the Wildlife Commission should see we need to have a season and limits to help control the population. Thanks again	Perquimans	HUNTER, PAUL A
GB20	District 2	Migratory Game Bird Other	Please rid NC of October duck hunts. This is a waste of days to hunt as the hunting is never good. We could add Sundays to at least the 3d split to have people who can only hunt weekends the chance to hunt more often.	Onslow	SMITH, BRADLEY W
GB20	District 2	Migratory Game Bird Other	Would like to get hunting on Sundays	Jones	DOWNS, MATTHEW P
GB20	District 3	Migratory Game Bird Other	I respectfully ask that the Wildlife Resources Commission petition the North Carolina Attorney General to initiate action to abolish the Game Commissions in Dare and Currituck Counties as well as abolish the "Safe Hunter Law" in Pamlico and Carteret Counties. Please advocate for following the North Carolina Constitution (Section 5) as well as the NC Public Trust Doctrine. No one should have the right of exclusivity for hunting in public waters; NC waterfowl hunters should be able to hunt in Public Trust waters anywhere in the state.	Johnston	BROADWELL, JAMES W
GB20	District 3	Migratory Game Bird Other	The start dates need to be held up a week or two at the begging and extend the season a week or two at the end. This can still allow a week of youth season to play out. Most parents take there kids to hunt threw out the year so a week and the end of the season should be fine. Trust me I hunt every day of the season and the two weekends that I have fathers bring in there kids I have to make fathers leave because I catch them shooting more then the kids do (taking the kids gun) or the child they bring (not theirs). The laws are broken more in these two weekends then most season (baiting, shooting time, and bag limits) and I personally am getting tired of seeing the state know that this is an issue and turn an look the other way. The law enforcers are very tired at this point of season and it is probably harder on them at this point of year then others. They work hard every year and I know they know of laws being broken at different places but can only handle what their resources allow.	Franklin	HOCUTT, JASON H
GB20	District 5	Migratory Game Bird Other	All in favor of the extension of the season to January 31.	Orange	LAMB JR, JOHN T
GB20	District 5	Migratory Game Bird Other	I commend you on adding days for veteran/military but again, it should be limited to 1 day. I also think there should be consideration given for a Senior day (65 and older) for waterfowl. We have paved the way for future generations and do our part in mentoring to insure the love and traditions have and will be preserved for years to come.	Guilford	HESTER, KEVIN B
GB20	District 6	Migratory Game Bird Other	If you guys aren't going to stop baited hunting (flooded unharvested crops) which has kept the birds from migrating till late, I think the season should run from late December to February.	Stanly	Thompson, Sarah B

REG	DISTRICT	POSITION	ADDITIONAL COMMENTS (OPTIONAL)	COUNTY	NAME
GB20	District 6	Migratory Game Bird Other	<p>I am a member of the Flyway Federation and would like you to consider our position on the late migratory patterns.</p> <p>Currently, the Migratory Bird Treaty Act ("MBTA") includes language that allows individuals and entities to plant, grow, and leave unharvested commodity crops on large numbers of acres throughout the United States, under the guise of following a "normal" agricultural practice, but with the sole intent of attracting and concentrating large numbers of migratory waterfowl. The consequence of these unnatural practices has resulted in migratory waterfowl exhibiting unnatural migration habits, including delayed migration as well as historically shortened migration routes.</p>	Stanly	THOMPSON, TAYLOR J
GB20	District 6	Migratory Game Bird Other	<p>North Carolina residents should be able to duck hunt on sundays, but should not allow out of state hunters to do so.</p> <p>Also, North Carolina permit hunts should only be allowed for NC residents. When I want to go hunt in other states they make it very costly and difficult to get the license and permits needed for their best hunts. In state residents are given a preference. We should do the same in NC. I'm paying state taxes in NC, yet my chance of hunting the best public NC duck hunting is only 4%, which is the same as an out of state hunter that pays no NC taxes.</p>	Mecklenburg	MILNER, CLIFFORD G
GB20	District 6	Migratory Game Bird Other	<p>Comorants are abundant in the Yadkin river chain. They are a nuisance animal and need to be put into a bag limit.</p>	Rowan	PATCH, CRAIG A
GB20	District 9	Migratory Game Bird Other	<p>I am very much in favor of limiting hunting season lengths and bag limits for all species mentioned above with the exceptions of Canada Goose and American Coot.</p> <p>The populations of all of our waterfowl and game birds other than the Canada Goose, are significantly lower than historic populations. I believe current limiting of season length and bag limits would greatly benefit hunters, fowl populations, and the habitats they both inhabit, for future generations. I believe we have a responsibility as Hunters and wildlife managers to steward our avian species back towards healthier populations.</p> <p>Thank you, ~ Luke Cannon</p>	Buncombe	Cannon, Luke
GB20	Out of State	Migratory Game Bird Other	<p>Season look good now I just need more time off to hunt. Keep up the good work.</p>	Out of State	BLAKE, THEODORE F
GB20	Out of State	Migratory Game Bird Other	<p>I feel that myself and my waterfowl hunting friends in the great State of N.Carolina are being adversely effect by Agricultural crops grown solely for flooding and baiting waterfowl. Please support a return to the original language as it was written in the MBTA. This will prevent shortstopping and holding waterfowl in one area which reduces the opportunities for many hunters.</p> <p>Sincerely, Kevin B. Fontenot</p>	Out of State	Fontenot, Kevin B

EXHIBIT I-3

April 25, 2019



2019-20 Migratory Game Bird Gun Season Frameworks and WMD Staff Recommendations

Species	Frameworks	Staff Recommendations	
		Staff Recommended Season	Daily Bag
Mourning Dove & White-winged dove	Outside Dates: September 1 – January 31, 90 days with 3 segments daily bag of 15 singly or in the aggregate	September 2 – October 5, November 16 – November 30 December 9 – January 31	15
King & Clapper Rails	Outside Dates: September 1 – last Sunday in January (January 26) 70 days with 2 segments daily bag of 15 singly or in the aggregate	September 7 – November 27	15
Sora & Virginia Rails	Outside Dates: September 1 – last Sunday in January (January 26) 70 days with 2 segments daily bag of 25 singly or in the aggregate	September 7 – November 27	25
Gallinule & Moorhens	Outside Dates: September 1 – last Sunday in January (January 26) 70 days with 2 segments daily bag of 15 singly or in the aggregate	September 7 – November 27	15
Woodcock	Outside Dates: October 1 – January 31 45 days with 2 segments, daily bag of 3	December 7 – January 28	3
Common Snipe	Outside Dates: September 1 – February 28 107 days with 2 segments daily bag of 8	October 28 – February 28	8

Species	Frameworks	Staff Recommendations	
		Staff Recommended Season	Daily Bag
Canada Goose (September season)	<p>Outside Dates: September 1 – 30 (statewide), 30 days daily bag of 15 Special methods: During the September Canada goose season only, the following expanded hunting methods area allowed:</p> <ol style="list-style-type: none"> 1. Extended shooting hours to ½ hour after sunset. 2. unplugged guns 3. electronic calls <p>Note: The special methods cannot occur during any other open waterfowl season, e.g., teal season.</p>	<p>September 2 – 30 (statewide)</p> <ol style="list-style-type: none"> 1. extend shooting hours to ½ hour after sunset 2. allow use of unplugged guns 3. allow use of electronic calls <p>These expanded methods are <u>only</u> to be allowed west of U.S. 17.</p>	15
September Teal	<p>Outside Dates: September 1 – 30, 16 consecutive days, daily bag of 6, east of U.S. 17 only</p>	<p>September 12 – September 30 (East of U.S. 17 only)</p>	6
General Duck Season	<p>Outside Dates: Saturday nearest September 24 (September 21) – January 31, 60 days with 3 segments, daily bag of 6</p> <p>Includes a total of 6 ducks with no more than 4 scoters, 4 eiders, 4 long-tailed ducks, 3 wood ducks, 2 mallards with no more than 1 hen mallard, 2 scaup, 2 redheads, 2 canvasbacks, 2 black ducks, 1 pintail, 1 mottled duck, and 1 fulvous whistling duck. The season on harlequin ducks is closed.</p>	<p>October 2 – October 5, November 16 – December 2, December 14 – January 31</p>	<p>Includes a total of 6 ducks with no more than 4 scoters, 4 eiders, 4 long-tailed ducks, 3 wood ducks, 2 mallards with no more than 1 hen mallards 2 scaup, 2 redheads, 2 canvasbacks, 2 black ducks, 1 pintail, 1 mottled duck and 1 fulvous whistling duck. The season on harlequin ducks is closed. The season on black ducks and mottled ducks is closed until November 23.</p>

		Staff Recommendations	
Species	Frameworks	Staff Recommended Season	Daily Bag
Mergansers	Dates: same as general duck season, daily bag of 5 mergansers with no more than 2 hooded mergansers	Same as general duck season	5 mergansers with no more than 2 hooded mergansers
Coots	Dates: same as general duck season, daily bag of 15 coots	Same as general duck season	15 coots
Special Sea Duck Season (in the special sea duck area)	Outside Dates: September 15 – January 31 60 consecutive days or season must coincide with the general duck season. daily bag of 5 sea ducks with no more than 4 scoters, 4 eiders and 4 long-tailed ducks	November 23 – January 31	5 sea ducks with no more than 4 scoters, 4 eiders and 4 long-tailed ducks
Canada Geese (Resident Population Zone) – includes Canada Geese and White-fronted geese	Outside Dates: October 1 – March 10 80 days with 3 segments, daily bag of 5 Canada geese or white-fronted geese singly or in the aggregate	October 2 – October 12, November 16 – December 7, December 14 – February 8	5
Canada Geese (Northeast Hunt Zone) – includes Canada Geese and White-fronted geese	Outside Dates: Saturday prior to December 25 (December 21) – January 31 14 days, daily bag of 1 Canada goose or white-fronted goose	January 16 – January 31	1 with a valid permit (unlimited point of sale permits available)

Species	Frameworks	Staff Recommendations	
		Staff Recommended Season	Daily Bag
Brant	Outside Dates: Saturday nearest September 24 (September 21) – January 31 30 days with 2 segments, daily bag of 2	December 28 – January 31 (30 days total)	1
Light Geese (includes snow and Ross's geese) – regular season	Outside Dates: October 1 – March 10 107 days with 3 segments, daily bag of 25 (no possession limit)	October 8 – February 8	25 (no possession limit)
Light Geese (includes snow and Ross's geese) – Conservation Order season	Outside Dates: Must occur when no other waterfowl season is open, no daily bag, no possession limit <ul style="list-style-type: none"> • electronic calls allowed • unplugged guns allowed • extended shooting hours to ½ hour past sunset allowed 	February 10 – March 31	<ul style="list-style-type: none"> • no daily bag limit • no possession limit • electronic calls allowed • unplugged guns allowed • allow shooting to extend to ½ hour past sunset
Tundra Swan	Outside Dates: October 1 – January 31 90 days, no segments allowed, 1 per season with valid permit (6,115 permits available)	November 9 – January 31	1 per season with valid permit

Species	Frameworks	Staff Recommendations	
		Staff Recommended Season	Daily Bag
Youth Waterfowl Day(s)	<ul style="list-style-type: none"> • 2 youth days allowed • The day(s) can occur up to 14 days before or after any regular duck season or in the closed portion between season segments. • The day must occur on any non-school day. In North Carolina, this includes Saturdays and any statewide holidays. • States may use their established definition of age for youth hunters. However, youth hunters may not be over the age of 17. 	February 1 & February 8	Includes ducks, geese, brant, tundra swans, mergansers and coots. Must have a valid permit if hunting tundra swans and Canada geese (Northeast Hunt Zone only)
Veterans/Military Waterfowl Day(s)	<ul style="list-style-type: none"> • 2 veterans/military days allowed • Includes veterans and members of the Armed Forces on active duty, including National Guard and Reserves on active duty (other than for training). • The day(s) can occur up to 14 days before or after any regular duck season or in the closed portion between season segments. • Can be held concurrently with the Youth Waterfowl Day(s) 	February 1 & February 8	Includes ducks, geese, brant, tundra swans, mergansers and coots. Must have a valid permit if hunting tundra swans and Canada geese (Northeast Hunt Zone only)

- Federal guidelines allow for shooting hours for all migratory game birds to be from ½ hour before sunrise to sunset.
- Possession limit is three times the daily bag for all species.

EXHIBIT I-4

April 25, 2019



Extended Falconry Season Highlights & WMD Staff Recommendations for 2019-20 Extended Falconry Seasons for Migratory Game Bird Species

General Restrictions/Guidelines

- Seasons must fall between September 1 and March 10
- Total days available for falconry cannot exceed 107 (for each species) and includes regular, i.e., gun seasons, experimental seasons and extended falconry seasons
- The falconry daily bag limit is 3 permitted migratory game birds, singly or in the aggregate. The regular, i.e., gun season bag limits for individual species do not apply.
- Each extended season may be divided into a maximum of 3 segments
- The falconry bag limit is not in addition to the gun bag limit

WMD Staff Recommendations

If the Commission chooses staff recommended “gun” seasons as presented, we recommend the following extended falconry seasons.

Mourning dove/White-winged dove	October 12 – October 26
Rails, Gallinule and Moorhens	November 30 – January 4
Woodcock	November 2 – November 30 and February 1 – February 29
Ducks, mergansers and coots	October 21 – November 2 and February 1 – February 15

EXHIBIT J

April 25, 2019



Staff Recommendations to Allow Take of Migrant Peregrine Falcons from the Wild for Use in Falconry- 2019

The Atlantic, Mississippi, and Central Flyway Councils approved an allowable take of 144 Peregrine Falcons by falconers. Based upon this allocation, the USFWS is allowing the take of up to 48 fall migrants in 2019 east of 100 degrees W longitude to Atlantic Flyway states. North Carolina is allocated up to 6 birds.

Based on this allocation of up to 6 birds for take from within North Carolina, WMD staff recommends that the WRC accept the USFWS allocation framework and establish a season in 2019 with the following stipulations.

- Total allowable take is up to 6 birds during the period from September 20, 2019 through October 20, 2019.
- Any bird taken must be a juvenile.
- Take would be allowed only by permit from the WRC and only east of US Highway 17.
- No banded birds could be taken. Any banded birds captured must be released immediately at the site of capture.
- Permits will be issued through our special hunts permitting system (random).
- An individual issued a permit must have the proper state and federal falconry licenses/permits.
- Each person receiving a permit must complete a post-season survey provided by WMD staff and submit that survey no later than December 15, 2019.

EXHIBIT K-1

April 25, 2019



Brook Floater Conservation Plan for North Carolina



BROOK FLOATER CONSERVATION PLAN for NORTH CAROLINA

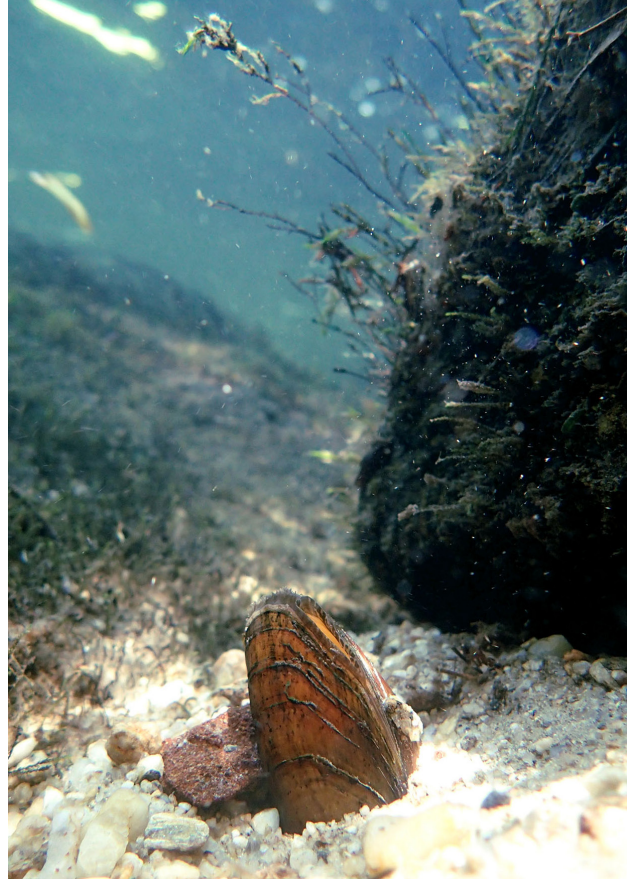
April 25, 2019



NORTH CAROLINA WILDLIFE RESOURCES COMMISSION



Brook Floater found in the Linville River



Brook Floater in Wilson Creek



Collecting tissue from a Brook Floater for genetic analysis



Brook Floaters from the Roaring River



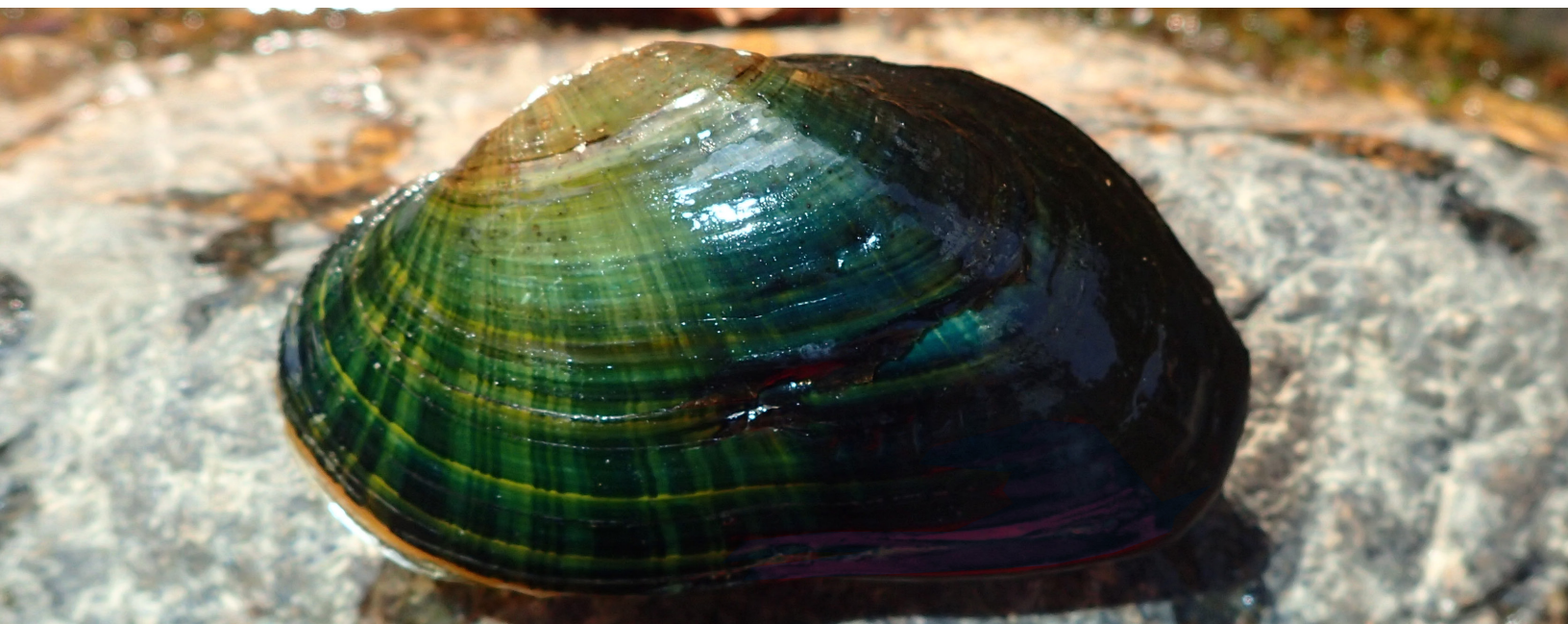
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Executive Summary

The Brook Floater (*Alasmidonta 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 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



Conducting mussel surveys

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

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 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)

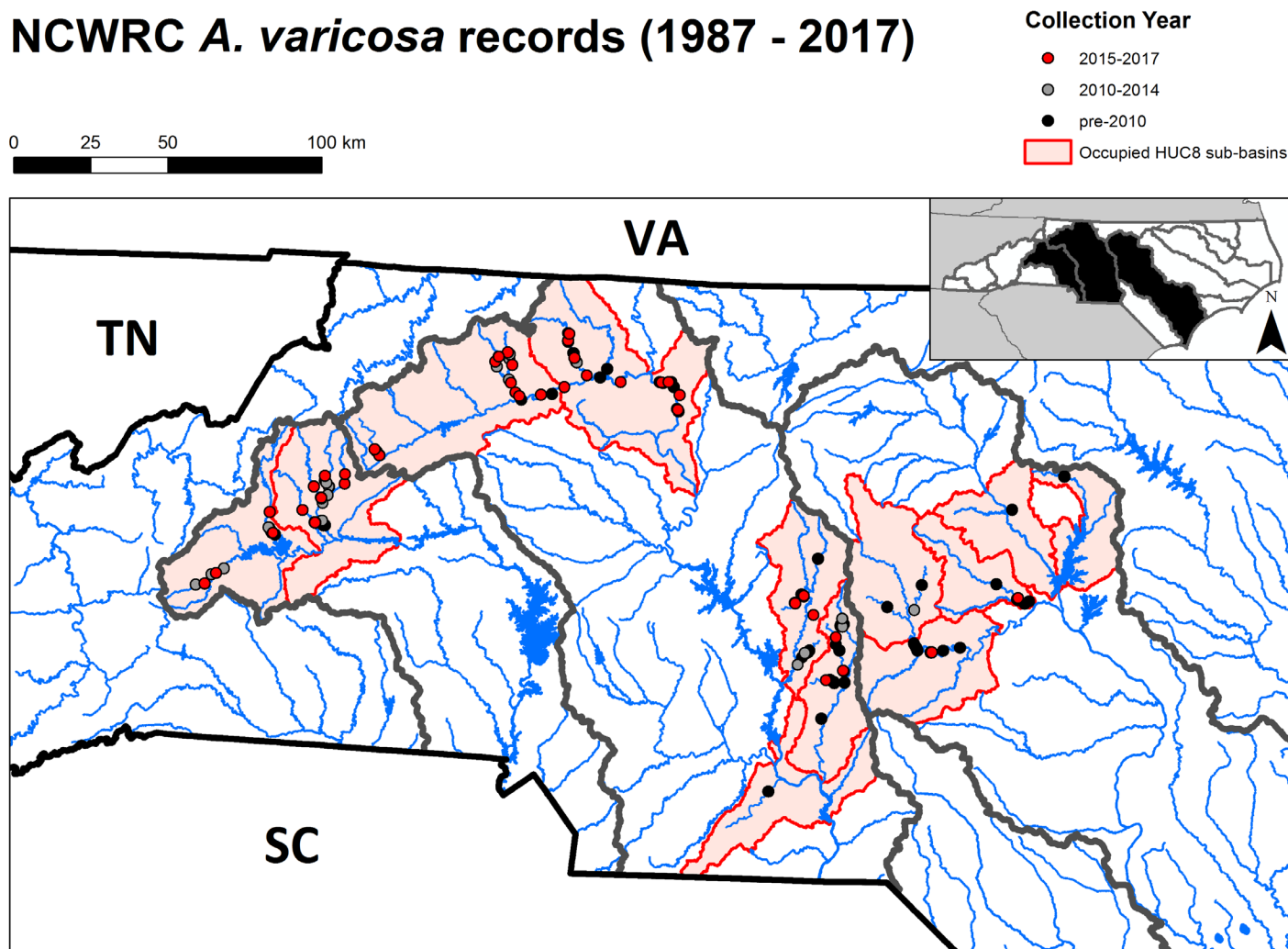


Figure 1. Distribution and collections of Brook Floaters in North Carolina

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).

ECONOMIC IMPACTS

Potentially Affected Parties

Implementation of this conservation plan will primarily affect the N.C. Wildlife Resources Commission. The Commission will be responsible for virtually all the population management, habitat management, monitoring, and research.

To a lesser extent, parties applying for development permits will also be affected.

Agency Costs

Monitoring and survey costs associated with this plan are anticipated to be approximately \$35,000 through 2030. Costs related to propagation of the Brook Floater are estimated at approximately \$30,000. Staff time to develop a Candidate Conservation Agreement with Assurances or Safe Harbor agreement are expected to be approximately \$3,000. There is no way to estimate how many projects Commission staff will review where the Brook Floater may be affected, but permit review requires approximately two hours of staff time per project and would cost an estimated \$74 per project. Cost for land acquisition depends on size of tract. Costs typically range from \$200,000 to \$5,000,000. However, tracts will be put in the Game Lands program and serve multiple purposes, so cost must be spread across multiple programs and benefits. Costs to produce outreach materials and conduct educational events should not exceed \$5,000.

Costs to Others

Developers will be required to assess projects for any potential impacts to listed species as part of the permit application process for development. All currently available species data is available free of charge on the Natural

Heritage website and applicants can request free assistance in interpreting the data. However, if data do not exist on a species, a survey may need to be completed, at the developer's expense, before the project begins. A site survey for a species is nominal to the developer compared to the total expense of a project. The costs associated with the survey are typically absorbed into other scoping, survey or environmental fees that developers incur as part of the site development.

Efforts to Minimize Costs and Adverse Economic Impacts

The Wildlife Commission will utilize two main strategies for minimizing the economic impacts of implementing this plan. First, the Commission will utilize federal grant funding to carry out most of the plan's actions. These activities are eligible for funding through the State Wildlife Grants (SWG) Program. SWG will cover 65% of the costs of virtually all of the plan's actions.

Second, the Commission will only introduce Brook Floater into new areas if listing is deemed not warranted or a Candidate Conservation Agreement with Assurances or Safe Harbor can be implemented, which will reduce adverse economic impacts related to potential restrictions of Endangered Species Act should the Brook Floater get listed as Endangered or Threatened by the US Fish and Wildlife Service.



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EXHIBIT K-2

April 25, 2019



Robust Redhorse Conservation Plan for North Carolina



ROBUST REDHORSE CONSERVATION PLAN for NORTH CAROLINA

April 25, 2019



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



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



Collecting eggs from a female Robust Redhorse



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 Isely 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.

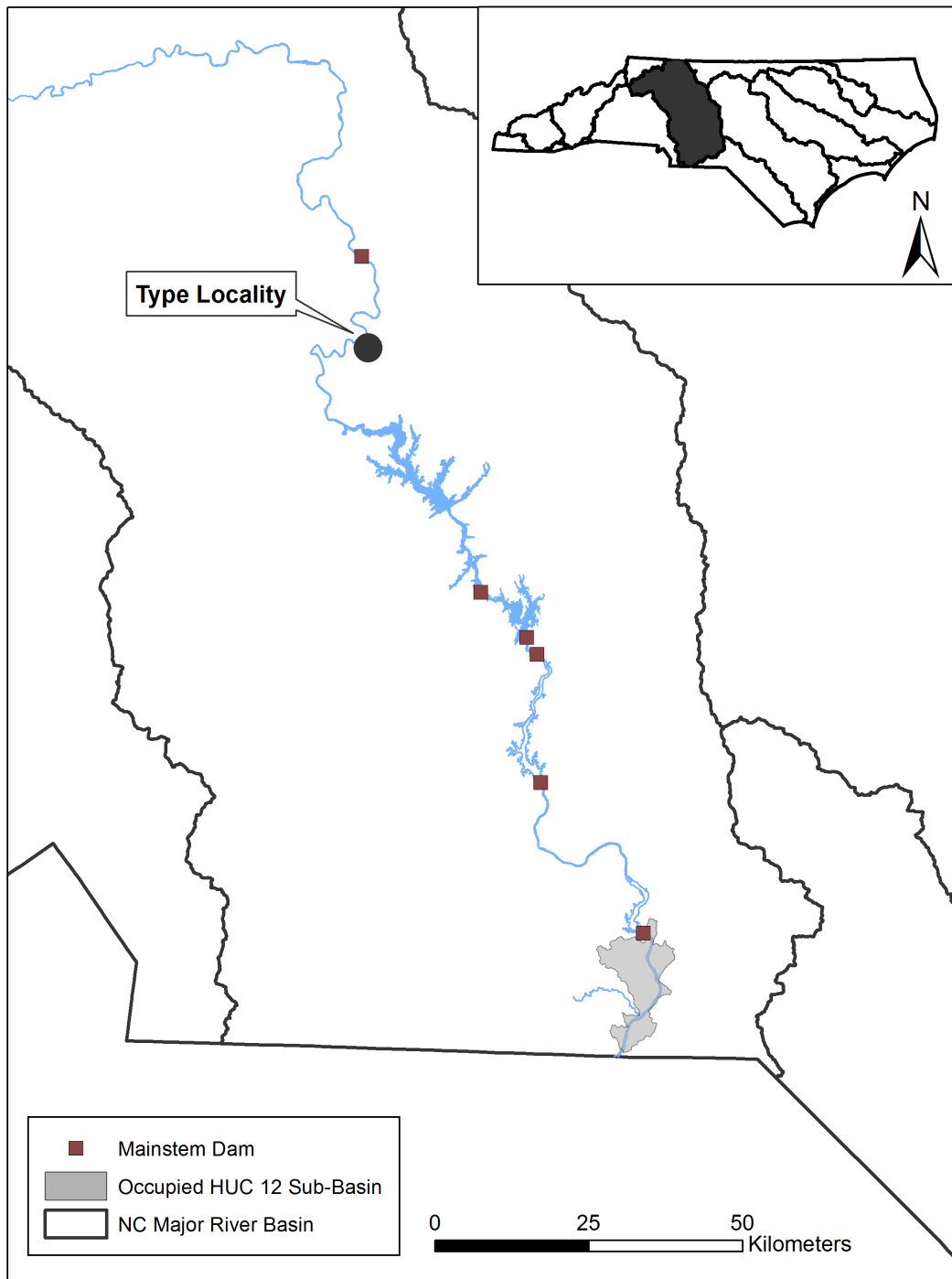


Figure 1. Range and type locality of Robust Redhorse in the Yadkin-Pee Dee River in NC.

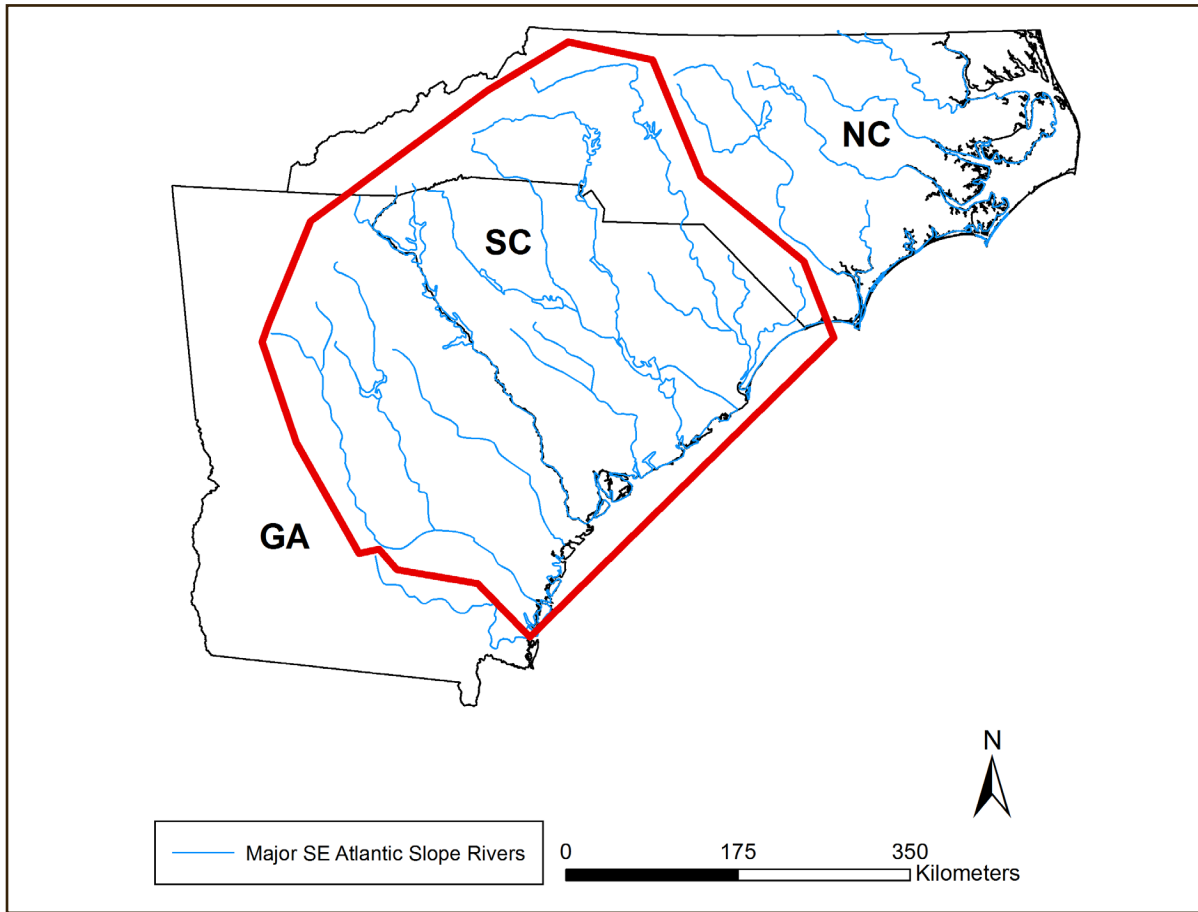


Figure 2. Historic range of Robust Redhorse in Atlantic Slope Rivers of the southeast as indicated by the red outline.

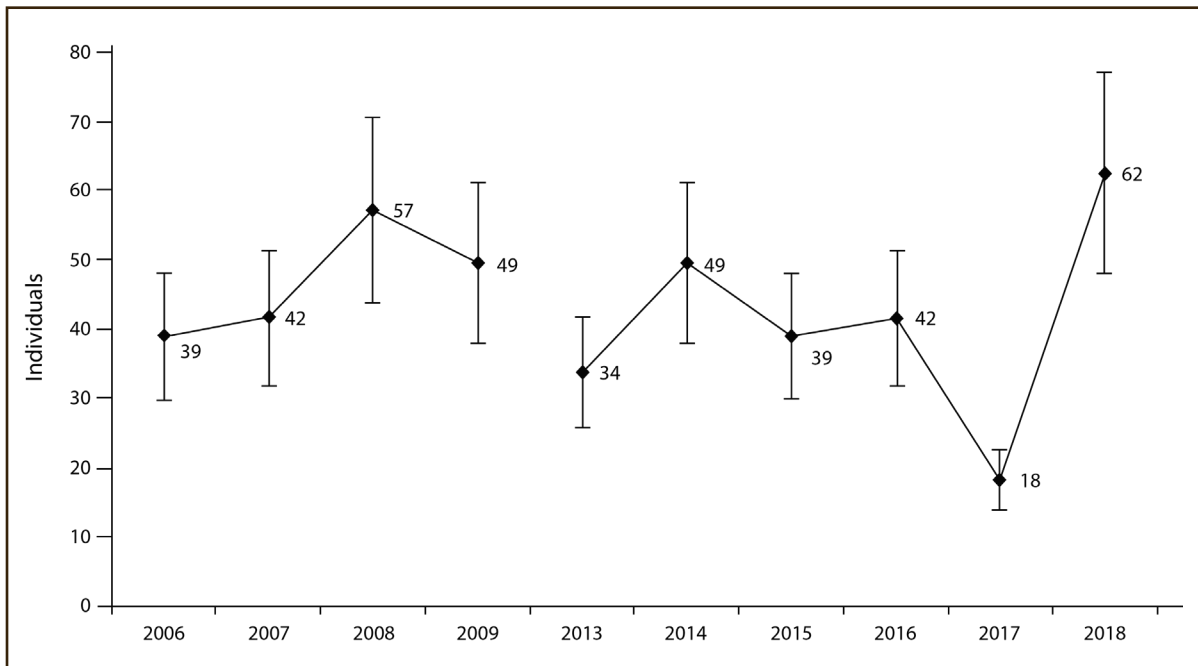


Figure 3. Annual adult breeding population estimates for Robust Redhorse on Pee Dee River spawning shoals in NC. Error bars represent 95% confidence intervals. Gap from 2010-2013 represents years spring sampling was not conducted.

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.

Economic Impacts

Potentially Affected Parties

Implementation of this conservation plan will primarily affect the Wildlife Commission. The Commission will be responsible for virtually all the population management, habitat management, monitoring, and research.

To a lesser extent, parties applying for development permits may also be affected.

Agency Costs

Monitoring and survey costs associated with this plan are anticipated to be approximately \$200,000 through 2030. Costs related to propagation of the Robust Redhorse are estimated at approximately \$90,000. Staff time to develop a Candidate Conservation Agreement with Assurances or Safe Harbor agreement are expected to be approximately \$3,000. There is no way to estimate how many projects Wildlife Commission staff will review where the Robust Redhorse may be affected, but permit review requires approximately two hours of staff time per project and would cost an estimated \$74 per project.

Costs to Others

Developers may be required by the NC DEQ or US COE to assess projects for any potential impacts to listed species as part of the permit application process for development. All currently available species data are available free of charge on the Natural Heritage website and applicants can request free assistance in interpreting data at any time. However, if data do not exist on a species, a survey may need to be completed, at the developer's expense, before the project begins. A site survey for a species is nominal to the developer compared to the total expense of a project. The costs associated with the survey are typically absorbed into other scoping, survey or environmental fees that developers plan for as part of the site development.

Efforts to Minimize Costs and Adverse Economic Impacts

The Wildlife Commission will utilize two main strategies for minimizing the economic impacts of implementing this plan. First, the Wildlife Commission will utilize federal grant funding to carry out most of the plan's actions. These activities are eligible for funding through the State Wildlife Grants (SWG) Program. SWG will cover 65% of the costs of virtually all the actions called for in this plan.

Second, the Commission will only introduce Robust Redhorse into new areas if listing is deemed not warranted or a Candidate Conservation Agreement with Assurances or Safe Harbor can be implemented, which will reduce adverse economic impacts related to potential restrictions of the Endangered Species Act should the Robust Redhorse get listed as Endangered or Threatened by the US Fish and Wildlife Service.



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EXHIBIT K-3

April 25, 2019



Gopher Frog Conservation Plan for North Carolina



GOPHER FROG CONSERVATION PLAN for NORTH CAROLINA

April 25, 2019



NORTH CAROLINA WILDLIFE RESOURCES COMMISSION



Gopher Frog in a "defensive" posture



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

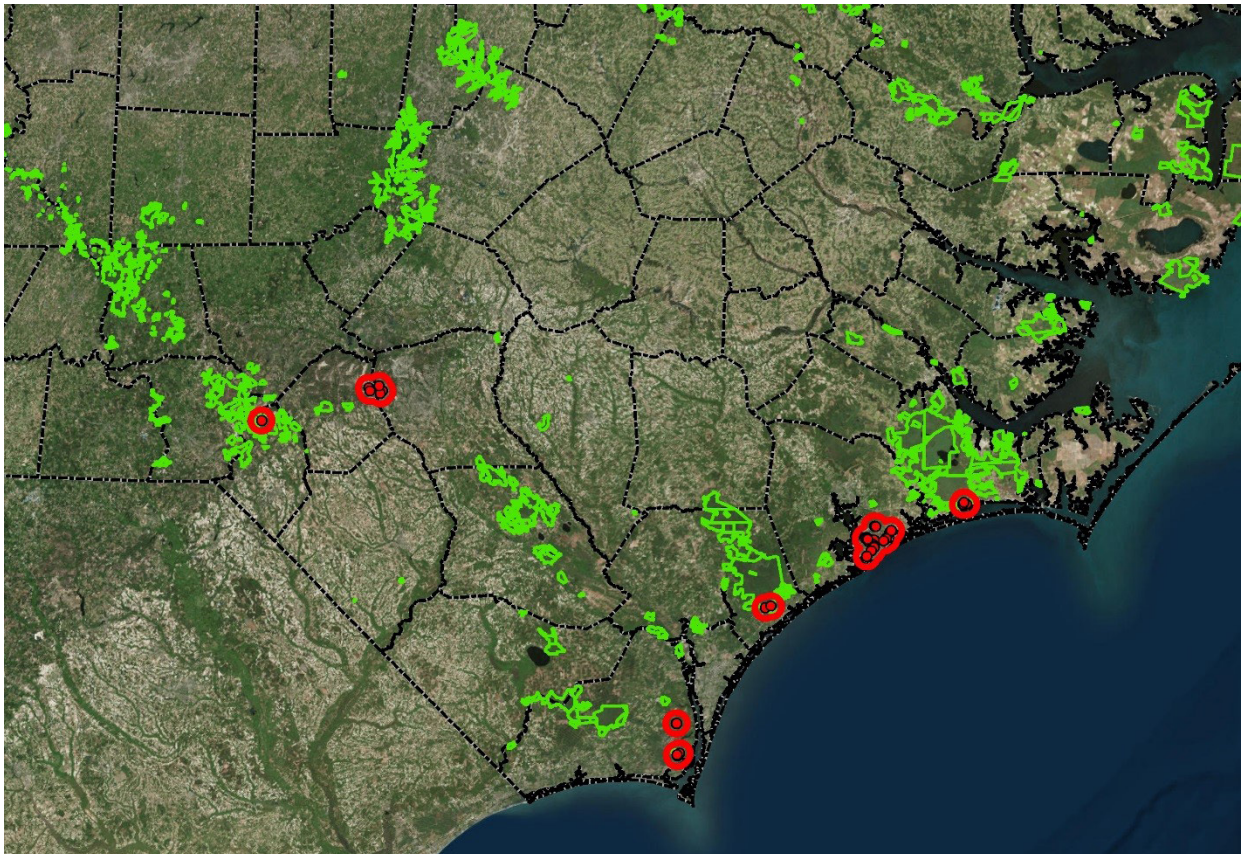


Figure 1. Distribution of known breeding ponds of *Rana capito* in North Carolina, depicted as red dots. Currently, there are only seven populations, depicted as red circles around the dots. Green outlines show extent of Wildlife Commission game lands. (Map source: Esri, DigitalGlobe, GeoEye, Earthstar 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

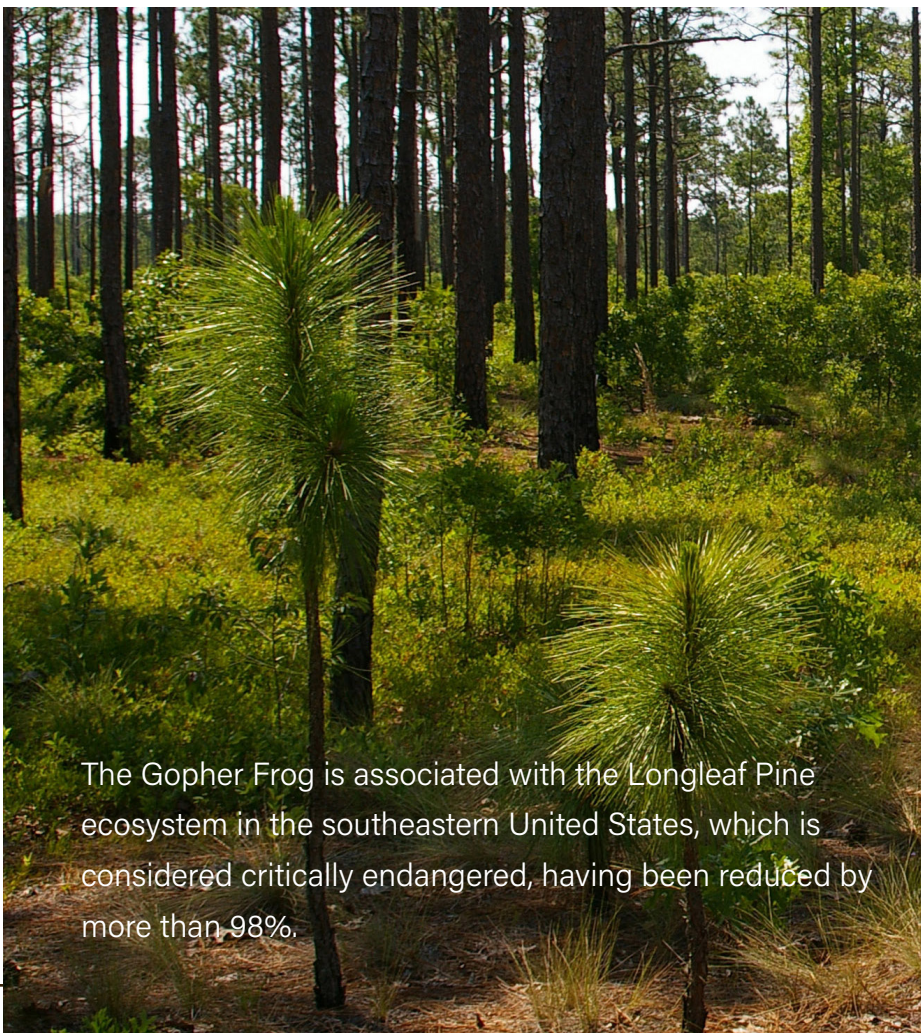
Braswell (1993) reported on the status of *R. capito* in North Carolina and recommended state Threatened status for the species based on a significant reduction in the number of active breeding sites and the threats to those remaining sites. Since that report, new Gopher Frog breeding sites have been 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*).

ECONOMIC IMPACTS

Potentially Affected Parties

Although Gopher Frogs can be found on several Wildlife Commission game lands (Holly Shelter, Sandhills, and Swain Tract), many are located on other public lands or on private lands. Partnerships with many agencies — both state and federal — as well as private landowners, will be required to maintain Gopher Frogs on the landscape in North Carolina. Agencies and/or municipalities with lands sustaining current populations of Gopher Frog include: US Forest Service (Croatan National Forest); Department of Defense (Camp Lejeune, Fort Bragg, and MOTSU); North Carolina Plant Conservation Program (Boiling Spring Lakes); and the town of Southport (which includes MOTSU lands). Agencies participating in head-starting efforts include: North Carolina Aquarium at Fort Fisher, North Carolina Aquarium at Pine Knoll Shores, and North Carolina Zoo. In addition, the North Carolina Division of Parks and Recreation (Carolina Beach State Park) has offered lands for collection of head-starting materials, habitat management, and potential future releases.

Agency Costs

Research, monitoring and survey costs associated with this plan could reach \$70,000 annually, and involve four to six staff. Costs related to head-starting Gopher Frogs are relatively minimal, because these costs are primarily incurred by partner agencies. Staff time to develop a Candidate Conservation Agreement with Assurances or Safe Harbor agreement are expected to be approximately \$3,000. The Wildlife Commission cannot estimate how many projects its staff will review where the Gopher Frog may be affected, but permit review requires approximately two hours of staff time per project, which incurs an estimated \$74 per project.

Costs to Others

Private

If private landowners are interested in providing funds for Gopher Frog habitat management, they can do so, but all activities on private land will be voluntary and landowners will not incur expenses unwillingly. Costs otherwise will be covered by the Commission, other partners, and conservation grants.

Municipalities

If municipalities are interested in providing funds for Gopher Frog habitat management, they can do so, but all activities on municipal land will be voluntary and municipalities will not incur expenses unwillingly. Costs otherwise will be covered by the Commission, other partners, and conservation grants.

Other State Agencies

There is the potential for costs to NC Department of Transportation for mitigation and measures to address road mortality adjacent to Gopher Frog sites. This could include installation of underpasses, fences to keep frogs away from roads, or other measures to reduce mortality.

State agencies that have Gopher Frog populations on their property may incur costs for labor, supplies, and equipment for habitat management. This includes NC Division of Parks and Recreation, NC Plant Conservation Program, and possibly NC Forest Service. Potential costs could involve costs for fee-simple purchase of properties for conservation protection.

The NC Aquariums at Fort Fisher and at Pine Knoll Shores, as well as the North Carolina Zoo, will incur costs associated with head-starting efforts for the Gopher Frog. However, all partners participate at their discretion, and only do so willingly. This can include field survey work, egg mass collection, egg mass hatching, tadpole rearing, juvenile frog marking, and eventual releases, as well as all supplies necessary for the various stages of head-starting. Personnel from several state agencies (including the NC Zoo, NC Museum of Natural Sciences, Natural Heritage Program, etc.) participate routinely in various aspects of field work at times, as well as office/lab work cataloguing specimens and/or records of Gopher Frogs. These activities incur expenses to these agencies, but the costs typically are included within their respective budgets.

Federal Agencies

Any of the federal agencies that have Gopher Frog populations on their property may incur costs for labor, supplies, and equipment for habitat management. This includes US Forest Service and Department of Defense. Potential costs could involve costs for fee-simple purchase of properties for conservation protection.

The USFWS will incur costs by helping fund protection efforts (fee simple, easements), providing staff for coordination and collaboration, providing funds for development of outreach and education information, and printing of materials for coordination meetings.

NGOs

Although no current Gopher Frog populations are known to occur on NGO properties, given the mission of these organizations, it is possible that they will have costs for conservation easements and fee-simple purchase of properties for conservation protection.

Efforts to Minimize Costs and Adverse Economic Impacts

The Wildlife Commission will use two main strategies for minimizing the economic impacts of implementing this plan. First, the Commission will use federal grant funding to carry out many of the plan's actions. These activities are eligible for funding through the State Wildlife Grants (SWG) Program. SWG will cover 65% of the costs of some of the actions called for in this plan.

Second, the Wildlife Commission will only introduce Gopher Frogs into new areas if listing is deemed not warranted or a Candidate Conservation Agreement with Assurances or Safe Harbor can be implemented, which will reduce adverse economic impacts related to potential restrictions of the Endangered Species Act should the Gopher Frog get listed as Endangered or Threatened by the US Fish and Wildlife Service.

The Commission's work to achieve the goals presented in this Conservation Plan will be reduced by the many partners interested in Gopher Frog conservation. Proactive conservation before federal listing will greatly reduce management costs, compared to the costs under Endangered Species Act protection. Both public and private landowners benefit when they conserve Gopher Frogs before listing.

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Photo: Mike Sisson

EXHIBIT K-4

April 25, 2019



Bog Turtle Conservation Plan for North Carolina



BOG TURTLE CONSERVATION PLAN for NORTH CAROLINA

April 25, 2019



NORTH CAROLINA WILDLIFE RESOURCES COMMISSION



Juvenile bog turtle



Searching for bog turtles



Counting scutes on a bog turtle (Photo: Gary Peeples/USFWS)



Measuring a bog turtle (Photo: Gary Peeples/USFWS)



Biologist with a bog turtle



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Executive Summary

Current Species Status

The bog turtle [*Glyptemys muhlenbergii* southern population] is listed as Federally Threatened due to Similarity of Appearance (T(S/A)) to the northern population (listed as Threatened by USFWS). It is state listed as Threatened in North Carolina. The northern population was listed because of threats to the turtles' habitat including degradation, fragmentation, succession due to invasive exotics, and threats to the turtles including illegal trade and collecting. The southern population was not simultaneously listed because limited information existed at that time regarding threats and survey coverage. It has become evident in recent years that the species faces many of the same threats in the southern United States. An estimated 80-90% of bogs have been lost in North Carolina because of decades of land-use conversion. Bog turtle range in North Carolina is the Blue Ridge Mountains and upper Piedmont eco-regions, with records existing in eight river basins. Bog turtles have been documented in 24 counties, though some of those records are historical only. In the past 10 years (2007-2016), only 18 sites have had 10 or more turtles captured. Relatively few bog turtle populations remain, and most of those appear to be in decline. There is significant concern for this species in North Carolina. Major threats to bog turtles include vegetative succession, vehicles, habitat loss and degradation, predation, development and changes in the watershed, and barriers to movement.

Habitat Requirements and Limiting Factors

Bog turtles are typically found in spring-fed bogs and fens with soft, saturated soils and little to no canopy cover. Ideally, bog turtle habitat has deep, loose low-strength soil with sphagnum mosses or similar low vegetation, unaltered or minimally altered hydrology, subsurface root structures and/or tunnels, and minimal threats in the immediate area. The wetlands that bog turtles inhabit in North Carolina are considered among the rarest and most imperiled habitat types in the Southeast. Most known bog turtle wetlands in North Carolina are privately owned with no long-term protective measures in place. About 60% of the wetland sites with at least one bog turtle captured in the last 20 years (44 of 74 sites) do not have any protection. Relatively few bog turtle populations remain, and most appear to be in decline.

Conservation Goals

Bog turtle conservation in North Carolina is a collaborative effort among partners. The overarching conservation vision for *Glyptemys muhlenbergii* is to protect and restore the populations and habitats of this species to prevent extirpation and ensure long-term viability across its current range in North Carolina for the next 100 years.

Goals that contribute to the vision are:

- A. Identify threats to bog turtle populations
- B. Maintain and maximize the number of viable populations
- C. Further our knowledge about bog turtles
- D. Expand outreach efforts

Actions Needed

1. Assess and address threats specific to high priority sites.
2. Protect habitat, focusing on high priority sites, metapopulations, and sites with landowners willing to sell or place land in conservation easements.
3. Create a schedule of habitat management needs for all extant bog turtle populations.
4. Write management plans for bog turtle sites, prioritizing sites that have:
 - complex and immediate management needs,
 - a bog turtle population that would benefit from a management plan, and
 - landowners willing to grant authority or permission to manage.
5. Conduct habitat management and restoration at high priority sites and metapopulations.
6. Develop a decision framework for determining when population manipulation techniques are appropriate and establish related policies and protocols.
7. Plan to develop and implement a structured and scheduled population monitoring plan.
8. Conduct research to answer critical questions about bog turtle distribution and ecology.
9. Develop and implement a robust education and outreach program, and improve communication and collaboration with key partners and stakeholders.

Gary Peeples/USFWS



ECOLOGY AND STATUS

Description and Taxonomic Classification

The bog turtle (*Glyptemys muhlenbergii* Schoepff) is the smallest freshwater turtle in North America. Its most distinguishing feature is a large, bright yellow to orange blotch on each side of its brown head. The carapace and plastron are light brown to dark brown or black, and the scutes on the carapace sometimes have a light center or pattern of lines radiating out. It has a moderately domed carapace with a low keel, and the plastron is hinge-less. The maximum straight-line carapace length is 11.5 cm (4.5 in) for males and 9.63 cm (3.8 in) for females (Ernst and Lovich 2009).

The *Glyptemys* genus comprises only two species — the bog turtle and the wood turtle (*Glyptemys insculpta*). Before 2001, the bog turtle and wood turtle were considered part of the genus *Clemmys*, but morphological and genetic analyses indicated these two species were much more closely related to each other than to the spotted (*Clemmys guttata*) or western pond turtle (*Actinemys marmorata*; Holman and Fritz 2001). Thus, the bog turtle and wood turtle were moved to the newly created *Glyptemys* genus, leaving the spotted turtle as the sole member of the *Clemmys* genus.

Life History and Habitat

Female bog turtles are sexually mature at about 6-7 years, though this can vary geographically (Ernst and Lovich 2009). They typically mate in spring, from March-June, and 21-31 days after copulation, females lay their eggs, with most nests laid from May-July. They choose locations in sedge and rush tussocks or sphagnum moss and lay between 1-6 eggs, with a 3.1-eggs average reported from a Maryland study (Wilson et al. 2003).



Bog turtles are found in a variety of spring-fed bogs and fens that have soft soils, such as this Southern Appalachian Bog. (Gary Peeples/USFWS)

The species is found in a variety of spring-fed bogs and fens that have soft saturated soils, including the Swamp-Forest Bog Complex, Southern Appalachian Bog, French Broad Valley Bog, Low Mountain Seepage Bog, and Southern Appalachian Fen (Schafale 2012). They are also found in “meadow bogs,” which have a plant community degraded from their original condition due to anthropogenic influences (Herman 2000); therefore, meadow bogs are not included in Schafale’s classification system (2012). Bog turtle habitat is typically dominated by sedges and sphagnum moss, has thick soft muck, saturated soils, and numerous springs, with some areas lacking canopy and others having shrubs

and scattered small trees (Buhlmann et al. 2008, Feaga et al. 2012). Plants often associated with these wetlands include sedges (*Carex* spp.), rushes (*Scirpus* sp., *Juncus* sp.), sphagnum moss (*Sphagnum* spp.), skunk cabbage (*Symplocarpus foetidus*), poison sumac (*Rhus vernix*), alder (*Alnus* spp.), willows (*Salix* spp.), and a variety of ferns (Herman and George 1986, Tryon 1990). Meadow bogs have many of the same components of the classified bog community types, including similar hydrology, soil types, and vegetation, but are sometimes lacking the same plant diversity. Bog turtles are often found in meadow bogs, including those that are currently grazed or have a history of grazing.

Most publications describe the habitat features observed in sites inhabited by bog turtles rather than specifying the actual habitat needs of bog turtles. Moreover, many authors refer to “suitable habitat” and “high-quality habitat” without clearly defining the terms. Herein we define these terms as used in this document based on what we know of bog turtle ecology and habitat use in North Carolina (see Glossary). The terms are likely applicable to bog turtle habitat in other states and regions:

Suitable bog turtle habitat will contain the following, at a minimum: 1) soft, saturated soils, 2) spring-fed hydrology, and 3) an area with low vegetation (no canopy) that gets full sun.

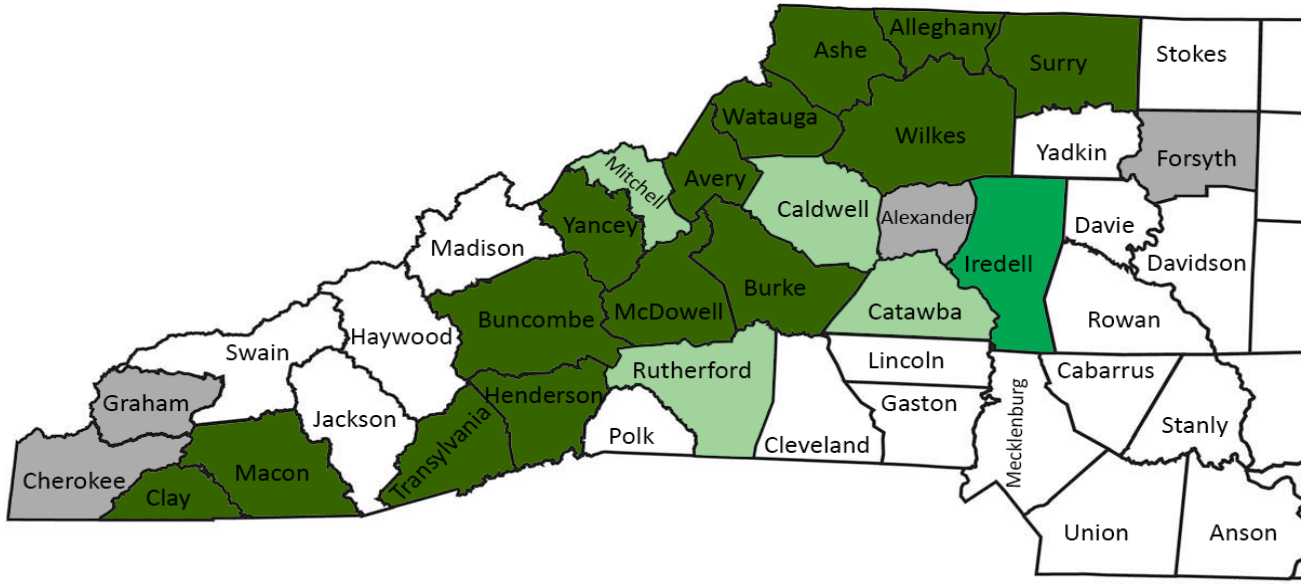
High-quality bog turtle habitat consists of the above plus the following characteristics: 1) areas with deep, loose, low-strength soils (Feaga et al. 2013), 2) presence of sphagnum mosses, rushes, sedges, and some wetland shrub species, 3) mosaic of low and shrubby vegetation with one or more relatively large areas with very low vegetation (ideally sphagnum, but also rushes and sedges) that receive full southern exposure sun, 4) relatively unaltered hydrology with stable groundwater levels that are 8 cm ± 1 cm (3.1 in ± 0.4 in) average depth from surface over multiple years, without flooding and inundation (Feaga 2010), 5) presence of subsurface root structures and/or tunnels, 6) adequate vegetation to conceal turtles when basking on surface, 7) minimal threats within habitat and/or adjacent property (e.g., busy roads, overabundance of predators).

Distribution and Population Status

In North Carolina, the bog turtle is found in the Blue Ridge Mountains and upper Piedmont eco-regions, and records exist within the Middle Tennessee-Hiwassee, Upper Tennessee, French Broad-Holston, Savannah, Santee, Upper Pee Dee, Kanawha, and Roanoke river basins (Beane et al. 2010; NCNHP 2017). The species has been documented in the following 24 counties: Alexander^{1,2}, Alleghany, Ashe, Avery, Buncombe, Burke, Caldwell², Catawba², Cherokee^{1,2}, Clay, Forsyth^{1,2}, Gaston, Graham^{1,2}, Henderson, Iredell¹, Macon, McDowell, Mitchell², Rutherford², Surry, Transylvania, Watauga, Wilkes and Yancey (Figure 1 (page 8); NCNHP 2016).

¹ Counties where a live bog turtle has not been found in recent surveys (i.e., last 15 years, from 2002-2017);

² Counties that only have single road records and/or sites with only one turtle ever captured.



County Records

- No records
- Records, but only 1/site and not since pre-2002
- Records, but only 1/site since pre-2002
- Records, more than 1/site but not since pre-2002
- Records, more than 1/site, since pre-2002

Figure 1. Counties in North Carolina with records of bog turtles

Surveys for the species have occurred regularly since the mid-1970s in the state (Herman 2003). The southern population of bog turtle is federally listed as Threatened due to Similarity of Appearance (T(S/A)) and state listed as Threatened. The NC Natural Heritage Program categorizes *G. muhlenbergii* as S2 (State Imperiled; typically, 6-20 occurrences or few remaining individuals), with a global rank of G3 (Vulnerable – at moderate risk of extinction; NCNHP 2016).

There are 162 confirmed occurrence records for the species in the state — 32 of which are solely road records with no habitat present nearby (most likely individuals dispersing on landscape), seven are locations without any known wetland habitat, and five are locations where the habitat (and often the exact location) is unknown (Figure 2, page 9). One hundred eighteen (118) location records are from wetland habitat — 41 of which are not considered a population because only one turtle was found at each of these locations. Of the 118 records from wetland habitat, only 77 sites have a record of two or more individual turtles being captured and have the potential to be a population (Figure 2, page 9).

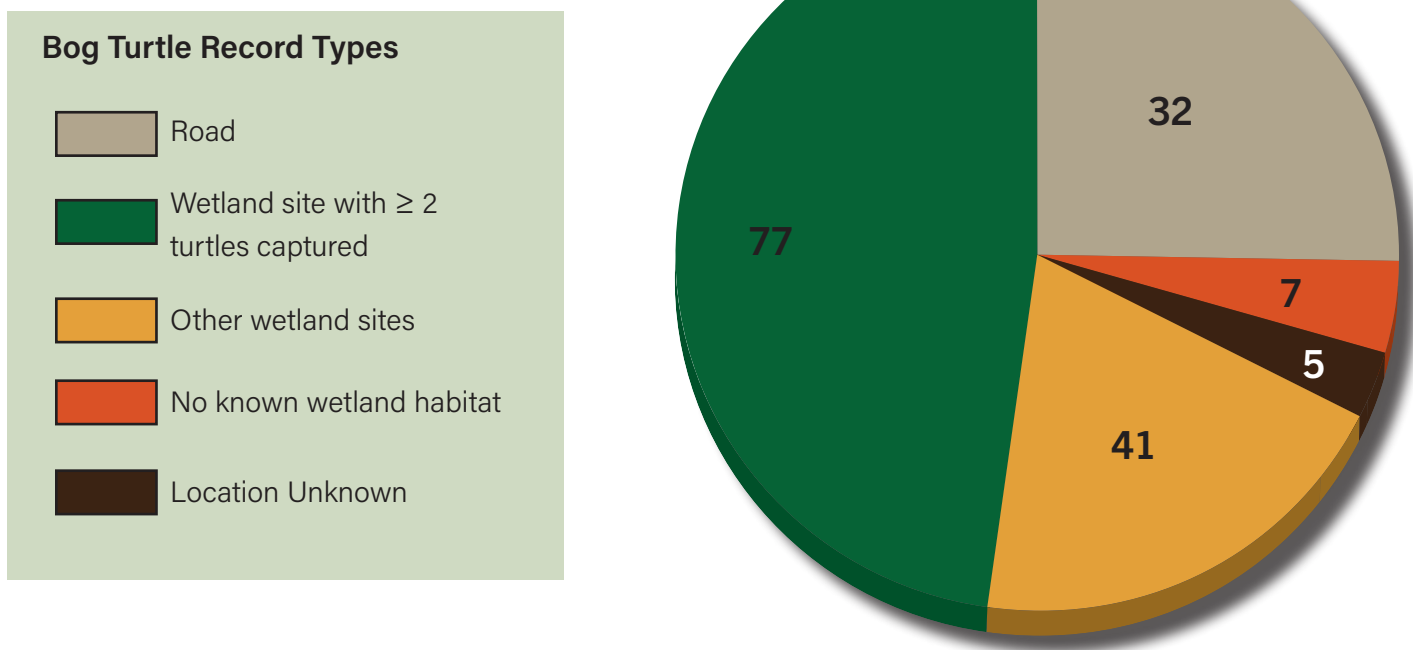


Figure 2. Types of location records for bog turtles in North Carolina. Note that the 41 “Other wetland sites” comprise 36 sites that only had one turtle captured and five sites where it was inconclusive whether one or two were captured due to turtles not being individually marked.

Many of the wetland sites have not had a recent turtle capture (Figure 3, page 10). In the past 10 years (2007-2016), only 49 of the 118 wetland sites had at least one bog turtle captured. There are only 18 sites where ≥ 10 turtles have been captured in the past 10 years (Figure 3, page 10). Thus, there are relatively few robust bog turtle populations in North Carolina. Recently, many sites with previously known populations have been surveyed and no turtles were found. Hence, the bog turtle may be extirpated from these sites. However, we acknowledge that survey effort has varied among sites and it is difficult to detect turtles with active surveys when populations are small (Somers and Mansfield-Jones 2008), so more targeted efforts are needed to understand better the true status of some of these sites. Substantial changes in habitat have occurred at many sites. A 10-year mark-recapture study of 11 bog turtle populations in New York indicated that bog turtle populations with as few as 15-20 females can persist as stable populations (Shoemaker et al. 2013). Although a full analysis has not been completed yet, data suggest that there are few populations in North Carolina with ≥ 15 adult females (NCWRC unpublished data).

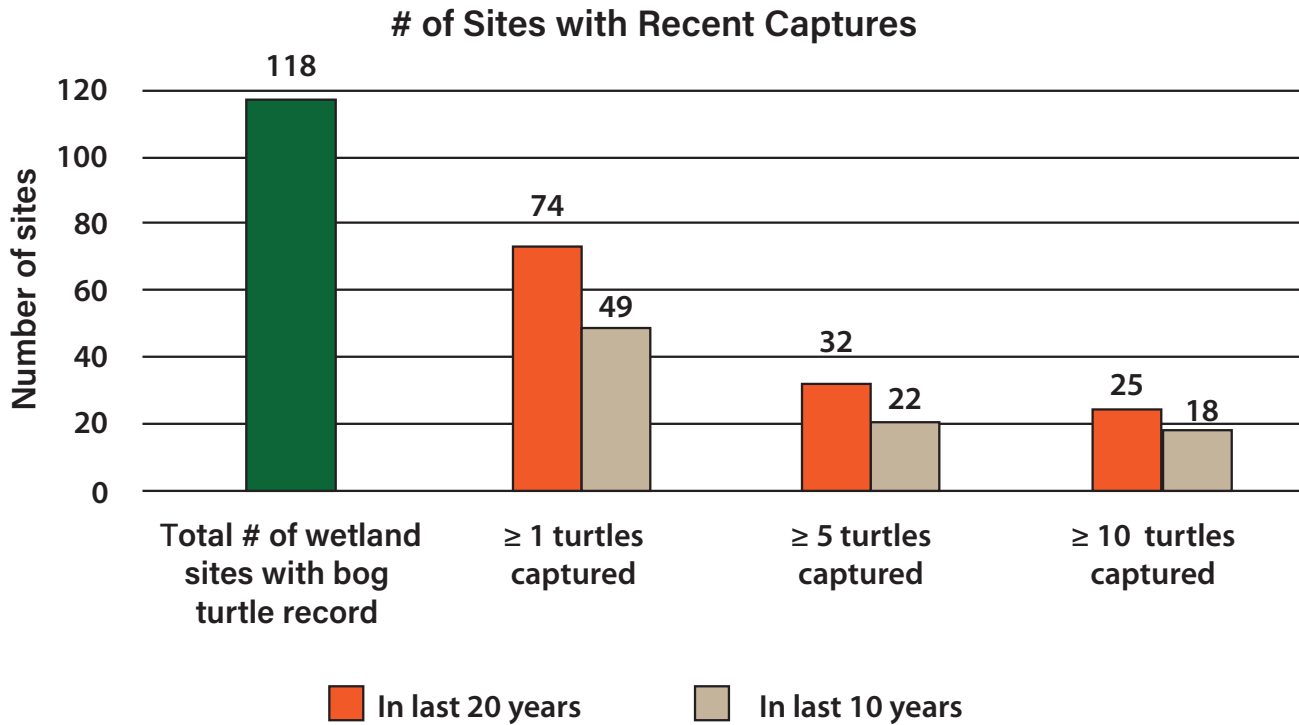


Figure 3. Number of sites in North Carolina with recent bog turtle captures. The total number of wetland sites with bog turtle occurrence records is 118. The number of sites with recent captures of 1, 5, and 10 or more turtles is shown for both the past 20 years (1997-2016) and the past 10 years (2007-2016). The number of sites with 10 or more individual turtles captured in the past 10 years is low, at only 18 sites.

In a recent analysis, adult survivorship of bog turtles in North Carolina varied from 0.855 to 0.942 among eight intensively sampled sites — all below a 0.96 adult survival estimate documented for northern bog turtle populations (Tutterow et al. 2017; Shoemaker et al. 2013). Because these eight sites support the most robust known bog turtle populations in the state, other, less robust populations in North Carolina likely exhibit relatively low survival. Juvenile survivorship was evaluated at three sites that had adequate data and varied from 0.510 to 0.68 with the lower survivorship of 0.510 occurring at a population in decline (Tutterow et al. 2017). We also observed a skew in age classes across all but two sites, with populations dominated by older individuals and very few juveniles (Tutterow et al. 2017). These estimates, along with other studies, suggest that North Carolina bog turtle populations are likely declining, and without additional efforts, local and regional extirpations may occur (Pittman et al. 2011; Tutterow et al. 2017). As our datasets on North Carolina populations grow, the Wildlife Commission will be able to assess the species' status more thoroughly based on the best available science and population modeling.

Historic and Ongoing Conservation Efforts

There is a long history of bog conservation efforts by a diverse partnership in western North Carolina. Partners include Project Bog Turtle (PBT), N.C. Wildlife Resources Commission, U.S. Fish & Wildlife Service (USFWS), U.S. Forest Service, Natural Resources Conservation Service (NRCS), The Nature Conservancy (TNC), NC State Parks,

NC Natural Heritage Program, Carolina Mountain Land Conservancy (now, Conserving Carolina), Blue Ridge Conservancy, National Park Service, Catawba Lands Conservancy, and private land owners. Bog turtle research in the state began in the 1970s by Robert Zappalorti and Dennis Herman. In the late 1980s, several other NC Herpetological Society members, including Jeff Beane and Thomas Thorp, began to assist with bog turtle surveys. In 1995, Project Bog Turtle was established and has been dedicated to monitoring and conserving bog turtles and protecting bog turtle habitat in North Carolina. Recently, the Wildlife Commission began leading bog turtle efforts in the state by working closely with Project Bog Turtle, the USFWS, and the above-mentioned partners. Collaboration and communication among these groups are essential to meeting conservation goals for the bog turtle in North Carolina.

Project Bog Turtle hosts an annual meeting at which all states in the range of the southern population share information and coordinate activities. This group and other partners have accomplished much for bog conservation over the last 25 years, including land acquisition at 26 bog turtle sites across western North Carolina, habitat restoration, and land management. Other conservation activities by partners include education of land owners, nest protection, and management of beavers when flooding is an issue. Partner programs such as the USFWS Partners for Fish and Wildlife and NRCS Wetlands Reserve Easement and Environmental Quality Incentives Program also provide incentives to private landowners to protect and manage bogs.

In 2015, the Mountain Bogs National Wildlife Refuge was established. The refuge will complement and expand existing conservation efforts by offering additional opportunities to protect sites via fee title or conservation easement and other avenues such as landowner-management agreements. At the same time, a new partnership, the Bog Learning Network, was formed. The Bog Learning Network is modeled after the successful Fire Learning Network and is a consortium of scientists and land managers working to advance the restoration and management of Southern Appalachian Bogs.



Landowner relationships are paramount to biologists' success in studying, managing, and protecting bog turtle habitats.

Despite these accomplishments, land protection and active, long-term management are still needed at most of the remaining mountain bog sites. While portions of some bogs have been conserved and a few bogs are protected in their entirety, most sites are still in private ownership and lack permanent protection. Of the 74 wetland sites with at least one bog turtle captured in the last 20 years, 44 are not protected (i.e., under conservation ownership or easement). Of the 18 sites that have 10 or more turtles captured over the last 10 years, eight are privately owned without any conservation protection. Landowner relationships are paramount to our success in studying, managing, and protecting wetlands that bog turtles inhabit.

Newly emerging partnerships across the species' range and within the southern population may aid conservation efforts in North Carolina. In North Carolina, biologists with the USFWS and Wildlife Commission have begun working more closely with biologists that work with bog turtles within the northern population. Likewise, discussions began recently about developing a regional bog turtle conservation plan for the southern population, which could be helpful in gaining additional funding for bog turtle conservation in the state.

Threat Assessment

Reason for Listing

The USFWS listed the northern population of bog turtle as Threatened on Nov. 4, 1997, noting that the species "is threatened by a variety of factors including habitat degradation and fragmentation from agriculture and development, habitat succession due to invasive exotic and native plants, and illegal trade and collecting." The southern population was simultaneously listed due to Similarity of Appearance to the northern population of this species (USFWS 1997). In the Federal Register, the USFWS identified its reasons for not proposing the southern population for listing: "(1) the recent discovery of bog turtle sites in the Piedmont physiographic province of North Carolina, well outside the species' previously known Appalachian Mountains range; (2) limited information regarding threats; and (3) inadequate survey coverage within the southern range" (USFWS 1997). Further, the USFWS stated that "A comprehensive status survey of the southern population is currently underway and is anticipated to be completed by December 1999. The Service agrees that it is premature to draw any conclusions regarding the status of the southern population until additional survey and threat information becomes available" (USFWS 1997). In 2003, a status report on the southern population was completed (Herman 2003). In North Carolina, an additional 36 records in 10 counties were discovered — three of which were new county records (Herman 2003). At the time, the author estimated that there were 53 populations in the state, with 30 designated as "viable or potentially viable," distributed across a total of 21 counties in North Carolina (Herman 2003).

Relatively few bog turtle populations remain, and most of these appear to be in decline. There is significant concern for this species in North Carolina.

In the "Bog Turtle Northern Population Recovery Plan," which applies only to the northern population, the following are cited as reasons for listing the species: 1. Continued loss, alteration, and fragmentation of habitat, 2. Illegal trade and collection, 3. Inadequacy of existing regulatory mechanisms to protect bog turtle habitat, and 4. Disease & predation (USFWS 2001). Although this document was drafted for the Northern Population, it has become evident recently that the species faces many of the same threats in the southern United States (Tutterow et al. 2017). Relatively few bog turtle populations remain, and most of those appear to be in decline. There is significant concern for this species in North Carolina.

Present and Anticipated Threats

Habitat Loss and Degradation

Habitat loss and degradation occur when a bog has been converted to another use such as a pond, agricultural field, or urban area or when a remnant of the habitat remains, but it is reduced in size and/or ecological integrity. This habitat degradation may result from human activities, such as draining and ditching, but also from canopy closure due to vegetative succession, pollution from land-use activities in the surrounding landscape, and encroachment of non-native invasive species, among others.

The wetlands that bog turtles inhabit in North Carolina are considered among the rarest and most imperiled habitat types in the Southeast (Richardson and Gibbons 1993 and references therein, Noss et al. 1995 and references therein, USFWS 2014b). As much as 80-90% of these bog habitats are estimated to have been lost over decades of land-use conversion (Weakley and Schafale 1994; Noss et al. 1995). Land was converted for a multitude of reasons, including agricultural, industrial, commercial, and residential development. Almost every remaining mountain bog shows evidence of past human manipulation. Many sites were ditched and drained for agriculture or livestock or flooded to form ponds or lakes. Most bogs and their hydrologic regime have been degraded through intensive efforts to increase the farmable area. Even where bogs remained relatively intact, they remain vulnerable to changes in the surrounding watershed that affect the habitat quality of each bog (USFWS 2014b). Habitat loss also impacts remaining bogs by isolating them within the landscape, with metapopulations composed of fewer or only one remaining bog turtle population. Thus, remaining populations are more susceptible to extirpation from stochastic events.

Most known bog turtle wetlands in North Carolina are privately owned with no long-term protective measures in place. About 60% of wetland sites with at least one bog turtle captured in the last 20 years (44 of 74 sites) do not have any protection (i.e., under conservation ownership or easement). Lack of conservation protection leaves many sites vulnerable to future habitat loss through ditching, draining, and other harmful activities.

Vegetative Succession

Due to landscape level changes, many factors that likely kept some wetlands in early successional stages are gone or diminished. For example, bison, elk, beavers, natural fire or fires set by Native Americans have all been cited as playing roles historically in maintaining these wetlands in an open state (NCWRC 2015). In addition, many wetlands, have altered hydrology from activities such as ditching and draining, and some wetlands presumably have a higher nutrient input than they did historically — both of which can result in an increased growth of weedy and woody vegetation (Fisher et al. 1996, Gustafson and Wang 2002, Stapanian et al. 2016). The combination of diminished influence from disturbance factors, increased nutrient input, and an altered hydrology means that many bog turtle populations are threatened from natural vegetative succession, whereby the herbaceous grasses, flowers, and shrubs are replaced over time by large shrubs, saplings, and eventually trees. Minimal sunlight reaches the ground. Bog turtles and other species that require more sunlight thus struggle to nest and produce young successfully, and find adequate sunlight for thermoregulation and other activities. More woody vegetation and a subsequent decrease in sunlight reaching the ground threaten the continuation of this species. With more woody plants, more water is transpired, contributing to a lower water table at some bogs (USFWS 2014b) and threatening the continued persistence of this species.

Development and Changes in the Watershed

Urbanization, from residential neighborhoods to commercial and industrial land uses, poses a threat to bog turtles. Some wetlands have been lost entirely to land conversion. More will be converted, and the remaining bogs will be subject to myriad side effects of changes in the surrounding landscape. Increasing presence of impermeable surfaces often leads to increased stormwater run-off and erosion, as well as the presence of additional nutrients and pollutants from these urbanized landscapes. Water consumption from wells may also result in less groundwater available within these wetlands.

Agricultural activity within the watershed of a bog can also be detrimental (Gustafson and Wang 2002). Many mountain bogs that remain are downhill from pastures, agricultural fields, orchards, nurseries, and Christmas tree farms — all of which can result in increased runoff of fertilizers and pesticides (USFWS 2014b). This increase in

nutrients, toxins, and sediments threaten the suitability of wetlands for bog turtle habitat. When unaltered, bogs are generally nutrient poor. Thus, increasing the nutrients to these systems can have damaging effects on native plants important to bog turtles, such as sphagnum moss (USFWS 2014b). One of the benefits wetlands provide agricultural landscapes is water quality enhancement by mitigating the amount of pesticides, fertilizers, etc. (Verhoeven and Setter 2010). Unfortunately, these chemicals can still negatively impact the biota, including reptiles, present in those landscapes. For example, de Solla et al. (2014) found that the soil fumigant metam sodium caused complete mortality of snapping turtle (*Chelydra serpentina*) eggs, even when used at 10% of the recommended dosage. These chemicals can even have effects when they are present at sublethal concentrations. Organophosphate pesticides have

been found at sublethal concentrations in the southern Sierra Nevada foothills of California — an area adjacent to prolific agriculture. Western pond turtles (*Emys marmorata*) from this region have significantly reduced activity of cholinesterase compared to turtles located farther from this agriculture (Meyer et al. 2013). This reduced enzyme activity from chronic exposure could possibly lead to reduced neuromuscular function or altered behavior (Meyer et al. 2013). Another source of pollution to the bog stems from the influx of sediments, which can result in a layer of mineral soil on top of the saturated, organic soils of a bog. This mineral layer significantly alters the habitat, making it difficult for bog turtles to access saturated soils (Torok 1994, Feaga 2010).

Myriad issues stemming from changes in the watershed and within the bog can have detrimental effects on the hydrology and the resident bog turtles (Torok 1994, Brennan et al 2001, Feaga 2010). Highway construction and other development within the recharge area of a bog turtle wetland reduce groundwater discharge to the wetland (Brennan et al. 2001). Other issues include increased stormwater runoff into these wetlands, which can lead to an increase in erosion problems such as channelization and head-cutting.



Many mountain bogs that remain are downhill from pastures, which can result in increased runoff of fertilizers and pesticides. (Photo: Wikimedia)

Climate Change

Climate models predict a variety of different outcomes for North Carolina (deWan et al. 2010, NCWRC 2015). The timing, amount, and type of precipitation are expected to change, but the precipitation predictions are still somewhat unclear for North Carolina (NCWRC 2015). Some models indicate that the amount of precipitation may not change, but the intensity and duration of both storms and droughts will increase (NCWRC 2015). Changes in storm intensity can increase the soil erosion potential and decrease the frequency of groundwater recharge (Karl et al. 2009). Periods of drought and intense rainfall events are both predicted to increase (NCDENR 2010, Schultheis et al. 2010). Intense rainfall events would likely flood many bogs, leading to scouring and further increasing nutrient loads (NCDENR 2010).

A recent study specifically aimed at predicting the effects of climate change on Southern Appalachian bogs indicated that future climates are likely to affect them primarily through the impacts of temperature and precipitation on sphagnum (Schultheis et al. 2010). The study suggested that temperatures may increase by 3.5 °C, but precipitation is only predicted to increase slightly. Thus, with temperature increases outpacing increases in precipitation, future climates are likely to exceed the temperature and precipitation thresholds for sphagnum and inhibit sphagnum growth. Warmer temperatures also increase decomposition, which could further decrease net sphagnum growth and release nutrients (i.e., carbon and nitrogen) into the environment (Schultheis et al. 2010). Dominant vegetation is likely to shift from sphagnum moss to woody shrubs because shrubs are better able to handle drought and higher nutrient levels (Schultheis et al. 2010). Succession of vegetation to shrubs is already a threat, as mentioned above, and climate change may intensify the threat and need for management. Likewise, invasive plants are likely to become increasingly prevalent in bogs as vegetation dominance shifts away from sphagnum (NCDENR 2010).

Illegal Collection and Trade

Illegal collection of bog turtles poses a serious threat, although we do not know how often it occurs in North Carolina or which sites have been targeted in the past, with one exception. In 1989, a presumably large number of turtles were collected from a bog in Henderson County, and turtles appeared on the illegal market in Ohio (D. Herman pers. comm.). In the years since that site was poached, the bog turtle population has consisted almost exclusively of old turtles, despite having high quality habitat. It has never recovered into a site with a good mix of age classes, and we attribute that to the loss of many breeding individuals from this poaching event (NCWRC unpublished data).

Collection of turtles in North America for illegal trade has become a lucrative business. There are documented instances of many species of turtles being illegally harvested with the purpose of sale into the black market (Christy 2008; Todd et al. 2010). There is evidence that people are seeking to purchase wild-caught or captive-bred bog turtles as pets and will pay as much as \$5,000 for one turtle

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(Turtle Survival Alliance pers. comm. 2014; Grover Brown pers. comm. 2017). A simulation model looking at the impact of removal of one adult turtle per year indicated that the study populations in New York and Massachusetts would be devastated by this and thus, anti-poaching measures would be warranted (Shoemaker 2011).

Intensive Grazing

Although the presence of grazers can provide many benefits to bog turtles and their habitat (see Conservation Tools section), there are potential risks. The most direct detrimental effect on bog turtles is from trampling on nests and adults. We know that bog turtle nests have been trampled and eggs destroyed by cattle in North Carolina (Knoerr 2018). We also know that adults have been injured and killed from being stepped on by livestock. In many cases, a bog turtle may get stepped on and simply pressed deeper into the mud, thereby escaping serious injury. Wildlife Commission staff has documented 18 injuries and three deaths of bog turtles that were attributed, because of the shape of the injury, to being stepped on by livestock (NCWRC unpublished data). These injuries were often described as “crushed.” In all cases, these turtles were at sites that had cattle at the time. Presumably, the heavier animals present the largest threat (e.g., cattle and horses rather than goats or sheep). Although we have documented injuries and deaths that appear to be from livestock, we know very little about the frequency of occurrence and population-level effects.

Intensive grazing can also have negative effects on the condition of the bog itself, which may in turn affect bog turtles. When stocked at low densities, cattle have little effect on nutrient (e.g., nitrogen and phosphorus) concentrations (Line et al. 2000, Capece et al. 2007). However, significant increases in nutrient concentrations can occur when cattle are stocked at high densities (Line et al. 2000). The average beef cow has 12 bowel movements per day, amounting to 23 kg of feces (Hoorman 2005). This increase in nutrient load into an otherwise nutrient-poor system, in conjunction with soil disturbance, can facilitate invasion of the habitat by exotic vegetation and alter the plant community (USFWS 2001). Intensive grazing can also cause excessive soil exposure, denuding of sphagnum moss and herbaceous vegetation, and destruction of rare plants (USFWS 2001, 2010). Similarly, erosion problems that threaten habitat quality in a site, such as head-cutting, may worsen with the presence of large grazers. Excessive grazing of vegetation can also increase exposure of nests and lead to increased risk of egg failure and predation (USFWS 2010).

In its Biological Opinion (B.O.) for the northern population of bog turtles, the U.S. Fish and Wildlife Service (2010) defined “light to moderate grazing,” also known as “habitat maintenance grazing” as grazing with a stocking density less than 0.75 animal units per acre of grassland. In addition, the B.O. specifies that with light to moderate grazing, grazers must have access to upland and wetland areas and large grazers (i.e., cattle, horses) must be excluded from known nesting areas during the bog turtle nesting season. According to the B.O., when light to moderate grazing is used according to the definition, “grazing is considered a beneficial activity and the risk of take is considered to be low.” The B.O. also defines “restoration grazing” levels as equal to or greater than 0.75 animal units/acre, with a maximum of one animal unit/acre if goats are used, but the grazing period cannot exceed five months and treatment cannot exceed five consecutive years (USFWS 2010). In this report, one animal unit equals the forage consumption of a 1,000 lb grazer (USFWS 2010). For example, four sheep or five goats can be stocked per acre, or one dairy cow can be stocked per two acres (USFWS 2010). However, this system of determining grazing impact does not account for variation between grazing species and breeds. For example, a horse eats more than a cow of equal weight, sheep eat a greater variety of plants, dairy cattle eat more than beef cattle, and goats and sheep tend to avoid wet areas (Crawley 1983, Menard et al. 2002).

To prevent the detrimental effects of intensive grazing, the U.S. Fish and Wildlife Service (2010) has recommended stocking densities of grazers for different conservation goals (see Conservation Tools section). Most bog turtle sites that are grazed in North Carolina are grazed year-round, with no protection for nesting areas. Moreover, some sites in North Carolina are grazed at higher stocking densities than recommended by the current B.O. More research is needed to assess the grazing recommendations by the USFWS (2010) and to inform decisions about the appropriate level of grazing under different scenarios. At this time, Wildlife Commission staff take a site-specific approach that weighs the risks against the benefits, prior to making an educated decision about the appropriate level of grazing for each site.

Vehicles

Roads present a major threat to small animals, including turtles (Gibbs and Shriver 2002; Aresco 2005; Marsh and Jaeger 2015). Beyond direct mortality, roads can have numerous other deleterious effects, including behavioral effects, decreased dispersal between habitats, reduced abundance, and loss of genetic diversity (Marsh and Jaeger 2015). Turtles are slow-moving animals and mortality risks as high as 95% per crossing attempt have been documented for turtles (Aresco 2005). We know that bog turtles often attempt to cross roads because the Wildlife Commission has many documented records of bog turtles found dead, alive, and injured on North Carolina roads (NCWRC unpublished data). The Commission has 62 records of bog turtles found on roads in the state (43 alive, 19 dead) from 1951 to 2016. Sometimes, they are found next to a known site, and sometimes there is no bog anywhere in the vicinity, and the turtle seems to be traveling over land. When a small population is losing even one turtle annually to an adjacent road, that may be too many. In this scenario, the population is likely in a slow decline from which it would be difficult to recover. Long-term demographic studies of turtle populations have indicated that a

2-3% annual road mortality rate is likely to cause population declines (Gibbs and Shriver 2002). Likewise, at a landscape scale, reduction of a population's dispersal ability can slowly drive a metapopulation to extinction (Marsh and Jaeger 2015).

Other vehicles and equipment, such as tractors and lawn mowers, can injure and kill turtles (Saumure et al. 2007, USFWS 2010). The Commission and its partners have captured three injured and two dead bog turtles over the years that have long, deep injuries to the shell that appear to be caused by a blade (NCWRC unpub-

lished data). The injured bog turtles sometimes recover. We have recaptured them with healed or healing injuries, but it is likely that some injured turtles do not survive. It is likely that they also get crushed under this equipment as it is driven in the fields surrounding wetlands and through the wetlands themselves. Bog turtles have been documented spending time in the fields surrounding some wetlands (Pittman and Dorcas 2009). Some farmers have shared that they take advantage of a drier year to bush hog a wetland to keep it from getting too overgrown. It seems likely that some bog turtles are crushed and injured from this, but little is known about the effects of this practice.

Roads present a major threat to turtles. Long-term demographic studies of turtle populations have indicated that a 2-3% annual road mortality rate is likely to cause population declines.

Barriers to Movement

Roads, railroad tracks, and other anthropogenic habitat alterations can serve as barriers to movement and even cause entrapment for turtles (Aresco 2005, Kornilev et al. 2006, Pittman and Dorcas 2009). A telemetry study of bog turtles at a site in North Carolina led to the discovery of the death of a bog turtle in a puddle adjacent to a railroad track, with the authors proposing that the turtle perished due to difficulty with crossing the railroad tracks to get back to the bog (Pittman and Dorcas 2009). It is likely anything within the landscape that is a barrier to movement or entraps bog turtles in place could increase stress, affect thermoregulation, and lead to death. Additionally, the isolation of populations due to barriers and loss of habitat limits gene flow and removes the benefits of a functioning metapopulation. The key to turtle conservation is the maintenance of the health and function of metapopulations, which relates directly to the overall long-term viability of a population (Frankham et al. 2002). This is especially important for bog turtles due to their dependence on small, isolated, and often rare habitat patches, and their frequently diminutive population sizes, making them naturally susceptible to local extirpations (Frankham et al. 2002, Pittman et al. 2011, Apodaca et al. 2012).

Detrimental Beaver Activity

In a relatively unaltered landscape and watershed, beaver activity can have benefits for bog turtles (see Conservation Tools section). However, beaver activity sometimes can be detrimental to a bog turtle population if a site is very small and the entire wetland is flooded for long periods of time due to beaver activity (Sirois et al. 2014). This



Beaver activity sometimes can be detrimental to a bog turtle population if a site is very small and the entire wetland is flooded for long periods of time due to beaver activity. (Photo: USFWS)

scenario is typically observed when a wetland has been reduced in size due to human activities and the surrounding landscape is altered. In this case, when the beavers flood the wetland, the turtles may have nowhere suitable to go because the surrounding landscape is developed and/or has no other suitable habitat available. Flooding, whether from beaver activity or increased intensity of storms due to climate change, could also affect nesting and hatching success. Zappalorti et al. (2015) found several nests with drowned embryos at low elevation in a wetland.

Disease

Although there has not been a die-off of bog turtles in the South, dead turtles with no obvious signs of predation are occasionally found during routine surveys (NCWRC unpublished data).

Nonetheless, the possibility of a disease having

detrimental effects on the species is of great concern, especially given the small size of these populations. Since 2009, there have been several reports of sick and dead bog turtles being found, mostly in the northern population. Some of the sick bog turtles had a grey or whitish substance or discoloration, skin lesions, sloughing of skin, and loss of claws, toes, or limbs. A Health Bulletin published by USFWS in 2014 reported 14 bog turtles found dead at one site in May 2014 in Pennsylvania and outlined protocols for decontaminating gear and submitting specimens for testing (USFWS 2014a). Test results have not indicated one causative agent, but a variety of potential factors

include injury, infection, pneumonia, and carcinoma. Of particular concern are *Mycoplasma* and *Ranavirus*. The USFWS warns biologists to be aware and take necessary precautions (2014). Pneumonia, likely caused by bacteria (e.g., *Pseudomonas* spp. and *Aeromonas* spp.), has been documented as the potential cause of death for two turtles in North Carolina and Virginia (Carter et al. 2005). However, there are few data available on the typical microflora associated with wild bog turtles (Brenner et al. 2002).

Competition

Although bog turtles in North Carolina often share habitat with snapping turtles (*Chelydra serpentina*) and occasionally mud turtles (*Kinosternon subrubrum*), competition has not been confirmed. A study conducted in Maryland found that there was substantial overlap between the area of a wetland used by spotted turtles (*Clemmys guttata*) and the area of the same wetland used by bog turtles (Dinkelacker et al. 2000). More specifically, the area of overlap between spotted and bog turtles constituted 79.6% of the total area used by bog turtles, but only 19.5% of the total area used by spotted turtles (Dinkelacker et al. 2000). Presumably, because these two species were overlapping in the same wetland, interspecific competition would at least be possible, but this was not tested. Spotted turtles have not been observed in any North Carolina bog turtle sites. Mud turtles are found in some of the Piedmont bog turtle sites and are absent or in lower numbers in sites within the Mountain Region. Elevation and temperature, rather than competition, may be factors that favor bog turtles over mud turtles at most sites.

A study in Pennsylvania looked at early (fall) and delayed (spring) emergence of hatchlings of snapping, painted (*Chrysemys picta*), spotted, wood, bog, and stinkpot (*Sternotherus odoratus*) turtles occupying the same wetland from 1965-1985 (Lovich et al. 2014). They observed that snapping, painted, and spotted turtles were facultative delayed emergers, and most individuals emerge in the spring, whereas wood, bog, and stinkpot turtles were obligate early emergers. They suggested that the obligate early emergence could be a means of reducing competition with species that predominantly emerge in the spring (Lovich et al. 2014). However, most of these species do not overlap with bog turtles in North Carolina, so it is difficult to evaluate the influence of competition. Bog turtles are likely competing with other species for resources or habitat, but there has not been any research yet that directly evaluated and/or confirmed this, especially in the southern population.

Predation

Data suggest that low nest success and juvenile survival may be important limiting factors for turtles in general (Congdon et al. 1983) and specifically for bog turtles in North Carolina (Tutterow et al. 2017). Limited research has been conducted on nesting, hatchling, and juvenile bog turtles due to the secretive nature of these age classes. Zappalorti et al. (2004) documented 14-59% hatch success for naturally incubated nests at five Pennsylvania sites. Of the nests monitored, the predation rates were 12-57%. The authors suggest that predation limits bog turtle nest success at some sites. A recent Maryland predation study observed approximately 40% of eggs preyed upon at one site and as many as 74% at another over a 2-year period (Byer 2015). Additionally, Macey (2015) documented a 62% predation rate over a 4-year period at 24 unprotected nests across nine sites in southeastern New York. Several studies have linked turtle nest predation rates to the landscape matrix (Kolbe and Janzen 2003, Marchand Litvaitis 2004). Human-commensal predators such as northern raccoons (*Procyon lotor*), striped skunks (*Mephitis mephitis*), and red foxes (*Vulpes vulpes*) are likely to represent the largest sources of increased predation in altered habitats (USFWS 2001). The following species are known or suspected predators of bog turtles: canids (*Canis familiaris*, *C. latrans*, *Urocyon cinereoargenteus*, *Vulpes vulpes*), egrets and herons (Ardeidae), minks (*Neovison*

vision), muskrats (*Ondatra zibethicus*), opossums (*Didelphis virginiana*), raccoons, skunks (*Mephitis mephitis*, *Spi-logale putorius*), snakes (e.g., *Coluber constrictor*, *Lampropeltis getula*, *Nerodia sipedon*, *Thamnophis sirtalis*), and snapping turtles (Ernst and Lovich 2009 and references therein). A study currently underway in North Carolina is examining the effects of predation on nesting success across multiple bog turtle sites. Those results will be helpful in gaining a better understanding of the influence of predation on bog turtles.

It is important to mention that domesticated pets may pose a serious problem for bog turtles, primarily house cats (*Felis catus*) and dogs (*Canis familiaris*). With their small size and lack of a hinge on the plastron, it is likely that

Bog turtles have many known or suspected predators, including raccoons, muskrats, foxes, egrets, herons, opossums, skunks, snakes, snapping turtles, and domesticated pets, mainly house cats and dogs.

adult bog turtles are more vulnerable than many other turtle species to predation by domesticated pets. Many bogs are located within a fragmented and developed landscape with residential areas, and thus, a source of cats and dogs that may be allowed to roam. House cats, both pets and feral, are significant predators on wildlife, especially small mammals and birds (Loss et al. 2013). Few data are available on their impact on herpetofauna, but Loss et al. (2013) estimated that annually 86-320 million amphibians (median 173 million) and 228-871 million reptiles (median 478 million) are killed by house cats in the continental United States. Likewise, dogs in Mexico have been observed digging up and scavenging sea turtle nests, and this behavior was positively correlated with insufficient food provision by owners (Ruiz Izaguirre et al. 2015). Dogs can also alter the behavior of wildlife. In parks and recreation areas, the

presence of dogs has been shown to significantly reduce the activity of deer and small mammals, and increase the activity of some wild carnivores, especially other canids (Lenth et al. 2008). If the current study does not elucidate the degree of threat that this poses to bog turtles, further research may be needed to get a better understanding. Anecdotal accounts of trained tracking dogs having difficulty locating bog turtles within a wetland indicate that domesticated dogs may not be a primary threat to bog turtle nests (pers. comm. Thomas Thorp), but further investigation would be helpful.

In the North Carolina Bog Turtle Database, the Commission has documented 24 injured and two dead turtles from bites, presumably a mix of native predators and domesticated pets (2017). Two additional bog turtles were injured by a pet that had entered the bog. Both were dogs — one that was a private landowner's pet and another that was being trained to find turtles for scientific purposes (NCWRC unpublished data).

Invasive Species

In general, wetlands are especially vulnerable to invasions by aggressive plants. Less than 6% of the land on Earth is wetlands, but 24% of the most invasive plant species are wetland obligates (Zedler and Kercher 2004). The accumulation of debris, sediments, water, and nutrients in wetlands helps facilitate invasions by creating canopy gaps, accelerating the growth of opportunistic plant species, and through direct input of invasive seeds (Zedler and Kercher 2004). Furthermore, many invasive wetland species grow as a monotype, resulting in lower biodiversity, altered habitat structure, and modified food webs (Zedler and Kercher 2004).

In North Carolina mountain bogs, the Commission has documented many non-native invasive species, including autumn olive (*Elaeagnus umbellata*), Chinese lespedeza (*Lespedeza cuneata*), Chinese privet (*Ligustrum sinense* and *L. vulgare*), Chinese silvergrass (*Miscanthus sinensis*), Japanese barberry (*Berberis thunbergii*), Japanese honeysuckle (*Lonicera japonica*), Japanese knotweed (*Polygonum cuspidatum*), Japanese stiltgrass (*Microstegium vimineum*), multiflora rose (*Rosa multiflora*), oriental bittersweet (*Celastrus orbiculatus*), purple loosestrife (*Lythrum salicaria*), reed canarygrass (*Phalaris arundinacea*), and yellow flag iris (*Iris pseudacorus*), among others. In some cases, these invasive plants are a small component of a wetland and appear to make little difference in the habitat structure and ecosystem functioning, though this has not been researched in any detail. There are several documented cases of invasive plant species forming a monotype in a bog and affecting the habitat quality for bog turtles in other states (e.g., Blossey 2002, Warwick 2014).



The Wildlife Commission has documented many non-native plants in North Carolina's mountain bogs, including purple loosestrife. (Photo: Liz West)

Wildlife not native to the bog may also pose a threat to bog turtles, especially any species that affects nest success and juvenile or adult survivorship. One animal of particular concern is the red imported fire ant (*Solenopsis invicta*). This species has been documented in 73 of North Carolina's 100 counties, including eight counties with bog turtle records (Burke, Cherokee, Clay, Gaston, Graham, Iredell, Macon, and Rutherford) (NCDA&CS 2017, NCWRC unpublished data). To our knowledge, the fire ant has not been documented within a bog in North Carolina, but this species could pose a serious concern to bog turtles should it begin invading the bog or perimeters of bogs. Fire ants have been documented preying upon nests of gopher tortoises (*Gopherus polyphemus*), snapping turtles (*Chelydra serpentina*), Florida cooters (*Pseudemys floridana*), and yellow bellied sliders (*Trachemys scripta scripta*) in the wild (Allen et al. 2004; Aresco 2004). Turtles are particularly vulnerable once an egg is pipped and if the species exhibits delayed emergence (Allen et al. 2004). While eggs are intact, the hardness of the shell influences whether fire ants can penetrate them. For example, fire ants were not able to penetrate the harder shelled eggs of musk turtles (*Sternotherus odoratus*) or Florida softshell turtles (*Apalone ferox*) but could penetrate the softer eggs of Eastern painted turtles (*Chrysemys picta picta*) and yellow bellied sliders (Diffie et al. 2010). Fire ants have been documented preying on unhatched spotted turtle (*Clemmys guttata*) eggs in captivity (Herman 1987). Given what we know about their aggressive behavior and their proclivity to invade newly disturbed areas, fire ants should be of great concern when it comes to these fragile ecosystems and communities, especially considering the vulnerability of bog turtle nests and the small size of juvenile turtles.

Summary of Threats

The potential threats outlined above include habitat loss and degradation, vegetative succession, development and changes in the watershed, climate change, illegal collection and trade, intensive grazing, vehicles, barriers to movement, detrimental beaver activity, disease, competition, predation, and invasive species. Many of these threats influence or are somehow interconnected with others, but this list encompasses all known or suspected threats to bog turtles and/or their habitat to some degree. Likewise, the degree of threat from some of these is largely unknown. Research and time may elucidate and fill some of these information gaps, but in the meantime, we must proceed and act with the best available data and information. Given our current knowledge of these threats and due to limited resources, it is important to recognize which threats are of greatest concern to bog turtles and their habitat in North Carolina. Major threats include vegetative succession, vehicles, habitat loss and degradation, predation, development and changes in the watershed, and barriers to movement. These threats comprise most of the problems for bog turtles, though the others certainly play a role and should be considered and incorporated into any action plans. Threats to monitor closely include illegal collection and trade, disease, and invasive species because these could have a large negative impact in a short time. Climate change is another threat that could have a negative impact and thus, it is essential to consider in all other planning for bog turtles and their habitat. Lastly, more research is needed to understand better the extent of threat that many of these issues pose. As we learn more, the Commission will need to adapt strategies accordingly.

Major threats for bog turtles and their habitats include vegetative succession, vehicles, habitat loss and degradation, predation, development and changes in the watershed, and barriers to movement.

CONSERVATION TOOLS

There is a broad array of "Conservation Tools" available to manage bog turtles and their habitat. This includes tools for inventory, monitoring, and research, habitat management and restoration, population management, regulatory tools, land protection, genetics, and Geographic Information Systems (GIS) and Imagery. We provide a brief description of each tool below, including an accounting of utility and information gaps. Each bog turtle population and its habitat are unique and thus require the use of a unique combination of conservation tools.

Inventory, Monitoring, and Research

A full accounting of possible techniques for inventory, monitoring, and research can be found in the Partners in Amphibian and Reptile Conservation's Inventory and Monitoring Handbook (Graeter et al. 2012). To find turtles we use a variety of active surveys that include looking for visible signs of bog turtles (e.g., basking turtle, nests, turtles on the move), probing with wooden broom sticks, and probing with hands to find turtles. We also employ passive methods to find bog turtles, including unbaited traps (Somers and Mansfield-Jones 2008) and placement of artificial cover (e.g.,

wood, metal, plastic) within bogs or along edges of bogs. Because bog turtles will go under artificial cover to warm themselves, this technique increases detection.

For our long-term monitoring efforts, we use two marking techniques — shell notching and PIT tagging, to give each individual captured turtle a unique mark (Graeter et al. 2012). This is critical as part of our long-term population monitoring effort at many sites. For research, we have used radio-telemetry, whereby small (<4 g and 5% of turtle's mass) transmitters are glued to the rear exterior of the turtle's carapace to allow us to track their movements and habitat use. Radio-telemetry reveals how turtles use areas within a bog and results help inform habitat management decision making. Staff also employs thread spoolers to track movement within a microhabitat. The thread spoolers can be attached to the shell for a few days to track the microhabitat use of a specific turtle (Graeter et al. 2012, Knoerr 2018).



To find bog turtles, staff uses a variety of survey techniques, including probing the soft ground with wooded broom sticks.

Habitat Management and Restoration

Although the habitat at some bog turtle sites appears to require little effort to maintain, this is certainly the exception. Many of the bog turtle sites that appear to have the most robust populations have had some form of repeated disturbance that maintained some open areas. Many factors that are believed to have kept some wetlands open historically are gone or diminished, such as bison, elk, beavers, natural fire or fires set by Native Americans (NCWRC 2015). Forms of disturbance that can help keep a bog relatively open include mechanical vegetation removal, grazing, prescribed burning, and/or beaver activity. We may also need to restore degraded hydrology and/or control non-native invasive plants. The aim is to create “high quality habitat,” as described in the Life History and Habitat section of this plan. Given that each site and situation is unique, the management techniques, intensity, and frequency of use of those techniques should be specific to each bog turtle site. These different habitat management techniques are summarized below.

Manual Vegetation Management

One method of setting back vegetative succession is to enter the bog on foot and use hand-held equipment, such as chainsaws, loppers, clippers, and hand saws to cut and remove woody vegetation. A detailed plan is devised with objectives, target areas to work in, and a plan to protect sensitive areas. Woody species commonly targeted include red maple (*Acer rubrum*), tag alder (*Alnus incana*), willows (*Salix* species), dogwoods (*Cornus* species), white pine (*Pinus strobus*), and swamp rose (*Rosa palustris*). In some sites, it may be desirable to avoid use of herbicides, but in most cases, wetland-approved herbicides are a valuable component of the woody vegetation control plan. Herbicide application methods used to control woody vegetation include injection, hack-and-squirt, and

cut stump (USFWS 2010). In North Carolina, we have most commonly used glyphosate (e.g., Rodeo) in treatment of woody vegetation within bogs, but other wetland-approved herbicides have been used by others, including imazapyr (e.g., Habitat). As we learn more about the various risks and utility of different herbicides, we will adjust our usage and application methods of these herbicides.

We are seeking to identify one or more methods for creating and maintaining high quality nesting habitat for bog turtles in sites and/or sections of sites that do not have grazers. We have experimentally used a handheld brush-cutter (i.e., weed eater with a blade) to lower the vegetation at several sites before the nesting season. As we learn more, we will apply any methodologies that show promise for improving nesting habitat to our conservation toolbox.

Vegetation management may also include the addition of native plants when non-native invasive plants have been removed, no shrubs are present within a bog, or if restoration has occurred and bare soil areas need to be planted to minimize erosion and get the process started on habitat improvement. When considering the addition of plants to a site, it is important to consult with plant experts, including botanists in the N.C. Natural Heritage Program and members of the Bog Learning Network, to establish an appropriate planting list. In choosing species to plant, we will account for the likelihood of each species to occur naturally on the property and the propensity of a species to spread invasively, among other factors.

Non-native Invasive Plant Control

At sites where the Commission has authority or permission to conduct management activities, we often survey and document the presence, abundance, and location of non-native invasive species, though to varying degrees depending on time and resources. Some invasive plant species can form monotypic stands and affect habitat suitability. Each species documented will be considered individually to determine what action and methods should be undertaken, if any. Some species may be best controlled through repeated pulling, while others may require treatment with herbicides or addressed through targeted grazing. The goal for some invasive plant species may be elimination. For other invasive plants, elimination may be an unrealistic goal, which results in efforts to control



Overgrown bog

and reduce the invasive plant species. Herbicide treatment methods for non-native invasive species include, but are not limited to: 1) injection of pellets into trunks of woody vegetation, 2) hack-and-squirt method using a sharp object to cut the trunk and spray the herbicide into the cut area, 3) cut stump method requiring application of herbicide immediately to a cut stem within 6 inches of the ground, 4) wick application method of applying an herbicide to intact leaves or stem of the plant, usually with a glove application method or stain stick, and 5) spot spray, which is a foliar application method that sprays herbicide on to the leaves and/or stem of the target plant (Tu et al. 2001). We have primarily used the cut stump application method with a sponge-tipped applicator to avoid dripping or spilling within the wetland but are open to using other application methods as necessary. We always use herbicides according to the protocols and safety warnings on the MSDS label. A list of non-native invasive plant species that have been documented within sites that have bog turtles in North Carolina is listed in the Threats section on Invasive Species.

Grazing

There are risks to having grazers in the wetland, but these presumably are minimal when grazing intensity is low to moderate (USFWS 2010; see Threats section). In many bogs with a history of grazing, low and moderate intensity grazing is beneficial to maintaining relatively open habitat (Tesauro 2002, Tesauro and Ehrenfeld 2007, USFWS 2010). Livestock grazing has played an important role in some bogs to stave off successional processes and keeping invasive plant species in check (Tesauro and Ehrenfeld 2007), thereby maintaining some open areas for bog turtle nesting and basking. Habitat conditions improved after grazers were added at several bog turtle sites in New Jersey (Tesauro 2001). Tesauro and Ehrenfeld (2007) found higher population abundances and densities, and more juvenile bog turtles in grazed sites. Cattle and other large grazers may also play an important role in bioturbation of the soil surface and creation of microhabitat from heavy footsteps. Tesauro and Ehrenfeld (2007) found that 45% of bog turtle captures in the grazed sites in their study were in hoof prints.

For some bog turtle sites, grazing will be an important tool in the conservation toolbox for bog turtles and for others, alternative management techniques will be more appropriate. In North Carolina, many of the sites with the most robust populations of bog turtles are "meadow bogs," which are characterized as a degraded natural area that has been kept relatively open by agriculture, livestock, or other human activity (Herman 2000) and several of these robust populations have been grazed. At sites with a history of grazing, we will presume that the benefits of low to moderate grazing intensity outweigh the risks, unless site-specific information and/or new research findings indicate otherwise. For sites that have never been grazed, use of grazing as a land management tool may be added to options in the overall toolbox.

There are various levels of grazing that can be employed. The USFWS B.O. outlines two general categories: "maintenance" grazing and "restorative" grazing with slightly different numbers of animals and periods of grazing. There are also a variety of different species and breeds that differ in many ways, from their size and weight, grazing style, and behavioral differences that influence the on-the-ground effects to the habitat and bog turtles. As mentioned under "Threats," a horse eats more than a cow of equal weight, sheep eat a greater variety of different plants, dairy cattle eat more than beef cattle, and goats and sheep tend to avoid wet areas (Crawley 1983, Menard et al. 2002). The management objectives may vary at a given site or even within different parts of one site. For instance, the objective could be vegetation maintenance, nesting habitat improvement, and/or reduction of a non-native plant species, among others. In an ideal situation, the most appropriate species, breed, grazing duration and frequency,

and area that is grazed would be customized specifically to meet site-specific management objectives. In North Carolina, we have taken an opportunistic approach to grazing. In almost all cases, the level of grazing and the species and breed has been determined based on the farmer's goals, without bog turtle or bog turtle habitat in mind, with a few exceptions. When possible, we would prefer a more strategic approach in the future, working with farmers to find a middle ground that maximizes the benefits and minimizes the risks of grazers, while meeting the needs of the farmer's business.

Several research topics related to grazing need to be explored in more depth. First, research is needed to investigate and better understand the ideal density for maximizing benefits while minimizing risks from intensive grazing. The USFWS B.O. (2010) states that when low to moderate intensity grazing is employed, the risk of cattle killing or stepping on bog turtles is low, especially when grazers have access to the uplands and grazers are excluded from nesting areas during nesting season. However, the most viable and stable known population of bog turtles in North Carolina has had cattle year-round for almost 70 years. Second, in addition to holding off succession by grazing, cattle and other large grazers are presumed to break up the soil surface (i.e., bioturbation), thus creating microhabitat and increasing access to subsurface water. However, research is needed to determine the role of detectability in these findings, to understand better the level of importance of bioturbation for bog turtles, and if it is an important component of high-quality bog turtle habitat, under what conditions is it needed. For example, it is possible that bioturbation is most needed in sites with degraded hydrology and/or sedimentation problems, in that cattle help break through the dry surface on the top to access the subsurface groundwater and soft mucky soils. Third, many bog turtle populations appear to decline when plant succession occurs. However, detectability likely decreases as habitat becomes more structurally complex with taller vegetation, thereby confounding comparisons of capture numbers between sites with regular disturbance, such as grazing, and those without it. Therefore, we need research to understand how site variables (e.g., vegetation structure and composition, soil saturation, microtopography, wetland size) affect turtle detectability to assess population status accurately.



Prescribed fire on a Wildlife Commission game land

Prescribed Fire

Prescribed fire can be used in some cases as a vegetation management tool, but managers should be cautious because very little is known about the ecological effects of these fires. Prescribed burning has been used minimally for vegetation management in bog turtle habitat. In fact, there are very few studies that have investigated the role of fire in wetland ecosystems in general (Osborne et al. 2013). We do not know the role or extent to which

wildfires in precolonial times would have helped slow succession in bogs. In some bogs, a fire may not be able to burn across the bog due to too much moisture and/or a lack of material to burn. But at other sites, it may be able to burn across the wetland under ideal conditions. Large shrubs are unlikely to be killed by most prescribed burns,

but small, new shoots may be stunted. Research is needed to understand better the ecological effect and utility of this method, and to determine general guidelines for using prescribed fire in bogs.

Restoration

Many of the restoration needs in wetlands with bog turtles involves addressing hydrology problems. Most wetlands have experienced human influence involving an attempt to minimize the wetland extent and increase rate of drainage out of the wetland area (Biebighauser 2007), including ditching, installing drainage tiles/pipes, and filling of wetland areas (Biebighauser 2007). Much of this work was done to improve agricultural and pasture lands. Landowners have also taken advantage of the constant flow of water from springs in the wetlands and created ponds on their property where bogs existed. To restore hydrology, we are often attempting to reverse those past efforts by removal and/or breakage of drainage tiles and other similar drainage materials, filling or plugging old ditches, and removal of fill dirt (Biebighauser 2007). Other hydrological restoration actions include addressing problems with head-cut erosion within or adjacent to the wetland, restoration of streams adjacent to bog. Another potential form of restoration in some cases is simply allowing a ponded area to fill in slowly over time so that it becomes a bog.

Allow and Monitor Beaver Activity

In a relatively unaltered landscape and watershed, beaver activity helps bog turtles, because it keeps some sections of a wetland complex open with mostly herbaceous and shrubby habitat, and areas are periodically flooded and opened back up so there is always some suitable habitat for bog turtles. Bog turtles are adapted to adjust their habitat use based on changing hydrology (Sirois et al. 2014, McCoy 2016). Flooding associated with beaver activity also benefits spotted turtles (Yagi and Litzgus 2012). A geomorphic study of a bog in western North Carolina indicated that the wetland has existed since the terminal Pleistocene, although it has changed in form over time (McDonald 2010). Thus, by allowing beavers to remain in these large wetlands, beavers may do the job of ensuring suitable habitat is present, though the site should be monitored to ensure flooding does not cover too much of the wetland or damage important habitat features.

Promotion of beaver activity at some bogs will require education of and outreach to landowners and managers. Beaver activity may be beneficial to wetland development, but often requires management to reduce flooding. Therefore, such activity may be better within a relatively undisturbed landscape with multiple areas where all essential habitat needs of bog turtles can be met even with some flooding. We will need to work with private landowners to find a balance between their needs and allowing beavers to remain and provide ecological benefits.

Population Management

One way to directly influence the bog turtle population at a site is through various forms of protection from predators or other threats such as use of electric fences surrounding a wetland and/or a nesting area, predator excluder cages over nests during incubation, and removal of meso-predators through trapping or other means (Macey 2015, Zappalorti et al. 2017, Knoerr 2018). These methods have made a difference in nest success, but much is still unknown about long-term population level effects. In some instances, these efforts to protect young bog turtles from predators may also extend benefits to juveniles and adults. Another technique that improves nest success involves moving nests to safer locations (Burke 2015), which could include attempts to mitigate for flooding of a nest or nesting area.

A multitude of population manipulation techniques, such as reintroductions and population augmentations, have been employed to restore wildlife populations, but very little is known about how effective they are with bog turtles. Population manipulation includes reintroductions (to sites that historically had that species), population augmentations (at sites with extant populations), introductions to sites (with no record of the species in past), and relocation of individuals from one site to another, although the terminology used in the scientific literature is not consistent (Dodd and Seigel 1991, Burke 2015). There are many tools used in these efforts, including captive rearing and head-starting. We need more information about how successful these management tools are for bog turtles to determine the suitability of using them in North Carolina. In Tennessee, more than 100 bog turtles were released at an experimental introduction site from 1991-2015, and although many turtles have been recaptured and several nests found during surveys, there has been minimal recruitment documented (Dresser et al. 2017). A head-starting simulation model by Shoemaker (2011) predicted very little effect on a New York population's security even with 10 years of head-starting, although the author notes that it may be useful if survivorship of head-started individuals far exceeds that of non-head-started yearlings.

Given that population manipulation efforts require much time, funding, and resources, we would only use these methods if we were confident that it was the best use of our resources to accomplish a specific goal for a site. If other non-population manipulation methods were available that would provide the same or better result with fewer resources and less time investment, then we would select the simpler method. The decision process will depend on the underlying goal — to restore the population to viability and self-sustainability, or buy time while we determine how to address major threats to a particular population.

Regulatory Tools

Existing regulatory tools that help conserve bog turtles include the Federal Endangered Species Act (16 U.S.C. 1531 to 1543), the State Endangered Species Act (G.S. 113-331 to 113-337), and Clean Water Act (33 U.S.C. 1344). However, the Threatened by Similarity of Appearance designation limits some protections afforded to the southern population by the Federal ESA, including incidental take. And, North Carolina state threatened and endangered listings in general allow incidental take. Therefore, some threats are not adequately addressed through current regulations and may have limited utility going forward due to land rights. Illegal take can be enforced and there is potential for addressing this threat through coordinated enforcement operations. Also, bog turtles are not the only wetland obligate species protected by the Federal and state ESAs; listed wetland obligate plants also rely on bogs and fens as habitat.

Land Protection

Land protection includes conservation ownership, conservation easement, and incentive programs. Public ownership, especially federal and state, or ownership by a conservation organization, such as The Nature Conservancy or a land trust, is often regarded as the strongest protection and the others are listed in generally decreasing effectiveness and/or longevity. Which agency is the best steward of the property often varies upon circumstances, but a goal of bog turtle conservation is necessary for maximum success. Partnerships with non-governmental conservation organizations are essential for many reasons, including their skills in grant writing and working with landowners, as

well as their ability to purchase property quickly. Some sites in conservation ownership are still at risk because of detrimental land-use activities and inadequate protection of the bog watershed. The value of watershed protection is acknowledged in the Mountain Bogs National Wildlife Refuge Land Protection Plan and Final Environmental Assessment as one of the four factors used in delineating Conservation Partnership Areas (USFWS 2014b). Private ownership with a conservation easement is strong protection if the conditions of the easement do not allow activities detrimental to the bog turtle or its habitat, but this does require regular inspection by the entity holding the easement. Conservation easements are often used by land trusts to allow private landowners to enjoy their property while also sustaining protected species. Both conservation ownership and conservation easements offer habitat protection.

Incentive programs on private lands improve habitat by providing a financial advantage to the landowner to manage for bog turtles and their habitat, but are not permanent protection.

Incentive programs on private lands improve habitat by providing a financial advantage to the landowner to manage for bog turtles and their habitat but are not permanent protection. The Wildlife Conservation Lands Program (WCLP) administered by the Commission is a tax incentive program available to landowners, including those with small wetlands or bog turtle records. The qualifications of the WCLP should be reviewed to increase interest and implementation to benefit bog turtles. Although the NRCS Working Lands for Wildlife Program only applies to the northern population of bog turtle, there will likely be opportunities in the future to work with NRCS in North Carolina to conserve bog turtles.

Genetics

Examining conservation genetic parameters, such as genetic diversity, inbreeding level, and bottlenecks, are important to bog turtle population management. For example, Pittman et al. (2011) compared the genetic status of an isolated population in North Carolina to five other bog turtle populations to assess population stability and genetic diversity of this population. A broader example of the use of genetics is examining range-wide population structure and historical patterns of differentiation among populations (Rosenbaum et al. 2007, Dresser 2017).

Genetics studies to investigate landscape effects on populations will benefit bog turtle conservation at a range-wide scale. Given that long-range movements are rare and difficult to document in bog turtles (Shoemaker and Gibbs 2013), exploring genetic patterns will give us a broader landscape scale perspective for this species. Landscape genetics can also help us infer metapopulation factors, such as levels of migration, effective population sizes, and levels of inbreeding, from genetic patterns. Results can inform conservation decision making as it pertains to the landscape features that may inhibit or enhance migration (Apodaca et al. 2012). Both the genetic parameters and metapopulation factors are valuable for decision-making about the use of potential population manipulation techniques. A genomic assessment can also be a useful tool for examining the success of a population manipulation program at a site, such as introduction of bog turtles to a novel location (Dresser et al. 2017).

GIS and Imagery

GIS (Geographic Information System) is a powerful and effective tool for managing, analyzing, and visualizing wildlife spatial data. Conservation partners use GIS and imagery resources such as historical imagery, LIDAR, current aerial photography, and parcel mapping to monitor and display population distribution, habitat use and preferences, and progress of conservation activities. Bog turtle populations can be discovered both on a small scale using aerial images to locate places with potential for bog habitats and on a larger scale by creating predictive GIS models to locate places with a high likelihood of having suitable bog turtle habitat. Historical imagery is a valuable resource for researching the land-use history of a site, such as past efforts to ditch, drain, or pond a site, whether it was forested/open and how the land cover has changed over time. This information can determine the best suite of management options. General mapping on GIS is useful to assess the connectedness of bog turtle populations (e.g., whether they lie in the same watershed or not; proximity to each other), as well as identifying landscape features that may pose a movement barrier to bog turtles.

CONSERVATION GOALS

The conservation vision for *Glyptemys muhlenbergii* is to protect and restore the populations and habitat of this species to prevent extirpation and ensure long-term viability across its current range in North Carolina for the next 100 years. The Wildlife Commission will work with our partners to achieve the following goals:

Goals

- A. Identify threats to bog turtle populations
 - A1. Improve knowledge of threats
 - A2. Conduct a site-specific threat assessment
- B. Maintain and maximize the number of viable populations
 - B1. Address threats
 - B2. Protect habitat
 - B3. Manage habitat appropriately
 - B4. Restore degraded habitat
 - B5. Manipulate populations when beneficial
- C. Further our knowledge about bog turtles
 - C1. Fill in information gaps about distribution in the state
 - C2. Monitor populations to determine status and trends
 - C3. Conduct research to improve our understanding of bog turtle ecology
- D. Expand outreach efforts
 - D1. Involve more collaborators
 - D2. More effectively reach landowners

CONSERVATION ACTIONS

Goal A: Identify Threats to Bog Turtle Populations

The more we understand the threats that bog turtles face, the more effective and efficient our conservation decisions can be. We need to learn more about the known and unknown threats to bog turtles and we need to assess and rank the threats on a site-specific basis.

A1. Improve Knowledge of Threats

We know quite a bit about the threats to bog turtles, but much is still unknown, especially in terms of the extent of impact from several threats. A first step is to continue learning more about these stressors through monitoring and targeted research. This can be done by studying specific populations to understand better what is shaping that population. Another angle is to learn more about the degree of impact of specific threats, such as road mortality, illegal collection, disease, grazing, and predation, on these populations. Through this process, we will develop a more thorough assessment of threats to bog turtles in North Carolina. This will be a valuable tool as we are making conservation and management decisions in the future. As part of this threat assessment, we need to gain a better understanding of which management actions may be most effective and economical to address these threats.

A2. Conduct a Site-specific Threat Assessment

To make educated management decisions on the ground, we need to have site-specific information about threats. We will rank the known threats for each site based on the best available data and information for each extant bog turtle population. Whenever possible, we will also attempt to determine the degree of influence of threats to the site. For example, at one site, the threat ranked #3 could be a huge threat to that population, whereas at another site the threat ranked #3 could have a minor impact. To accomplish this site-specific assessment, we will need to visit sites to assess the current situation, conduct a GIS analysis, and spend time organizing this information into a user-friendly format. Our initial focus will be on the Tier 1 and Tier 2 sites (see Goal B).

Goal B: Maximize the Number of Viable Populations

To prioritize and have an organized action plan for maximizing the number of stable populations, we have established a definition of viability. This definition is based on the most current published science and expert opinion on how best to assess the status of bog turtles. A single population will be considered viable if it is estimated to have 1) at least 15 individual female adult turtles found within past 10 years (Shoemaker et al. 2013) AND all age classes have been observed in the past 10 years (eggs, hatchlings, juveniles, and adults). Ideally, populations that meet these criteria for viability will also be stable or increasing, rather than in decline. We propose the following categories related to viability: non-viable, unknown viability, potentially viable, and viable.

Maximizing the number of viable bog turtle populations will necessitate several strategies and actions. First, the Commission will collaborate with conservation partners to rank all known extant populations from most to least viable using the categories shown above. Ranking will be accomplished through an objective and data-based method that considers survivorship, number of captures, life stages represented, metapopulation potential, and

other factors. Very few populations are truly viable (Tutterow et al. 2017) and even fewer are likely considered stable (Knoerr 2018). To provide structure and focus, we will target a subset of 10 sites at a time. Initially, most effort will go toward bringing the 10 “best” populations (“Tier 1”) to a viable state, with a plan for maintaining them as viable for the long-term. If there are restrictions on our ability to work in a site (e.g., no access on private land), we will add the next site from the ranked list. Also, some actions may be needed to help keep other populations from being extirpated or undergoing extreme population declines. Likewise, if opportunities arise for progress at lower priority sites in the tiered system, we will act whenever feasible. We will work at as many sites as possible at a time, but the tiered system will give us the ability to focus our efforts.

After Tier 1 populations are deemed viable and stable and an organized plan is in place for maintaining their viability, the focus will shift to the next 10 “best” populations (“Tier 2”). After Tier 2 populations are deemed viable, the Commission will shift focus to the next 10 populations (“Tier 3”) and so on, until the Commission has attempted to work on all known extant populations. Although many single populations appear to be relatively isolated on the landscape from others, whenever possible, high priority and extra effort will be given to populations that are part of a metapopulation.

After the populations have been ranked, the optimal strategy for maintaining or restoring a viable population can be developed for each. Ensuring there are a set of populations that are stable or increasing is an important first step toward minimizing the chances of this species being fully federally listed or becoming regionally extirpated in North Carolina. Also, through this process, the Commission will learn more about the most efficient and cost-effective way to move a population from “declining” to “stable or increasing,” which will help in the restoration, management, and protection of additional populations.

Several actions must be used to work toward meeting this goal, with some actions more central and others more peripheral, yet still important. Population monitoring, habitat management, targeted research, and implementing actions to address threats at a specific site are the most integral strategies to this process. However, other actions that also play a role in the success of meeting this goal include habitat protection, population manipulation, law enforcement, and disease-abatement efforts.

B1. Address Threats Specific to each Site

After identifying threats and issues that each site faces, the Commission will devise a plan to implement activities that will improve the viability of a population. In some cases, we may need to act before we fully understand the situation. The response needed to address each threat is described below. This list is not exhaustive. It is based on current knowledge and subject to change:

Habitat loss and degradation:

- Protect remaining bogs and the surrounding landscape through fee-simple purchase, donations, conservation easements, and other protective means.
- Through permit-reviews (e.g., NCWRC, USFWS) and enforcement of current regulations (e.g., USACE, EPA, NCDEQ), protect bogs from further destruction and degradation (e.g., filling, ditching, flooding to create ponds).
- Propose additional regulations to protect remaining mountain bogs.

- Launch education and outreach programs for landowners that encourage bog turtle habitat best practices, with the aim of reducing additional habitat loss through activities such as ditching and draining.
- Explore development of additional incentives for landowners to implement habitat management best practices.

Vegetative succession:

- Create a map of vegetative zones of the wetland and surrounding landscape and place points or polygons on the map to indicate locations of different known habitat features (nesting areas, hibernacula, springs, etc.). Begin devising a plan for each of the zones to provide all critical bog turtle habitat needs somewhere in the wetland (shrubby area for shade, open sunny area with short herbaceous vegetation for basking and nesting, areas with deep mud for overwintering, food sources within or on perimeter of wetland, area with thick vegetation for hiding, multiple areas with surface saturation, etc.).
- As part of the plan for each zone and based on the scientific literature and recent research results, determine what the most appropriate management technique to use (e.g., grazers, mechanical vegetation removal, prescribed fire).
- Develop a management schedule (manual shrub thinning and herbicide application, grazing, burning, etc.) for all extant populations, beginning with Tier 1 and 2 sites. This schedule will be adaptive relative to site-specific needs.
- Partner with agencies that have programs that facilitate habitat management on private property, including NRCS and USFWS Safe Harbor Agreements

Development and changes in the watershed:

- Purchase or protect surrounding landscape when feasible to mitigate detrimental changes in the watershed.
- Through attentive permit review, make recommendations that reduce stormwater runoff, decrease impermeable surface area, and support measures that increase infiltration into the groundwater.
- Partner with NRCS and USFWS programs to aid in reducing agricultural runoff into wetlands.
- Educate adjacent landowners about water conservation.
- Partner with a hydrologist to understand better the hydrology of each site, to map springs, understand flow regimes, and potential threats to the hydrology.

Climate change:

- Prioritize protection of bogs that have multiple and productive springs because these wetlands have the best chance of remaining saturated enough for bog turtles when droughts occur.
- Protect surrounding landscape so that the negative effects of intense rainfall events are lessened due to water infiltration and the ability to address runoff issues.
- Be prepared to increase the frequency of management activities targeted at woody stems and invasive plants, because these are likely to fare better under most predicted climate change scenarios.
- Devise ways to help protect the diverse sphagnum species from reduction and die-off with increased temperatures and higher nutrient levels.

Illegal collection and trade:

- Increase enforcement efforts by state and federal officers, including patrolling near Tier 1 and 2 sites and any others deemed vulnerable to illegal collection.

- Foster stronger relationship between biologists and enforcement officers across the state, but especially those who work in western North Carolina and the Piedmont counties with records of the bog turtle.

Intensive grazing:

- When grazing exceeds 0.75 animal units/acre and/or ≥ 2 nests are trampled, work with the landowner to reduce the intensity of the grazing in the wetland, especially during the bog turtle nesting season (June 1-September 30).
- Consider installing temporary or permanent fencing that makes it possible to limit excessive grazing in known or suspected nesting areas after turtles have nested each year. Conservation partners such as USFWS and NRCS may be able to assist with funding and implementation.
- If a site is on the brink of a local population extirpation, determine whether the potential risks of grazing are outweighing the benefits when the loss of one adult turtle may have a significant detrimental effect on the viability of the population, and act accordingly.
- When appropriate, set up grazing lease agreements on properties that are state or federally owned to ensure that sites with a history of grazing continue to provide suitable habitat. These lease agreements may include seasonal components and protection of sensitive areas if that is deemed important for the population.
- At sites with no history of grazing, when the plant community and/or topography of a site is deemed too sensitive for grazers, use other habitat management techniques.

Vehicles:

- Educate landowners about ways to minimize injuries/deaths of bog turtles from mowing and bush hogging near bog turtle habitat. Discourage them from bush hogging in the wetland and offer to assist in doing that work by hand. Encourage them to raise the blade level as high as possible and to leave a buffer that is rarely disturbed between the wetland edge and agricultural crops. Encourage them to mow when turtles are less likely to be in the field (e.g., during heat of the day in summer).
- Protect property so use of heavy equipment in or near bogs can be eliminated or minimized.
- Form a task force to address issues of roads and determine a multi-faceted plan for dealing with this issue. Address this issue at sites we know or suspect bog turtles are impacted the most by road mortality/injuries. An important partner in this task force is the N.C. Department of Transportation (NC DOT).
- When we have evidence of bog turtles crossing a road at a site, install drift fences to reduce access to the road surface and direct them toward under-road crossings.

Barriers to movement:

- The task team addressing issues with transportation infrastructures will include this in its discussion and planning.

Detrimental beaver activity:

- When beavers are causing damage to bog turtle habitat, determine best action(s) to take, which may include setting up devices such as the Clemson Pond leveler to reduce problems associated with flooding (CUCES 1994), trapping and removal of beavers, and/or regular manual removal of beaver dams to prevent flooding, among other tactics.

Disease:

- Form a task team to address disease concerns and develop protocols for handling disease cases and preventing spread of parasites and pathogens from one site to another. Use sources that already exist (e.g., SEPARC disease task team reports, Bog Learning Network Decontamination Protocols) as a starting point.

Competition:

- Given that experts see this topic as a minor threat relative to other issues, the Commission will likely not set specific objectives to mitigate competition, especially because this is presumably a natural aspect of the bog turtle's ecology. At some point, research could be done to examine how much competition there is, from what species, and what effect it has on the bog turtle population, but this is a low priority research question currently.

Predation:

- Additional research is needed to determine which sites are threatened by predation issues and to characterize the extent of this problem. Although predation is a part of the ecology of bog turtles, some populations are in such peril that action is needed to give the population a boost.
- When a predator issue is identified, an action plan should be devised. The plan of action will be tailored to the site and management options that are available. At some sites, a single predator may need to be removed from the property. In other cases, it could be much more complex and may require other techniques, including trapping and humane euthanasia of the problematic individual predators and protection of nests via predator excluder cages. In most cases, it will be necessary to monitor the situation after taking action to see if the problem has been fully addressed or whether we need to adapt the plan. Predator removal is not always appropriate and may not be effective in some situations.
- Education of adjoining landowners may be needed when feral pets have been identified as a problem. This need may include knocking on doors and talking with landowners and possibly providing educational programs and literature in the community.

Invasive species:

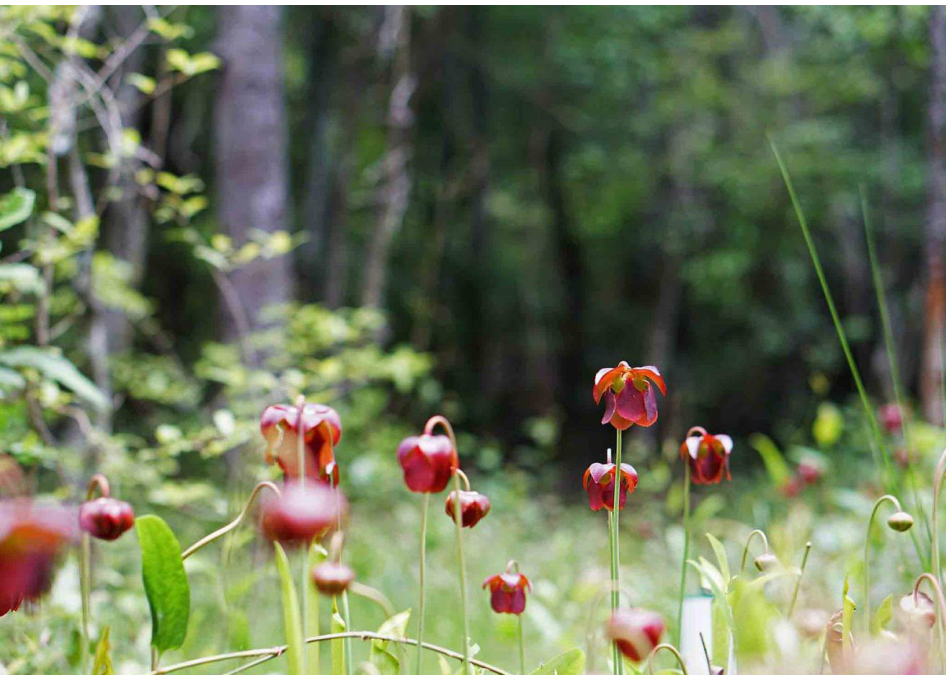
- Incorporate treatment and removal of invasive plants into site-specific Management Plans that are being written.
- Develop a plan to survey for and eradicate invasive plant species when they are first found and have not spread. This strategy is especially important for species that have proven to dramatically alter the structural integrity of a bog turtle site and that are particularly difficult to eradicate/treat (e.g., reed canarygrass, purple loosestrife).
- Develop a response plan to prepare for the discovery of fire ants at a bog turtle wetland.

B2. Protect Habitat

With partners and willing landowners, the Commission will aim to protect all known bog turtle populations through conservation easements, fee-simple purchase or donation, or some other form of protection with 20 populations

as the initial goal. The Commission will make protection of the Tier 1 sites a priority and secondarily, the Tier 2 sites. These are our most important bog turtle populations and without protection, all our other efforts could be in vain. Commission staff will only work with landowners who have voluntarily expressed an interest in protecting a bog. Our strategy will require developing a prioritized list of all sites that we would like to have protected as well as a concerted effort to reach out to landowners and ask for their interest in selling or setting up an easement or taking other protective action, such as registration under the NCNHP Registered Heritage Area program or permanent easements through NRCS. When conservation easements are created, we will ensure that the language in the easement document allows for appropriate management of the bog turtle habitat.

The initial planning list will have more than 20 sites so the Commission can identify 20 that have landowners potentially willing to cooperate in site protection. It would be ideal to maintain relationships with all landowners that have bogs on their property and convey to them that we are interested in purchasing their property if they are interested in selling. Although some landowners may not currently be interested in selling or setting up an easement, they may be interested in the future. It will take time and patience to maintain relationships with families so the Commission is in a position to act to protect bog habitats when opportunities arise. Hopefully, some of these sites will be the ones identified above.



Mountain sweet pitcherplant grows in Southern Appalachian bog (Photo: USFWS)

The Commission has identified bog turtle metapopulations in the state from which staff will create a ranked list of sites from most to least functional as a metapopulation. Ultimately, we would like to see all metapopulations protected, but our initial efforts will focus on the five best metapopulations. The Commission will make a concerted effort to protect, appropriately manage, and when necessary, restore these metapopulations. Commission staff also will attempt to protect the land between these metapopulations, especially rivers and streams and their associated riparian areas, as well as any undeveloped terrestrial land that lies between the bogs that make up a metapopulation. Through partnerships with land trusts, other agencies, and private landowners, the Commission

will attempt to protect as many of the wetlands and uplands between them in each of these five metapopulations. The regional land trusts will play a critical role in developing relationships with additional landowners and assisting in an educational campaign in the communities closest to these metapopulations.

Protecting the actual wetland is the first priority, but the Commission will also strive to protect additional land because this is critical for habitat quality and suitability for bog turtles. Other target lands for protection will include

the land immediately surrounding the wetland, the entire watershed that feeds the wetland, the land between wetlands, and any other lands/wetlands that would benefit the population or metapopulation. Protecting the watershed is critical. Key components for this include inclusion of riparian buffers, minimization of impervious surfaces, and limiting activities that involve water extraction. When possible, the Commission will also protect the upland, wetland, and stream habitat between bogs and within all identified bog turtle metapopulations to maintain or improve movement corridors, habitat connectivity, and gene flow. Any additional protection is considered positive.

B3. Manage Habitat Appropriately

The Commission will draft management plans for bog turtle sites, prioritizing sites where a bog turtle population would benefit, where staff has permission to manage the site (i.e., state, federal, or NGO owned, or with permission from a private landowner), and where complex and immediate management needs exist at the site. The Commission will collaborate with partners to draft these plans. The full suite of management and conservation tools that are available will be considered in development of these plans. The habitat and threats that each site faces are site-specific, and thus, different tools and techniques will be appropriate and suitable for any one site. Conservation and management tools to be considered include mechanical thinning and removal of vegetation, treatment of invasive plants, prescribed fire, use of herbicide for treatment of invasive native and exotic plants, hydrologic restoration (e.g., plugging ditches, fixing head-cuts, breaking up drain tiles, removal of fill dirt), population management (e.g., nest protection, head-starting, re-introductions), use of grazers/browsers (e.g., cattle, goats, bison), planting desirable native plants, and any other management tool that helps staff accomplish goals.



Treating invasive plants with use of herbicide is one management tool Commission staff will consider to manage bog turtle habitat appropriately.

Each of the Tier 1 and Tier 2 sites should be evaluated to determine if any habitat management is needed at those sites to ensure that all essential components of suitable habitat are present (see “Life History and Habitat” section), and that it is of adequate size and quality. If any essential components are missing, then the plan of action moving forward should be to take action on anything that has minimal risk to the turtles with a good chance of a neutral or positive outcome, even if a Management Plan has not been written for that site. It is important to take actions with little risk now, rather than watch a population decline over time while waiting for a perfected plan. After habitat management has been conducted, Commission staff will evaluate the management efforts through subsequent rigorous population and habitat monitoring, as well as research (e.g., radio-telemetry).

The Commission will also work toward establishing a prioritized schedule for habitat management of all extant bog turtle populations. The schedule’s purpose is to help organize and prioritize what needs to be done and to determine what is realistic given our resources. The Commission will identify needs related to that schedule, including

staff capacity, partners, budgets, funding, and anything else required to carry out the habitat management plan. The Commission will then reach out to partners for assistance in implementing these management activities. The schedule also will incorporate monitoring for each site that will be managed.

Another important effort will involve habitat management of all the wetlands that are part of the five priority metapopulations that have been identified, whenever landowners are willing and the funding is available. Even if all the wetlands in a metapopulation do not have records of bog turtles, those habitats should be managed and restored whenever possible with bog turtles' needs in mind. These actions will be done in consideration of the existing plant community and with the aim of improving habitat for other wildlife and the conditions for rare plants. Wetlands that are not occupied by bog turtles now may be colonized in the future or used periodically during movements across the landscape.

B4. Restore Degraded Habitat

The Commission will identify 20 bog turtle sites that have the potential through restoration activities to provide high quality habitat to bog turtles. When those 20 have been addressed, we will assess needs at additional sites. These sites must have a bog turtle population with some suitable habitat. It is also essential that experts have determined that by taking certain steps it is likely the habitat will be expanded and/or improved. We also must have the ability to manage the property. Therefore, sites with a permanent conservation easement or owned by government or conservation entities will take priority due to the ability to manage and protect the site long-term.

After we identify these 20 sites, the Commission will determine the actions needed at each site and begin scheduling and planning restoration work. In some cases, projects may be small enough to allow Commission staff to conduct the necessary work with assistance from partners and/or volunteers. In other cases, Commission staff will



Appalachian Mountain Bog

need to seek additional funds, design a detailed restoration plan, consult with experts, and hire contractors to carry out the restoration project. After these 20 sites are restored and a management schedule established to maintain the sites for long-term suitability, Commission staff will choose additional sites that also have the potential to provide high quality habitat and take action with those as well. Programs such as NRCS landowner agreements and USFWS Safe Harbor Agreements may prove to be helpful tools for habitat management, restoration, and short-term habitat protection.

B5. Manipulate Populations When Beneficial

A summary of the various population management techniques can be found in the Conservation Tools section. To protect nests and hatchlings on-site, staff should implement appropriate population management techniques whenever necessary and likely to be effective. However, for more intensive population manipulation activities, we will collaborate with partners to develop an objective, science-based evaluation process. This process will require certain criteria be met before a population manipulation technique is deemed appropriate for a specific site, as was done with a reintroduction program for Blanding's turtle (*Emydoidea blandingii*; Buhlmann et al. 2015). This process must include a method for evaluation of the program at specific times (e.g., once a year) after a population manipulation project has been initiated.

We also need to develop a Commission policy on these types of population manipulations, perhaps as an overall agency herpetofaunal augmentation or head-starting policy. The policy should include measures to limit any type of population manipulation to sites where data indicate bog turtles are likely to benefit from population-manipulation actions and staff is likely to succeed in taking these actions. Similarly, we will develop requirements for facilities involved in handling or holding turtles for population management purposes (e.g., secure from illegal collection, ability to follow protocols for rearing/head-starting, disease concerns, genetic concerns). This will include exploring potential partnerships with facilities for future projects that involve rearing or head-starting North Carolina bog turtles.

The Commission will learn from studies in other states (e.g., Dresser et al. 2017), but we will also initiate a pilot study in North Carolina to learn more about the utility of these techniques. Long-term mark-recapture population monitoring at sites that have had some form of population management — from efforts to protect nests to augmentation and reintroduction — will be extremely valuable in improving our understanding of the utility of the various population management techniques. Research is also needed to investigate survivorship and fertility of head-started turtles. Genetic studies will be especially helpful as we develop guidelines on the use of these population manipulation techniques.

Goal C: Further Our Knowledge about Bog Turtles

We have learned a lot about bog turtles in North Carolina over the last 40 years, but there are areas where we need more information. Using new GIS technology, we would like to identify geographic areas to target for surveys, and eventually create a more comprehensive distribution map of the species in North Carolina. Likewise, we need to continue monitoring the status and trends of the species, with a focus on creating a more organized and robust monitoring plan. Lastly, additional research is needed to address specific questions related to management and conservation.

C1. Fill in Information Gaps about Distribution

It is likely that there are still bog turtle populations that have not been discovered in North Carolina. In recent years, through concerted efforts, the Commission has found several bog turtle populations that we did not know existed previously. Many small wetlands are not easily accessed or seen from public roads. Given how cryptic the species is and most humans' aversion to getting deep into a muddy place, many landowners do not know they have bog turtles on their property. New GIS technology has improved our ability to detect these small mountain bogs from aerial imagery. Attempts have been made to create a predictive mapping layer in GIS (e.g., Stratmann et al. 2016), but none of these efforts have proven accurate enough to aid in narrowing the areas to search for new populations. However, there is now LIDAR imagery for western North Carolina and with this GIS layer, individual wetlands can be identified. Thus, the Commission can tap into this resource and design a predictive model that will prove useful in locating bogs with high potential for bog turtles. Biologists in the states where the southern population of bog turtles exists have discussed collaborating to fund this type of endeavor. Not only would this predictive model be helpful in locating potential bog turtle populations, but it could also aid in finding bogs that would benefit from restoration or habitat management.

Another potential method that may aid in increasing our knowledge of bog turtle distribution is the use of small airplanes or drones to identify wetlands with potential for bog turtles. We could target specific areas of interest in parts of western North Carolina that are more remote with fewer roads. It may also prove helpful to reach out to private landowners through news releases, newspaper articles, and through NRCS offices, especially in counties with extant populations, to encourage them to contact the the Commission and consider allowing us to survey wetlands on their property.

It is important to learn more about the distribution of bog turtles in the state so the Commission has complete information of how many bog turtle populations exist, their geographic distribution, and their status. With this information, we can make more informed conservation decisions.

C2. Monitor Populations to Determine Status and Trends

Regular monitoring through mark-recapture, site occupancy, and presence-absence surveys is important so we can continue, or in some cases, begin to assess the status of these populations over time. Monitoring is important because it can detect positive or negative changes that occur in response to our efforts or other factors. Although the Commission and partners have monitored bog turtles for many years, the project would benefit from long-term strategic planning and a more structured and scheduled monitoring plan as an important first step. This plan will specify the monitoring scheme for each site. Regular monitoring and consistent mark-recapture data collection at the Tier 1 and Tier 2 populations are important for assessing the status and trends of these populations over time. This information can help inform adaptive management. We also need to gain a better understanding of detectability of bog turtles in North Carolina's varied bog habitats.

Monitoring will need to be multi-faceted, where some sites have more intensive monitoring and others are simple presence-absence monitoring. At the more intensively monitored sites, we may need to conduct multiple surveys each year, using multiple sampling techniques (e.g., active searching, trapping, coverboards) with cooperation of

partners. Ideally, we would conduct three surveys a year at high priority sites. The Commission will minimize potential negative impact from our own work in these bogs.

C3. Conduct Research to Improve Our Understanding of Bog Turtle Ecology

Research is needed on multiple topics to understand better the ecology, habitat use, and appropriate habitat management actions to take. As we consider what needs to be done to help a site become or remain a viable population, the Commission will likely have many questions about why these populations are currently in apparent decline. In some cases, it may be obvious why a population is in decline, but when it is not, we must use research to answer our questions and identify the main limiting factors, so our efforts can be focused on actions that will bring positive outcomes. Research studies can also be used to examine the success of certain conservation efforts. In addition to identifying major threats to bog turtle survival, the Commission will evaluate the success of potential conservation strategies (e.g., using radio-telemetry to examine the behavioral response of turtles to habitat improvements).

The Commission conducts research to understand the threats and issues for a particular population so we can choose the most effective tools from the conservation toolbox. If we already know what actions to take, then research is not necessary. The Commission will only pursue research when the results will aid in our conservation and management decisions.

Given the importance of these Tier 1 and 2 sites, we must carefully weigh the needs and benefits of the information gained against any risks from the work and minimize potential negative impact to these populations during research.

Some prioritized research topics we need to address are listed below, but this list is not exhaustive. As we learn more and as we begin working toward the goals in this Plan, different questions may arise that need to be answered.

1. Research life stages that affect potential for successful recruitment into adults (adult fertility, adult female fecundity, proportion of females that produce fertile eggs each year, egg survival/nest success, hatchling survival, juvenile survival). Learn more about which of these stages is the limiting factor(s) so we can better target our efforts.
2. Gain a better understanding of which threats (e.g., predation, flooding, poor nesting habitat, infertility) are playing the most significant role(s), and which management actions may be most effective and economical to address these issues (e.g., predator control, nest protection, habitat management, population augmentation).
3. Identify new wetlands with turtle populations (e.g., LIDAR proposal).
4. Investigate suitability of population manipulation (e.g., reintroduction, population augmentation, captive



Collecting data on a bog turtle (Photo: Gary Peeples/USFWS)

- breeding), including investigating differences in survivorship and fertility of head-started turtles and genetic studies/guidelines on these techniques.
5. Examine the efficacy of different vegetation management techniques (e.g., appropriate level and use of grazing at different sites). Include grazing studies focused on ideal density of grazers, influence of detectability on perception of population status, importance of grazers breaking up wetland soil (i.e., bioturbation).
 6. Develop a predictive population modeling program specific to bog turtles that can be used to determine which conservation and management actions (e.g., nest protection, habitat restoration, head-starting) are most feasible, cost-effective, and ecologically beneficial to each population.
 7. Conduct genetic studies to determine gene flow and population health and to guide population management actions such as reintroductions, augmentations, relocations, and captive-breeding.
 8. Improve understanding of landscape ecology and metapopulation dynamics (e.g., degree that different landscape features pose a movement barrier, degree of connection between different populations).
 9. Improve understanding of bog hydrology (e.g., variation between bogs, inter- and intra-annual differences, influence of past disturbances, relationship of bog hydrology to bog turtle habitat use) and water quality (e.g., baseline conditions, effects of agriculture and development).
 10. Estimate detection probability, including (but not limited to) individual detectability, site-specific estimates, and effect of different habitat features.
 11. Refine survey methods to improve detection of hatchlings and juveniles.
 12. Conduct occupancy modeling to determine what qualifies as suitable habitat, adequate habitat size, and adequate habitat quality.
 13. Examine differences in food availability across bogs.
 14. Conduct in-depth studies to improve understanding of dispersal distances traveled, habitat used.
 15. Study overwintering sites and determine if they can limit bog turtle populations.
 16. Identify diseases and health issues that may affect certain populations.
 17. Conduct behavioral study of reproduction; parentage study (e.g., are there behavioral limitations that can affect reproduction at some sites? can adults find each other: do they breed with close relatives, and if so, are those offspring viable?)
 18. Investigate the effects of climate change on bogs (e.g., hydrology, vegetation, resiliency of bogs over long-term).

Goal D: Expand Outreach Efforts

Although we have a strong network of collaborators and solid relationships with many private landowners, there is still room for improvement. Working with additional partners could make a significant difference in conservation of the species if it brings increased funding, programs, and protection of the species. Likewise, having a more robust outreach program for landowners would help us to effect more positive change and reach more landowners.

D1. Involve More Collaborators

We need to continue building relationships with entities that can provide management and protection assistance to landowners, including NRCS and land trusts. The main objective is to improve our communication and collaboration with NRCS staff about bog turtle conservation needs and how they can help. Another task will be to provide educational programs for NRCS staff about mountain bogs and bog turtles. With land trusts, we need to provide

information that outlines specifically how and where we need their assistance with protection measures for bogs. The Commission will continue to build on the strong relationships we already have with many land trusts in the region and take steps to strengthen those that have not been as active in bog turtle conservation efforts.

Second, collaboration with law enforcement officers must improve. A first step is to provide educational forums for law enforcement officers so they can help in education and protection of the species and its habitat in the state. The Commission will focus efforts on western North Carolina. Instruction topics will include bog turtle ecology and habitat, as well as identification of potential illegal collection of the species. We also will strengthen our relationships and work more closely with law enforcement officers that have bog turtle populations in their districts so that they will know the geographic areas that need extra patrolling for potential poachers.

D2. More Effectively Reach Landowners

In collaboration with partners, the Commission will develop and implement an effective outreach and education program about bog turtles that is designed for landowners that have bog turtles and/or mountain bogs on their property. A first step is to form a planning committee to determine what the most effective products and/or programs will be. This could include an information packet, an educational program, and/or any other idea the group develops. Project Bog Turtle and the USFWS each have some materials that may be useful, but they likely need to be updated. The committee will decide whether this will be a single effort or if the committee will meet regularly to continue long-term education and outreach efforts for landowners. This planning committee will also consider how best to assist landowners with habitat management on their property, especially when they have an interest in taking responsibility for this work.

In addition to developing outreach materials and programs, we need to consider how to employ the materials to reach additional landowners better and we need to identify tactics to help maintain the existing relationships. Likewise, due to the time-consuming nature of maintaining landowner relationships (e.g., many visits, long conversations, regular phone calls), we need to increase staff capacity to meet this need better.



SUMMARY OF ACTIONS NEEDED

Table 1 in this bog turtle plan summarizes the conservation actions recommended by Wildlife Commission staff in general order of priority. However, each of these actions is high priority and necessary. Additional actions may be identified as we learn more about this species and the sites in North Carolina. Actions will be taken as time and resources allow.

TABLE 1. A summary of Conservation Actions needed to address the goals, the partners involved, and the desired outcomes of each action. These actions are listed generally in order of priority, though all actions are considered important and necessary.

#	ACTIONS	GOALS	PARTNERS	DESIRED OUTCOMES
1	Rank all known populations from most to least viable, with the top 10 populations called Tier 1 and the 10 next best populations Tier 2. Focus on Tier 1 initially until determined "viable" then Tier 2, then continue to next 10 best populations.	B	USFWS, PBT, NCNHP, NPS-BRP, State Parks	1) Organized plan for focusing efforts, 2) Many viable bog turtle populations in North Carolina.
2	For Tier 1 (Tier 2 sites when possible) assess threats, determine highest priority actions, and act to address identified threats (e.g., vegetative succession, vehicles, disease, predation) and other needs (e.g., research, land protection, monitoring).	A, B, C	USFWS, NRCS, and PBT, plus agencies and owners of sites identified	1) Reduction of threats affecting Tier 1 and Tier 2 sites, 2) Securing Tier 1 and Tier 2 populations as solidly viable
3	Take actions that are needed to help keep the Tier 2 populations from being extirpated or undergoing extreme declines.	B	USFWS, PBT, and land-owners	Maintenance of Tier 2 populations as still recoverable
4	Evaluate Tier 1 and Tier 2 sites to determine if habitat management is needed and carry out any needed management.	B	USFWS, BLN, PBT, NCNHP, NPS-BRP, State Parks, NRCS, etc.	All Tier 1 and Tier 2 sites are managed well over long term.
5	Develop a prioritized list of sites that need protection. In the short-term, identify and protect 20 bog turtle populations that can be protected.	B	PBT, NCNHP, USFWS, other partners	1) Prioritized list of sites that have no protection that have known populations, 2) Protect 20 bog turtle populations.
6	Protect Tier 1 sites and secondarily, the Tier 2 sites	B	Land trusts, State Parks, NCNHP, TNC, and USFWS	Protect all Tier 1 and Tier 2 sites and their watersheds
7	Protect bogs that have willing landowners (fee-simple, donation, conservation easement, etc.), with the long-term goal of protecting all known bog turtle populations.	B	Land trusts, State Parks, NCNHP, TNC, and USFWS	Protect all known bog turtle populations

#	ACTIONS	GOALS	PARTNERS	DESIRED OUTCOMES
8	Identify 20 sites that have potential through management/restoration to provide high-quality habitat. Then determine actions needed at each of these 20 sites, make a schedule, and implement management/restoration.	B	PBT, USFWS, owners of sites, other partners	1) List of 20 sites will target that have potential to provide high-quality habitat, 2) Regular habitat management and restoration of these 20 sites
9	Create a prioritized schedule for habitat management that includes all extant populations, including the specific needs of each site.	B	PBT, USFWS, and other partners	Organized schedule of habitat management for all known sites with extant populations
10	Research life stages that affect potential for successful recruitment into adults. Learn more about which stages are limiting, so conservation efforts are more efficient and effective.	C	Researchers	Data gaps filled through research about life stages that affect recruitment (e.g., hatchling success, hatchling and juvenile survival)
11	Learn more about role of different threats and which management actions may be most effective and economical to address these threats	A	Researchers, and other partners	1) Solid understanding of relative roles of various threats to bog turtles, 2) solid understanding of the effectiveness of different conservation actions to address these threats
12	Develop a population viability modeling program to aid in assessing utility of various conservation and management actions for their benefit to a population.	C	Researchers	Tool to improve our planning and management abilities for bog turtles in North Carolina
13	Build relationships with entities that provide management and protection assistance to landowners (e.g., NRCS, land trusts) through improved communication and collaboration and educational programs.	D	USFWS, NCRS, land trusts	1) Knowledge of bog turtle conservation needs and engagement from NRCS, land trusts, and other entities that provide management and protection assistance to landowners, 2) Many landowners signed up for programs that help conserve and/or protect bog turtles.
14	Generate a ranked list of metapopulations from most to least intact functioning. Initially focus on top 5. Make concerted effort to protect, appropriately manage, and when necessary, restore these 5 metapopulations as well as the land between them and within their watersheds	B	USFWS, PBT, other partners	1) Organized plan for protecting, managing, and restoring metapopulations, their watersheds, and the land/water between, 2) Full protection, appropriate management, and necessary restoration accomplished within these 5 best metapopulations in the state.
15	Determine most appropriate monitoring scheme for Tier 1 and Tier 2 sites and implement	C	PBT, USFWS, other partners	Solid monitoring plan for all populations at Tier 1 & Tier 2 sites being carried out in organized, regular, and consistent basis

#	ACTIONS	GOALS	PARTNERS	DESIRED OUTCOMES
16	Conduct big-picture planning and develop a structured and scheduled monitoring plan that includes all known bog turtle sites. Implement this monitoring plan.	C	PBT	Solid monitoring plan for all known bog turtle populations being carried out in organized, consistent, and regular basis.
17	Conduct research to answer critical questions about bog turtle biology, habitat requirements, population health, genetics, and habitat management, etc.	C	Researchers and other partners	Gain relatively good understanding of major threats, habitat requirements, turtle population dynamics, and landscape ecology; use knowledge to appropriately manage habitat and turtle populations
18	Take steps to improve collaboration with law enforcement officers (e.g., educational forums, strengthen relationships)	D	USFWS, other partners	Educate N.C. law enforcement officers, especially those within the geographic range of bog turtles, to become very knowledgeable about the species, the signs of illegal collection, the sites within their work area, and ensure the officers are searching for illegal collection and other illegal activity related to bog turtles.
19	Develop a decision framework (objective, science-based) for determining if and when population manipulation techniques are appropriate, their chance of being successful, and their cost-effectiveness.	B	PBT, USFWS, other partners	Clear and effective decision framework based on science that can be used to determine if and when population manipulation techniques are appropriate at a site.
20	Make a concerted effort to reach out to landowners, educate, build relationships, and connect land-conservation partners (e.g., land trusts) to landowners	D	PBT, USFWS, other partners	These efforts and good relationships lead to more bogs protected and managed appropriately, and more bog turtle populations discovered.
21	Write management plans for bog turtle sites, prioritizing sites with complex and immediate management needs, a population that would benefit, and that the Commission has permission to manage. Apply these plans.	B	PBT, USFWS, owners of sites	1) Management plans are helpful documents in guiding our actions and help us focus our efforts where needed most, 2) Sites with management plans are managed appropriately.
22	Develop a predictive model using LIDAR (and/or other promising methods) to identify new potential wetlands and increase our knowledge of the distribution of bog turtles in North Carolina.	C	Other states, researchers	1) This model is a tool with great utility in helping us locate previously unknown bog turtle populations, 2) We fill in distribution gaps for bog turtles in North Carolina.
23	Through collaboration with partners, including PBT, land trusts, TNC, and USFWS, develop and implement an effective outreach and education program for landowners	D	PBT, land trusts, TNC, USFWS	1) Better educated landowners, 2) More resources that can be used to inform and educate the public about bog turtles, their ecology and habitat, and the importance of protecting and managing their habitat, 3) More habitat protected and managed appropriately.

#	ACTIONS	GOALS	PARTNERS	DESIRED OUTCOMES
24	Develop requirements and guidelines for captive turtle facilities and consider options for facilities to partner with	B	PBT, USFWS	These guidelines will provide protocols for captive facilities.
25	Formulate a multi-faceted plan to fill in data gaps on bog turtle distribution.	C	PBT, USFWS	A plan will provide a clear path forward for increasing our knowledge of the species' distribution in North Carolina.
26	Address priority research questions (in the list), identify additional data needs, and plan studies to answer those questions.	C	PBT, USFWS, other partners	Answering research questions will help advance bog turtle conservation efforts.

ECONOMIC IMPACTS

The economic costs associated with each conservation goal are estimates dependent on many factors. Although the Commission attempted to develop an average per-site cost, each site requires a unique set of actions, in part, because sites vary in size. Thus, the actual cost for performing on-the-ground actions will vary among sites, as will the average cost per site listed below.

Potentially Affected Parties

This Plan discusses topics and proposes initiatives that could generate both costs and benefits to a variety of individuals and organizations. The following table details potentially affected parties (Table 2).

Table 2. A list of potentially affected parties by this plan.

TYPE	LOCAL	STATE	NATIONAL
Governments	<ul style="list-style-type: none"> - Cities - Counties 	<ul style="list-style-type: none"> - WRC - DOT - DEQ - Universities (Public) - DCR (State Parks, NHP) - NWAC - NC Plant Conservation Program - Division of Soil and Water Conservation - Zoos, Nature Centers (Public) 	<ul style="list-style-type: none"> - USFWS - USDA (Pisgah & Nantahala NF) - NRCS - NPS (Blue Ridge Parkway) - USDA (APHIS) - EPA (wetland regulation) - U.S. Army Corp of Engineers (permits to alter wetlands)
Businesses	<ul style="list-style-type: none"> - Wildlife Damage Control Agents - Landscaping companies - Animal grazing companies - Restoration firms - Engineering firms - Farms (esp. cattle farms) - Reptile rehabilitators 	<ul style="list-style-type: none"> - Universities (Private) - Zoos and Nature Centers (Private) 	<ul style="list-style-type: none"> - Universities (Private) - Zoos and Nature Centers (Private)

TYPE	LOCAL	STATE	NATIONAL
Groups	<ul style="list-style-type: none"> - Riverlink - MountainTrue - Riverkeepers - Mainspring Conservation Trust - Conserving Carolina - Blue Ridge Conservancy - Piedmont Land Conservancy - Highlands-Cashiers Land Trust - Southern Appalachian Highlands Conservancy - Foothills Conservancy - Catawba Lands Conservancy 	<ul style="list-style-type: none"> - NC Herpetological Society - NC PARC - The Nature Conservancy - Clean Water Management Trust Fund - Project Bog Turtle - Conservation Trust for North Carolina 	<ul style="list-style-type: none"> - PARC and SEPARC - SSAR - Bog Learning Network - Turtle Survival Alliance - Turtle Conservation Fund
Individuals	<ul style="list-style-type: none"> - Landowners - Private donors - Public in regions with bog turtles 		

Costs to the Wildlife Commission

The implementation of the actions listed in the Conservation Actions section will require upfront and long-term costs for the Commission. The amounts given here are estimates and will change over time. Some work on Goals A, B, C, and D will be completed with existing staff and resources, and therefore will not add additional costs.

In many cases, using existing agency staff to perform new or additional tasks comprise opportunity costs (i.e., an existing or different task will be forgone). All efforts will require additional staff time in planning and coordination. Permanent staff time is assessed at \$34 per hour. Costs to produce the NC Bog Turtle Conservation Plan were incurred by Commission staff writing and reviewing the document. The total estimated cost is \$7,500.

Costs to the Wildlife Commission by Goal

Goal A: Identify threats to bog turtle populations

Most of the work on this goal can be accomplished with Commission staff and through assistance from collaborators. However, in some instances research may be necessary to complete a site-specific threat assessment and, in that case, costs may arise. That contingency is accounted for within Goal C (below).

Goal B: Maintain and maximize the number of viable populations

Measures to address threats to bog turtle populations include materials for nest protection (e.g., predator excluders, wildlife cameras) and predator removal services, among others. Habitat management actions include equipment expenses (e.g., chainsaws, brushcutters, chipper rental), supplies (e.g., herbicide, gloves, safety gear), and paying for services (e.g., manual labor, goat rental). The costs for the total management and threat assessment measures are estimated to range between \$200 - \$2,500 per site. Some expenses will be one-time costs while others will occur annually (e.g., vegetation and predator management) at an estimated cost of \$200 per acre per year.

In addition to providing staff time for coordination, the Commission will also provide funds for fee-simple purchases of bog properties. The per-acre cost of land varies widely throughout the bog turtle range in North Carolina. Therefore, prices for land acquisitions are difficult to assess. Acquired parcels vary in price but average \$7,500 per acre and are typically about 150 acres for a bog and its immediate watershed. Furthermore, as desirable parcels become available, they should be evaluated and purchased through the Commission's land-acquisition process. After we have identified the Tier 1 and Tier 2 populations and the five best metapopulations, we can estimate the cost of protecting them.

The steps to restore habitat will differ between sites, although restoration will likely be needed to some degree at most sites. Some sites with severely degraded hydrology will require intense and costly efforts. Estimates of habitat restoration are \$10,000 - \$200,000 per site.

Goal C: Further our knowledge about bog turtles

This conservation work will require at least one 11-month seasonal technician to focus on goals B and C. This technician will take the lead in developing a prioritized schedule for bog habitat management, coordinate habitat-management activities at bogs, and assist in writing bog-management plans, and other related tasks. The technician will also assist in ensuring that bog turtle sites are adequately monitored, including coordination of volunteers and partners to assist with surveys. The current cost for a seasonal technician is \$20 per hour. The duties of the technician will require about 2,000 hours per year.

The Commission will pursue a contract with a researcher for a LIDAR-based Species Distribution Model. For a master's level research project, the estimated cost is \$250,000.

The Commission has identified major research questions that will increase our knowledge of bog turtle biology and thus our ability to plan and execute meaningful conservation projects. The research projects outlined for Goal C will range in cost from \$50,000 - \$500,000, depending on the approach taken to answer research questions — group questions collectively into a single project, or answer research questions separately through multiple projects.

Goal D: Expand outreach efforts

The Commission will assist in creating updated outreach materials. Also, staff from the Commission's Wildlife Education Division will assist in some of the outreach and education activities involved in Goal D. Costs are estimated at \$2,000.

Costs to Others

Private

If private landowners are interested in providing funds for bog habitat management, they can. Otherwise, costs will be paid by the Commission, its partners, and conservation grants. All activities on private land will be completely voluntary and landowners will incur no expenses unwillingly.

Business/Commercial

Businesses will benefit through opportunities to sell equipment and supplies and provide services (grazing rental company, hardware stores, equipment rental companies).

Municipal

Nature Centers and other education-based programs could incur costs if they are interested in developing education and outreach programs.

Other State Agencies

Potential costs exist for the NC Department of Transportation for mitigation and measures to address road mortality adjacent to bog turtle sites. This could include installation of underpasses, fences to keep turtles away from roads, or other measures to reduce mortality.

Any of the state agencies that have bog turtle populations on their property may incur costs for labor, supplies, and equipment for habitat management. This includes State Parks and possibly State Forests. Potential costs could involve costs for fee-simple purchase of properties for conservation protection.

The NC Zoological Park could incur costs if it adds additional education and outreach materials and/or programs on bog turtles.

The NC Department of Environmental Quality could need to review more permits for wetland restoration projects, but this will likely fit within their current staffing capacity.

Federal Agencies

The USFWS will incur costs by helping fund protection efforts (fee simple, easements), research, and management through the State Wildlife Grants Program and other programs such as Partners for Fish and Wildlife. USFWS also provides staff for coordination and collaboration and funds for development of outreach and education information and for printing of materials. Staff will also help bog turtle populations.

NRCS will incur costs through its landowner-wildlife programs. NRCS staff will need additional training to conduct more bog turtle work, but the training will be provided by USFWS and Wildlife Commission staff.

Several federal agencies, including the Blue Ridge Parkway and the USDA's Pisgah and Nantahala National Forests, may incur costs for labor, supplies, and equipment for habitat management on their property, as well as costs for addressing other threats to bog turtles on their property (e.g., poaching, nest protection). This also may involve costs for fee-simple purchase of properties for conservation protection.

The US Army Corps of Engineers also may be more involved with permit review as we launch additional wetland restoration projects, but this will likely fit within its current staffing capacity.

NGOs

Land trusts and The Nature Conservancy may incur costs for labor, supplies, and equipment for habitat management on their property or others, as well as costs for addressing other threats to bog turtles on their property

(e.g., poaching, nest protection). Given the mission of these organizations, it is likely that they will also have costs for conservation easements and fee-simple purchase of properties for conservation protection.

Economic Benefits

- NRCS programs, such as Working Lands for Wildlife, provide benefits to landowners who have bog turtles on their property. These programs can provide money to willing landowners, potentially reduce their tax burden, and provide funds to do projects on their land. State Wildlife Grants may also provide benefits to interested landowners because their wetlands may be managed at no cost to them.
- Landowners can have their tax burden reduced if they participate in the Commission's Wildlife Conservation Land Program (WCLP).
- The work involved in the Plan will result in support of local businesses, agencies, and universities through sales of equipment and supplies, as well as payment for services and consulting. This includes payment for vegetation management, predator removal at bog turtle sites (e.g., Wildlife Damage Control Agents, APHIS), and services provided by landscaping companies, engineering firms, wetland restoration companies, and university researchers, among others.
- Land trusts and The Nature Conservancy benefit from grants to help fund their mission
- Funding from grants could also benefit local businesses and universities.

GLOSSARY

Captive breeding: The process of breeding animals in controlled environments by experts within well-defined settings, such as wildlife reserves, zoos and other commercial and noncommercial conservation facilities.

Conservation easement: A conservation easement is a restriction placed on a piece of property to protect its associated resources. The easement is either voluntarily donated or sold by the landowner and constitutes a legally binding agreement that limits certain types of uses or prevents development from taking place on the land in perpetuity while the land remains in private hands.

Extirpation: Local extinction or extirpation is the condition of a species (or other taxon) that ceases to exist in the chosen geographic area of study, though it still exists elsewhere. Local extinctions are contrasted with global extinctions.

Fecundity: The actual reproductive rate of an organism or population, measured by the number of gametes (eggs), seed set, or asexual propagules.

Fee-simple purchase: A fee-simple purchase transfers full ownership of the property, including the underlying title, to another party.

Fertility: The quality of an organism's ability to produce offspring, which is dependent on age, health, and other factors.

GIS: A geographic information system (GIS) is a system designed to capture, store, manipulate, analyze, manage, and present spatial or geographic data.

Head-starting: The act of rearing wild hatchlings in protective enclosures before release at less susceptible size/age, thereby avoiding the heavy mortality of young age classes in the wild.

High-quality habitat: This habitat has the components of "suitable habitat," plus the following characteristics: 1) areas with deep, loose, low-strength soils (Feaga et al. 2013), 2) presence of sphagnum mosses, rushes, sedges, and some wetland shrub species, 3) mosaic of low and shrubby vegetation with one or more relatively large areas with very low vegetation (ideally sphagnum, but also rushes and sedges) that receive full sun, 4) relatively unaltered hydrology with stable groundwater levels that are $8\text{ cm} \pm 1\text{ cm}$ ($3.1\text{ in} \pm 0.4\text{ in}$) average depth from surface over multiple years, without flooding and inundation (Feaga 2010), 5) presence of subsurface root structures and/or tunnels, 6) adequate vegetation to conceal turtles when basking on surface, 7) minimal threats within habitat and/or adjacent to property (e.g., busy roads, overabundance of predators).

Hydrology: The science dealing with the properties, distribution, and circulation of water on and below the earth's surface and in the atmosphere.

Invasive species: Is a species 1) that is non-native (or alien) to the ecosystem under consideration and 2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health.

LIDAR: This term stands for "Light Detection and Ranging" — a remote sensing method that uses light in the form of a pulsed laser to measure ranges (variable distances) to the Earth.

Metapopulation: Consists of a group of spatially separated populations of the same species that interact at some level.

Mycoplasma: Any of numerous parasitic microorganisms of the class Mollicutes, comprising the smallest self-reproducing prokaryotes, lacking a true cell wall and able to survive without oxygen.

Occurrence record: A location with a record of a bog turtle is an occurrence.

Population: A group of bog turtles that interact and share the same habitat.

Population augmentation: The addition of animals to an existing population, usually a small population that has habitat that can support a larger population that has not been expanding on its own due to impacts from threats, stochastic events, or demographic limitations. Animals can be translocated from a source population or may be added through captive breeding or head-starting of individuals that originated at the site.

Population manipulation: Refers to reintroductions, population augmentations, relocation, head-starting, and captive rearing.

Ranavirus: Ranavirus is a genus of viruses in the family Iridoviridae that includes viruses that are infectious to amphibians and reptiles.

Recruitment: Occurs when juvenile organisms survive to be added to a population, by birth or immigration — usually a stage whereby the organisms are settled and able to be detected by an observer.

Restoration: An intentional activity that initiates or accelerates the recovery of an ecosystem with respect to its health, integrity and sustainability.

Southern Appalachian Bog: Includes open, acidic, permanently saturated wetlands of flat stream bottoms or gentle slopes, with a distinctive bog flora, with varying amounts of shrubs and sometimes with moderate amounts of tree cover, but with a well-developed, dense herbaceous layer and, generally, extensive Sphagnum cover. These wetlands generally appear to have a substantial amount of groundwater input, and therefore would be considered poor fens.

Suitable habitat: Habitat composed of the following at a minimum: 1) soft, saturated soils, 2) spring-fed hydrology, and 3) an area with low vegetation (no canopy) that gets full sun.

Threatened due to Similarity of Appearance: A species that is threatened due to similarity of appearance with another listed species or the same species in another geographic area and is listed for its protection. Species listed as T(S/A) are not biologically endangered or threatened and are not subject to Section 7 consultation with USFWS.

Watershed: A drainage basin or 'catchment area' is any area of land where precipitation collects and drains off into a common outlet, such as into a river, bay, or other body of water.



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EXHIBIT K-5

April 25, 2019



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

April 25, 2019

Neuse River Waterdog





Neuse River Waterdog



Dwarf Wedgemussel



Carolina Madtom



Yellow Lance



Tar River Spiny mussels



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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



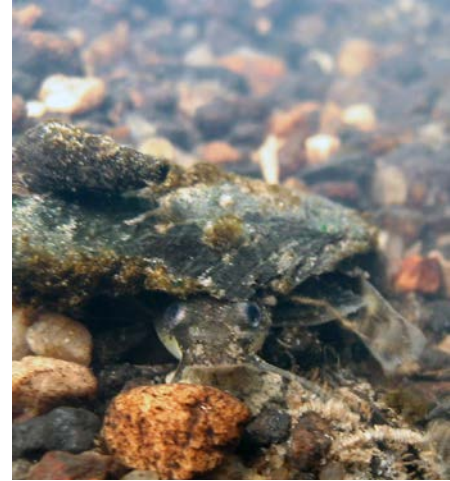
Yellow Lance



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.

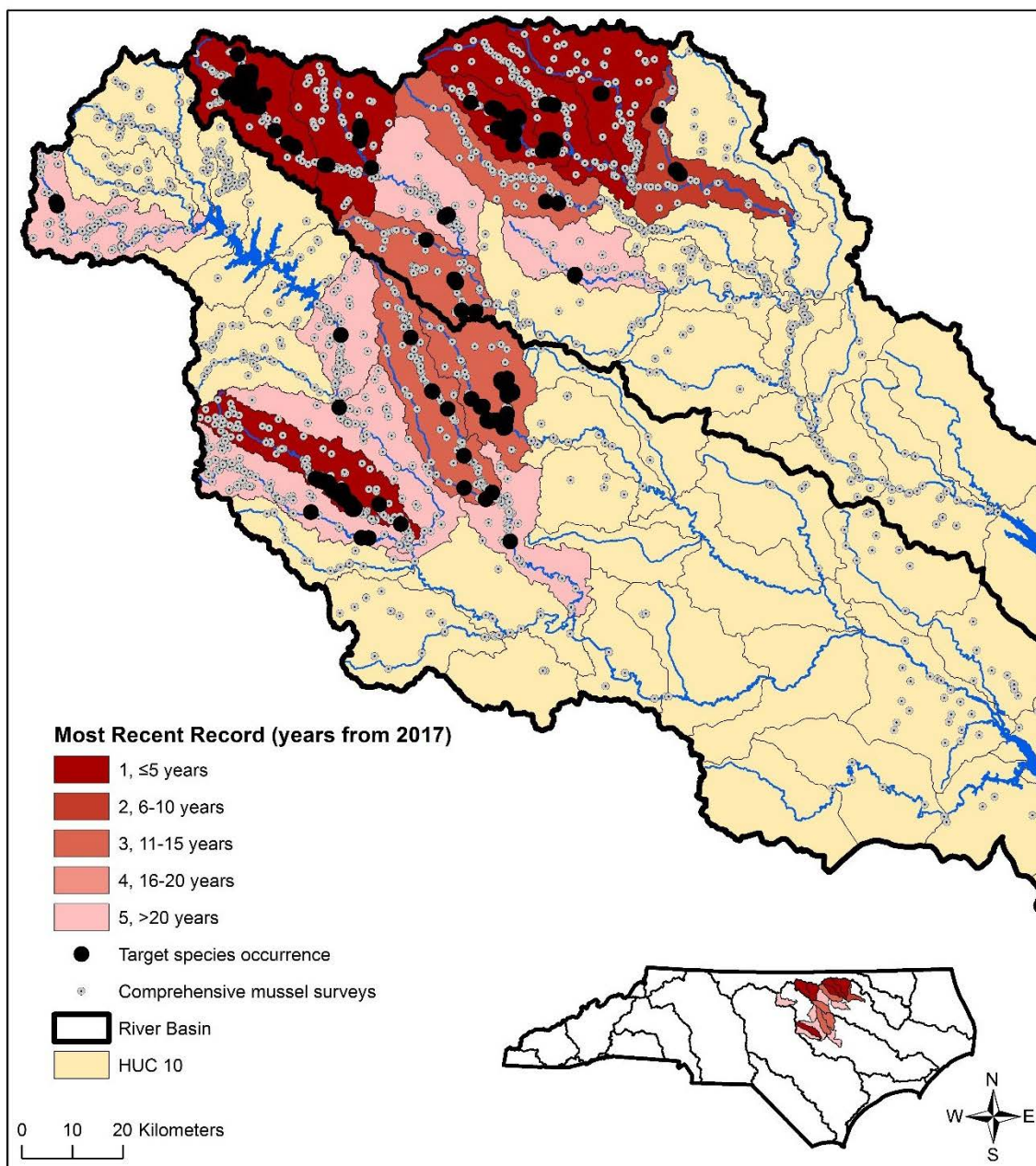
8. Determine the known historical range of Dwarf Wedgemussel by verifying the identification of specimens held in museum collections.
9. Determine the impact of Flathead Catfish on Dwarf Wedgemussel host fish populations.

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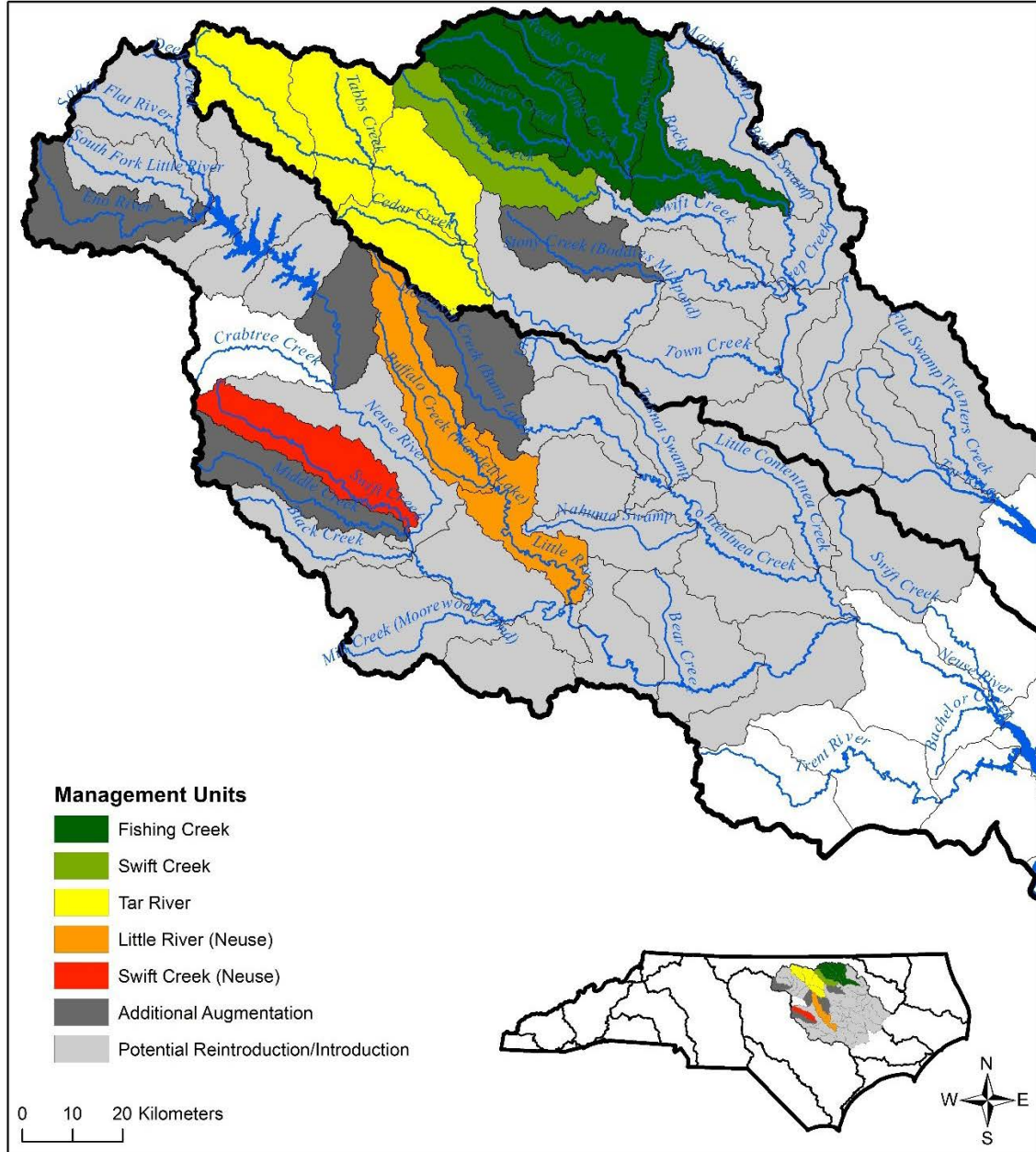
Occurrences by HUC 10 Watershed of the Dwarf Wedgemussel (*Alasmidonta heterodon*) and Survey Locations



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* (Swallowtail 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

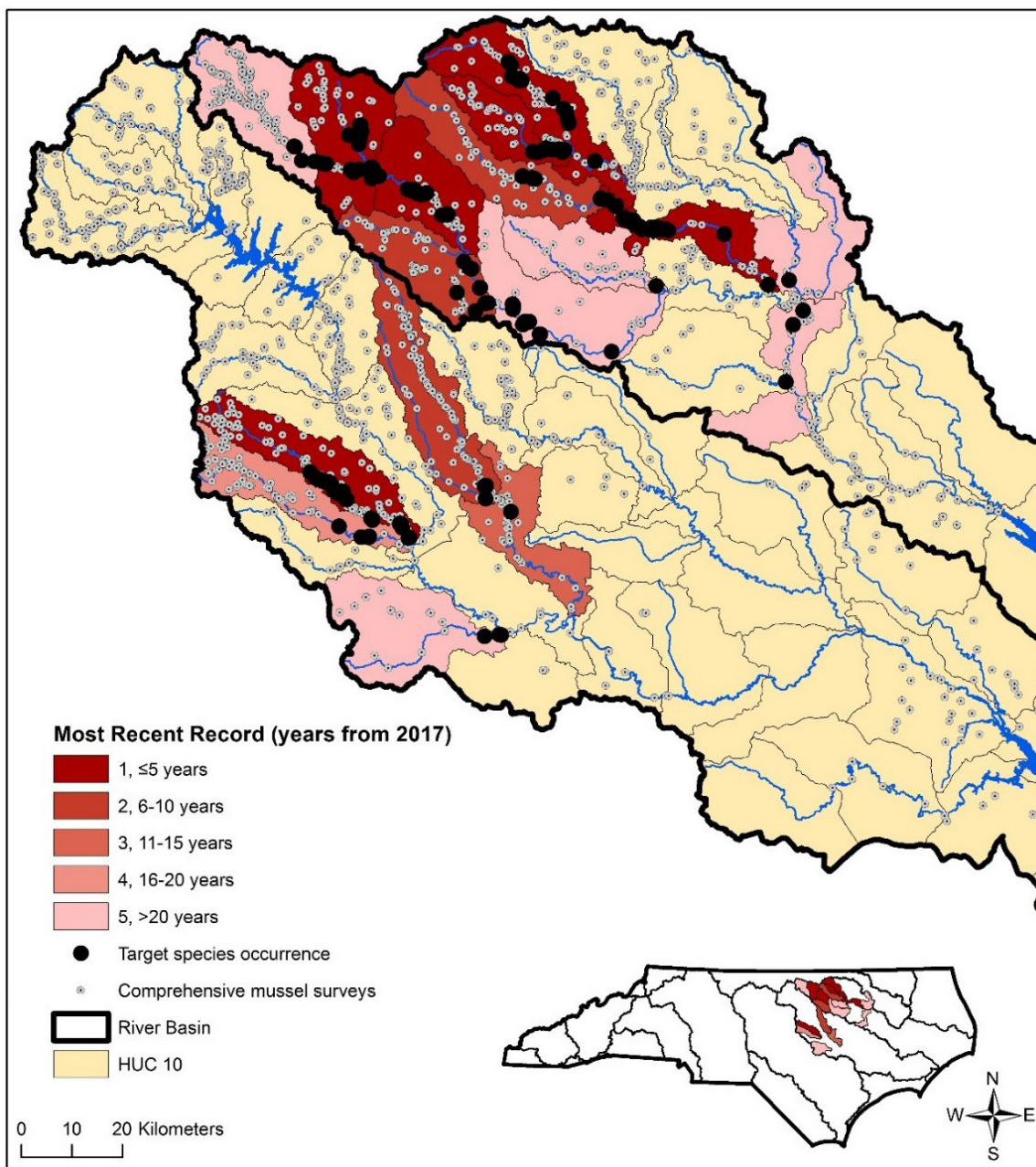
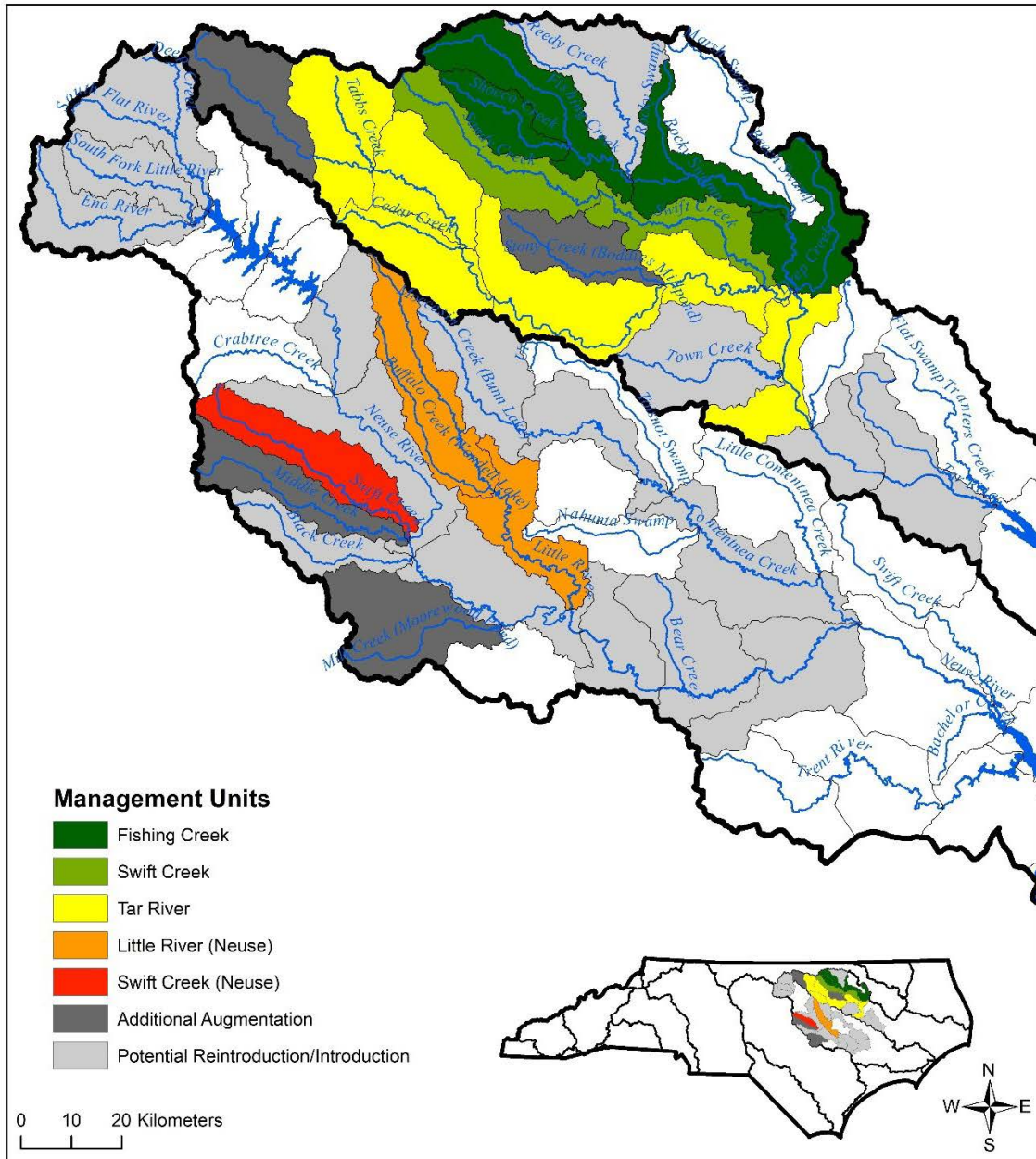


Figure 3. Distribution map of the Yellow Lance (*Elliptio lanceolata*) within the Neuse and Tar-Pamlico river basins depicting 10-digit hydrologic units (colored and categorized based on year of observation), collection locations (black dots), and survey locations (gray dots).

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).

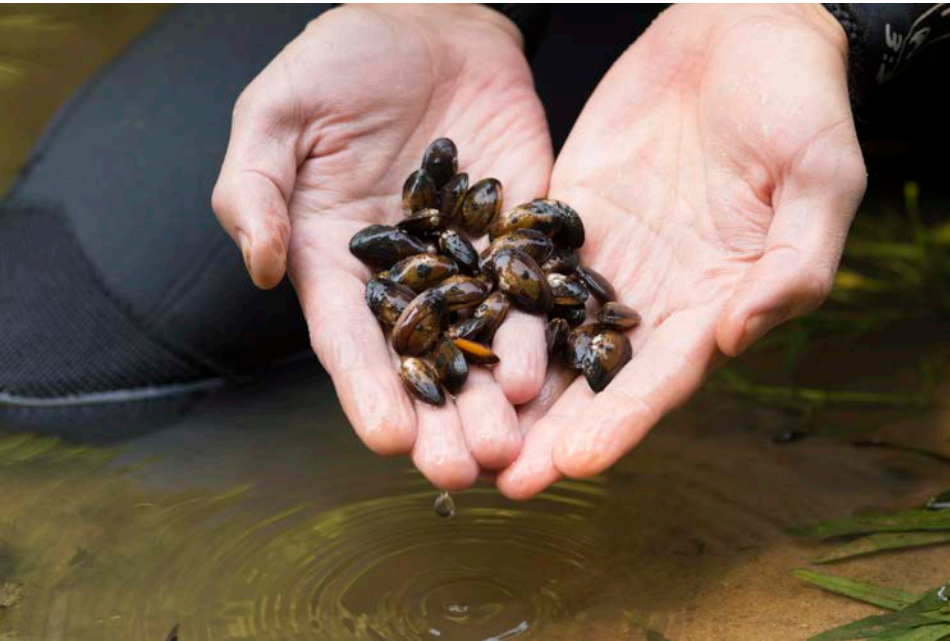
This species has been informally cited as “spiny naiad” by Shelly (1972), “*Canthyria* sp.” by Fuller (1977) and the “Tar River spiny mussel (*Canthyria* sp.)” by Biggins (1982). It was first formally described by Johnson and Clarke (1983) as *Elliptio (Canthyria) steinstansana*. The reasons for placement 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 leptcephalus* (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

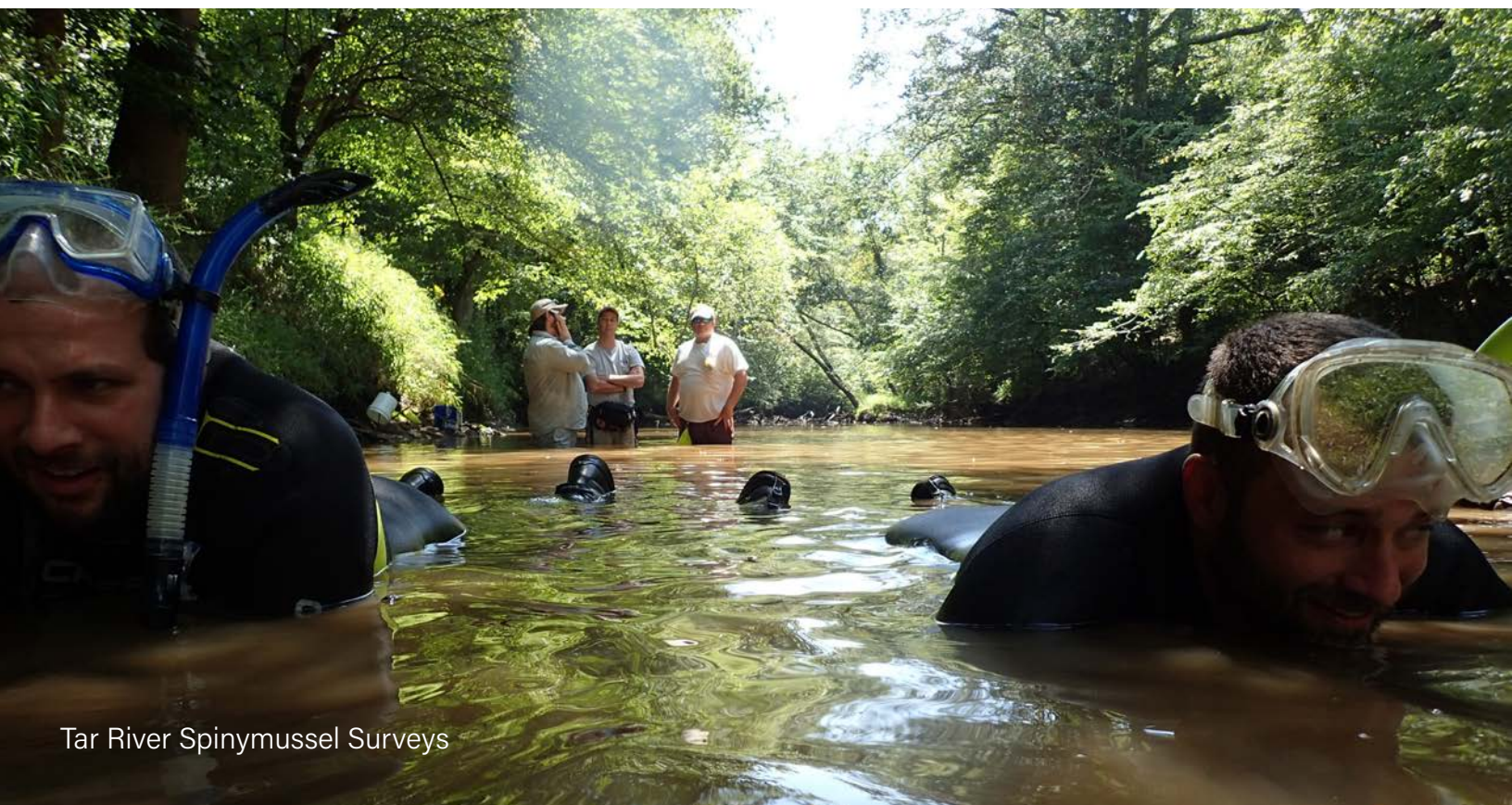
Tar River Spiny mussel glochidia are very small (170 μm wide), hookless, and relatively spherical, which causes them to naturally lay with their hinge down (Eads and Levine 2008). The glochidia are packaged in a single row along the margin of a ribbon-like, flat conglutinate that is 5-7 mm long (Eads 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

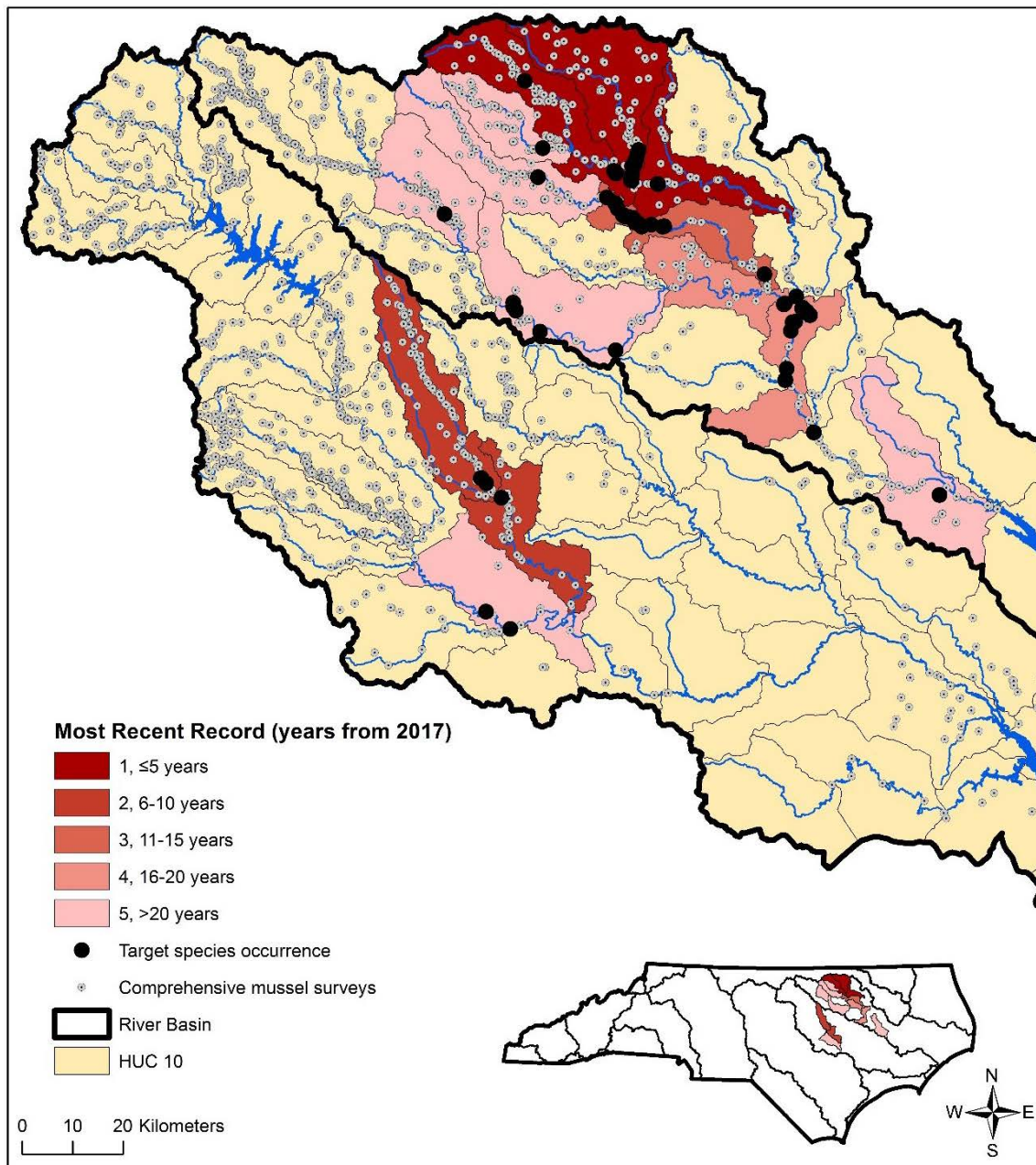


Figure 5. Distribution map of the Tar River Spiny mussel (*Parvaspina steinstansana*) within the Neuse and Tar-Pamlico river basins depicting 10-digit hydrologic units (colored and categorized based on year of observation), collection locations (black dots), and survey locations (gray dots).

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

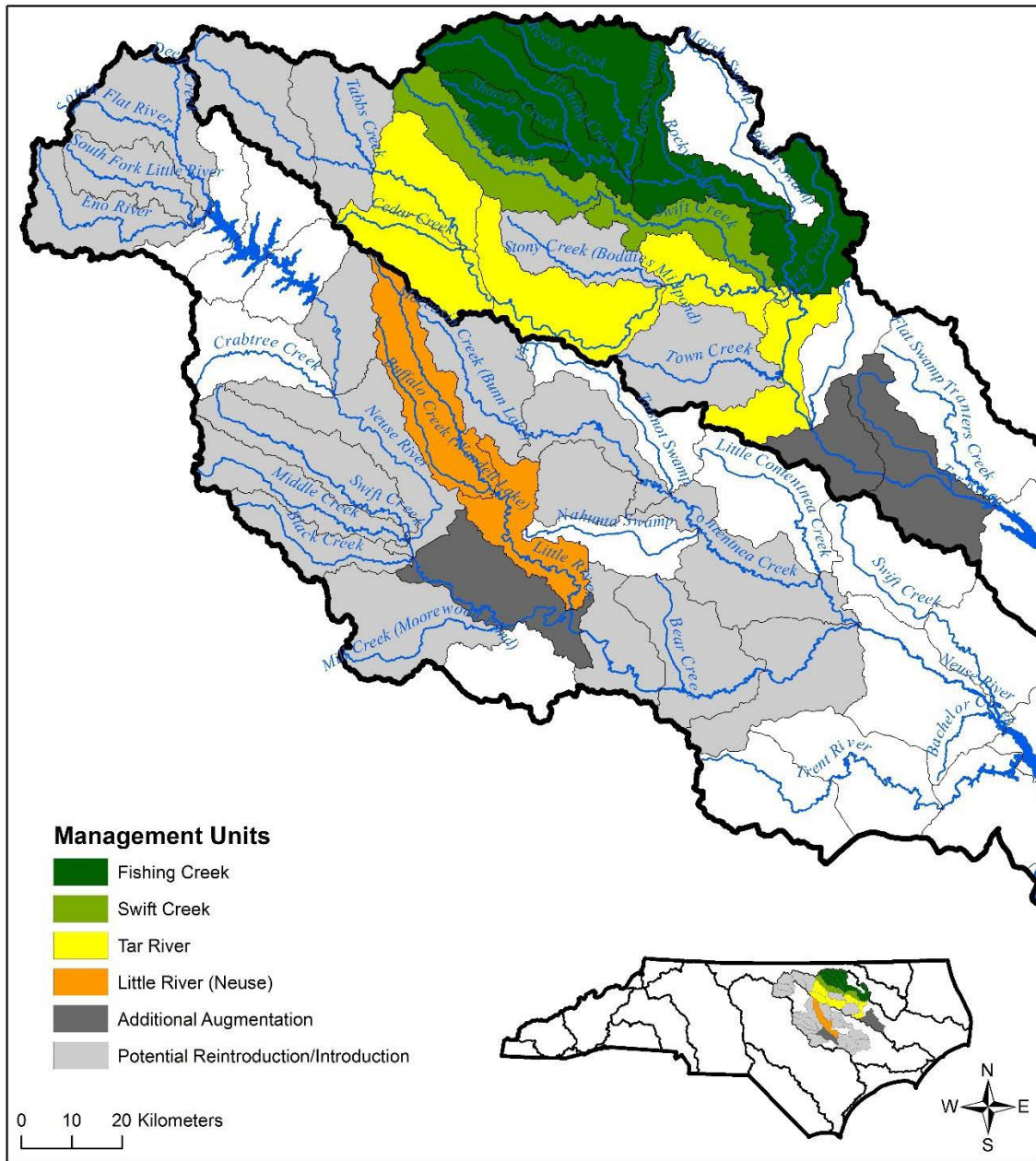


Figure 6. Management units the Tar River Spiny mussel (*Parvaspina steinstansana*) within the Neuse and Tar-Pamlico river basins depicting 10-digit hydrologic units (colored-based management units and future management scenarios).

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; 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).



Carolina Madtom

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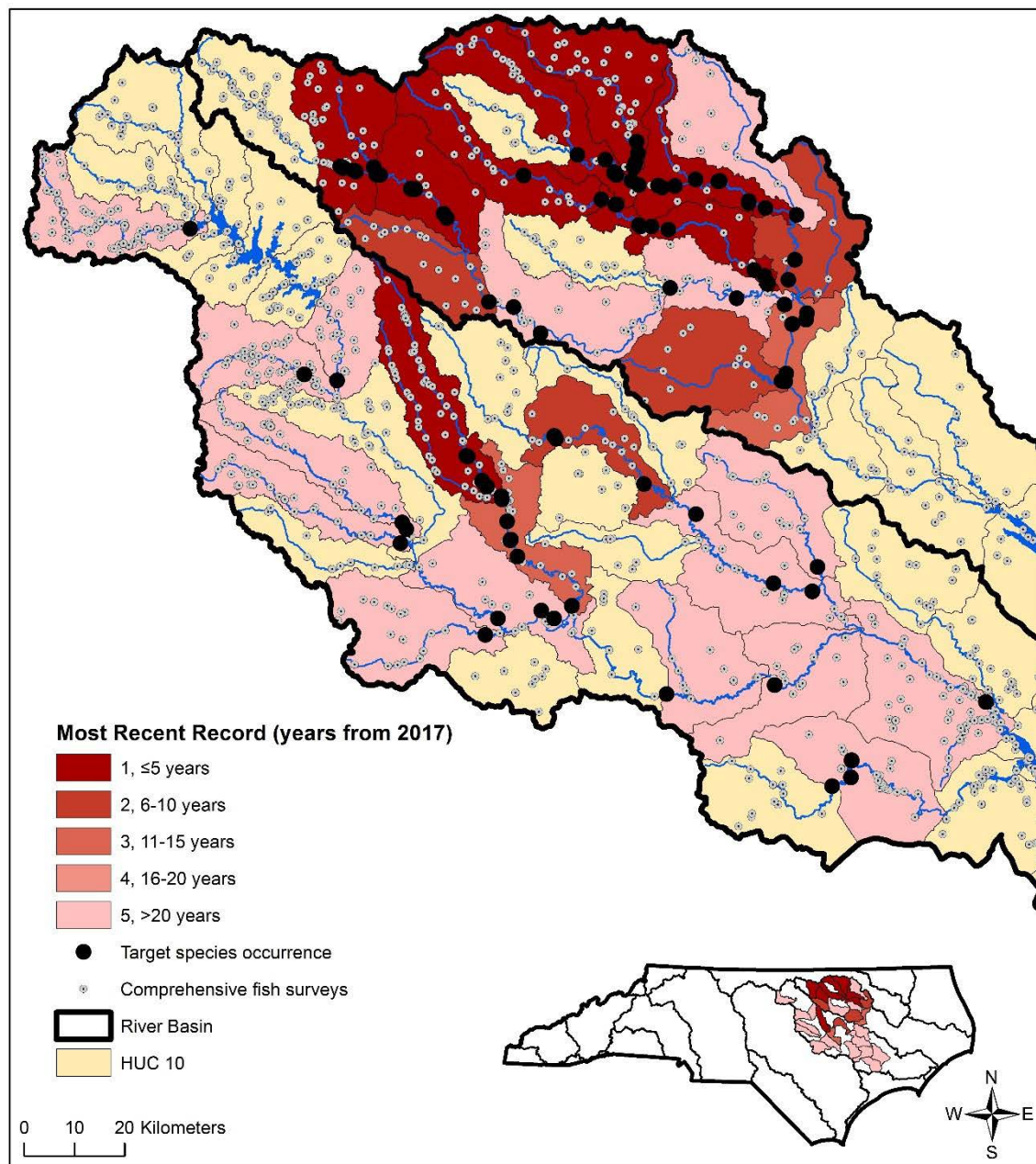
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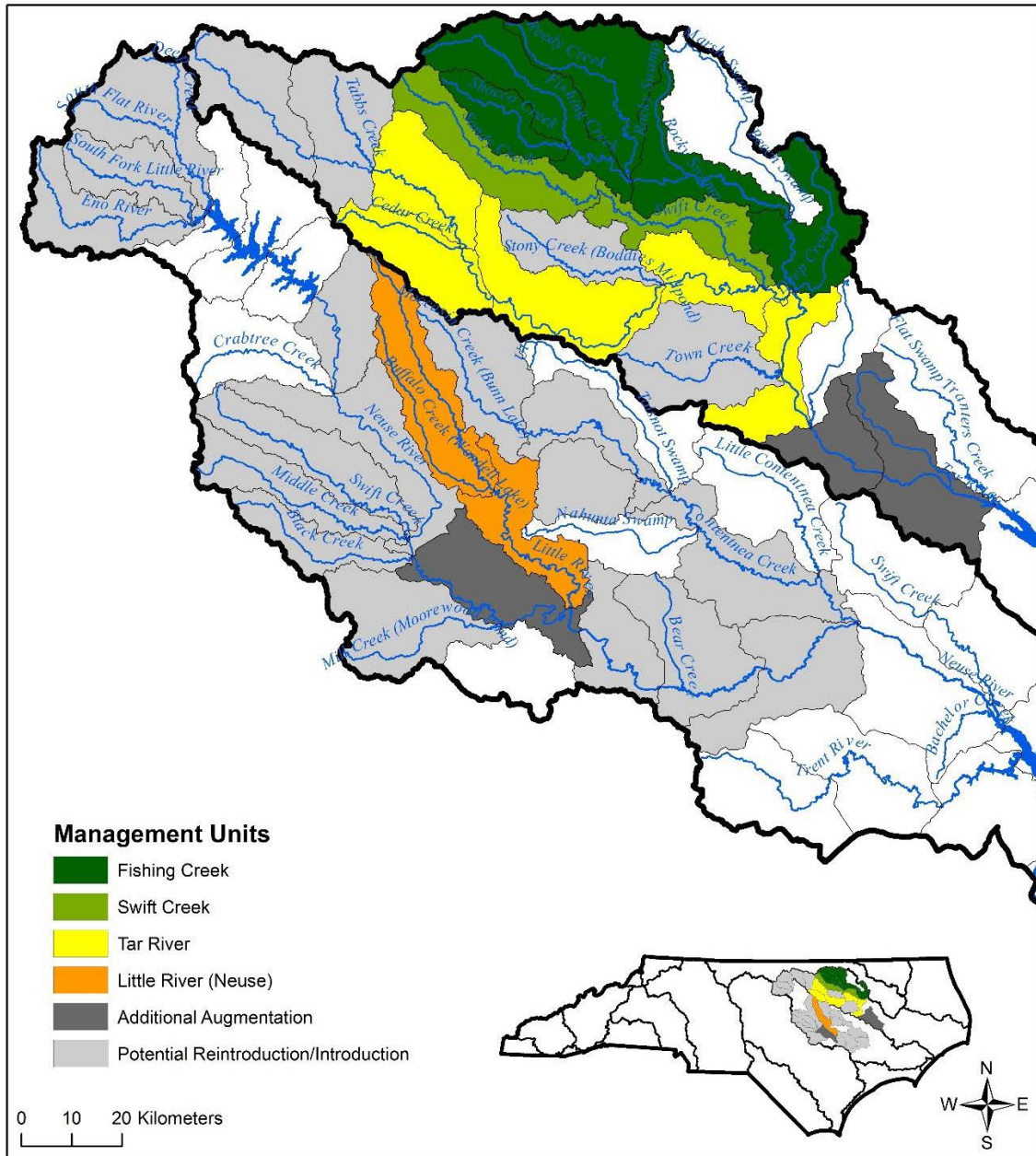
Occurrences by HUC 10 Watershed of the Carolina Madtom (*Noturus furiosus*) and Survey Locations



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).

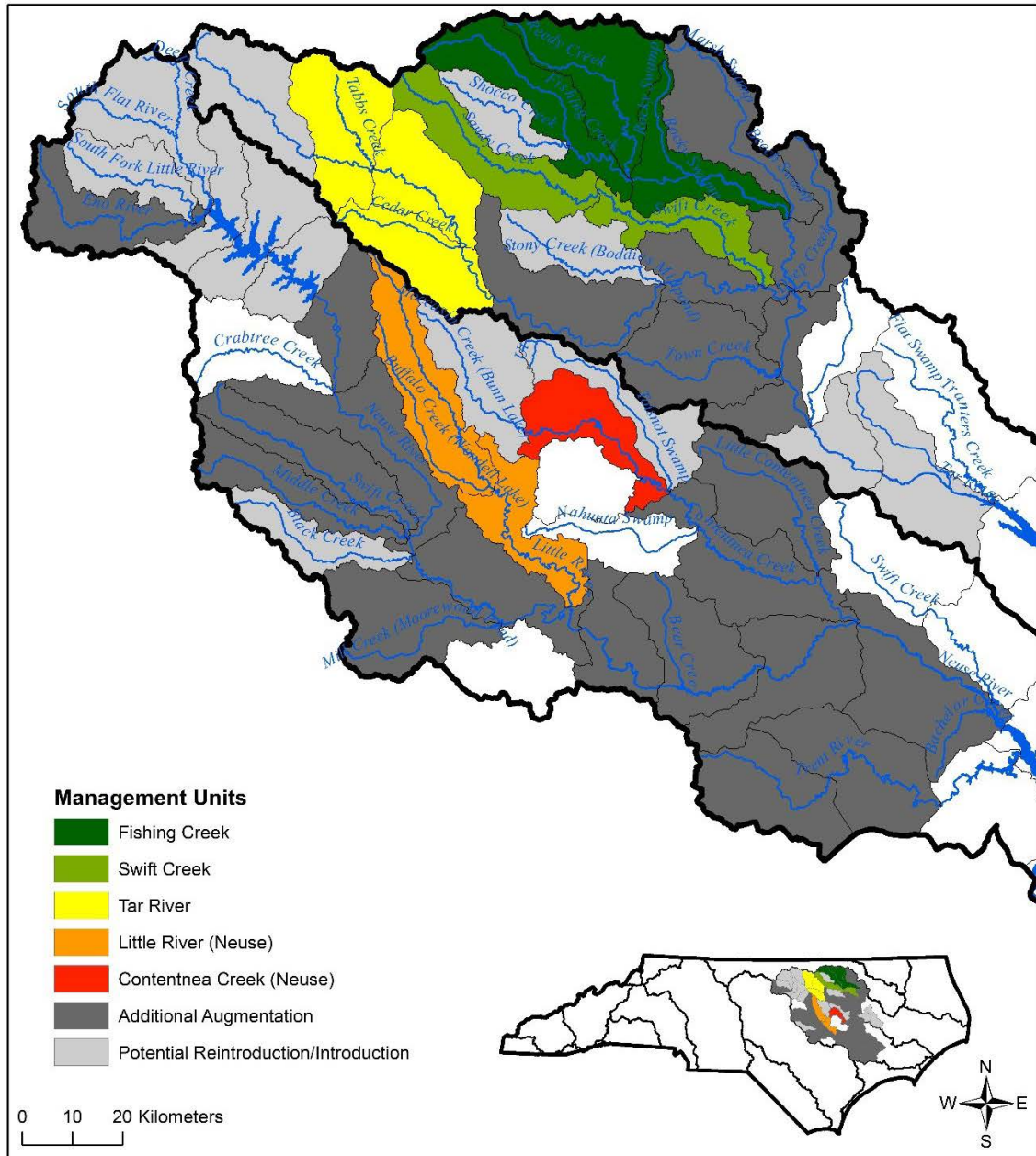
**Carolina Madtom (*Noturus furiosus*) and Invasive Flathead Catfish (*Pylodictis olivaris*)
Distribution Overlay**



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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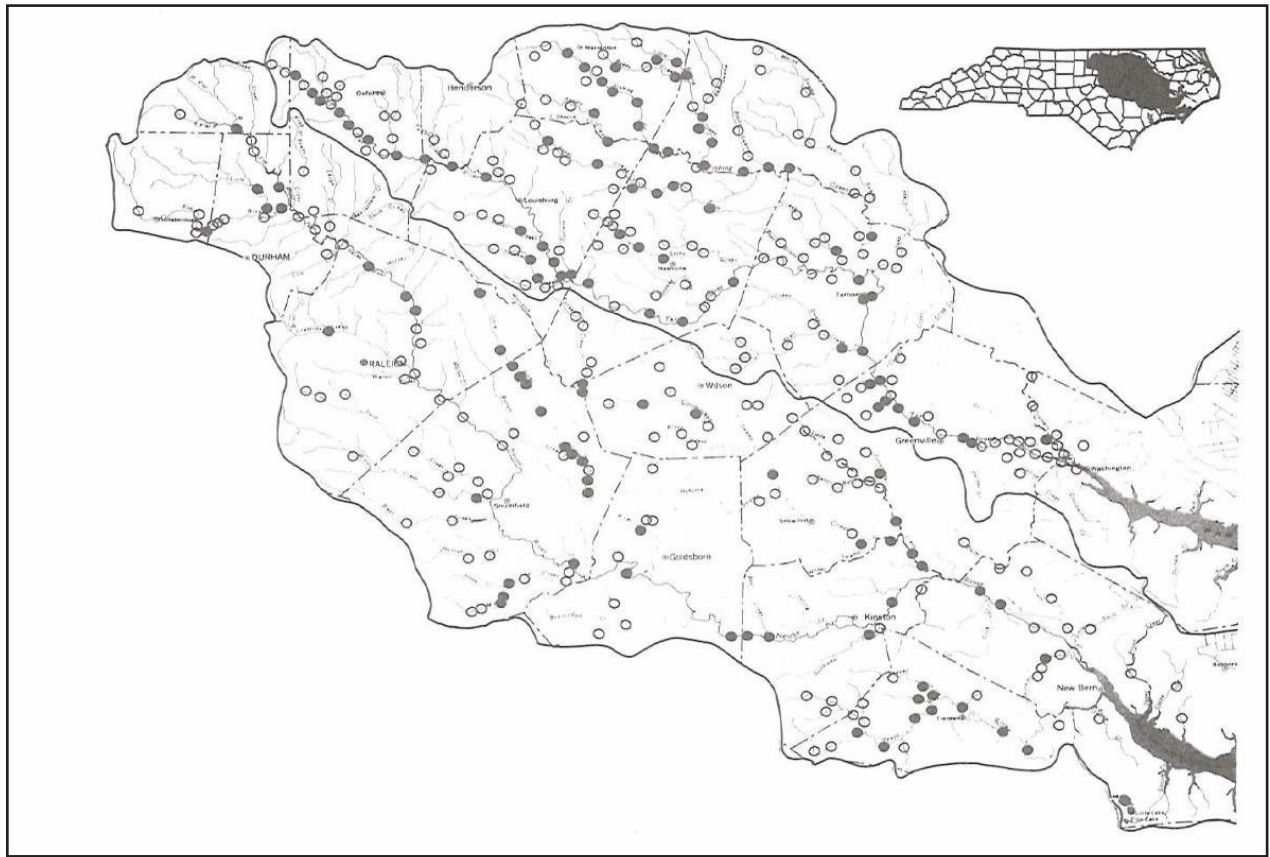
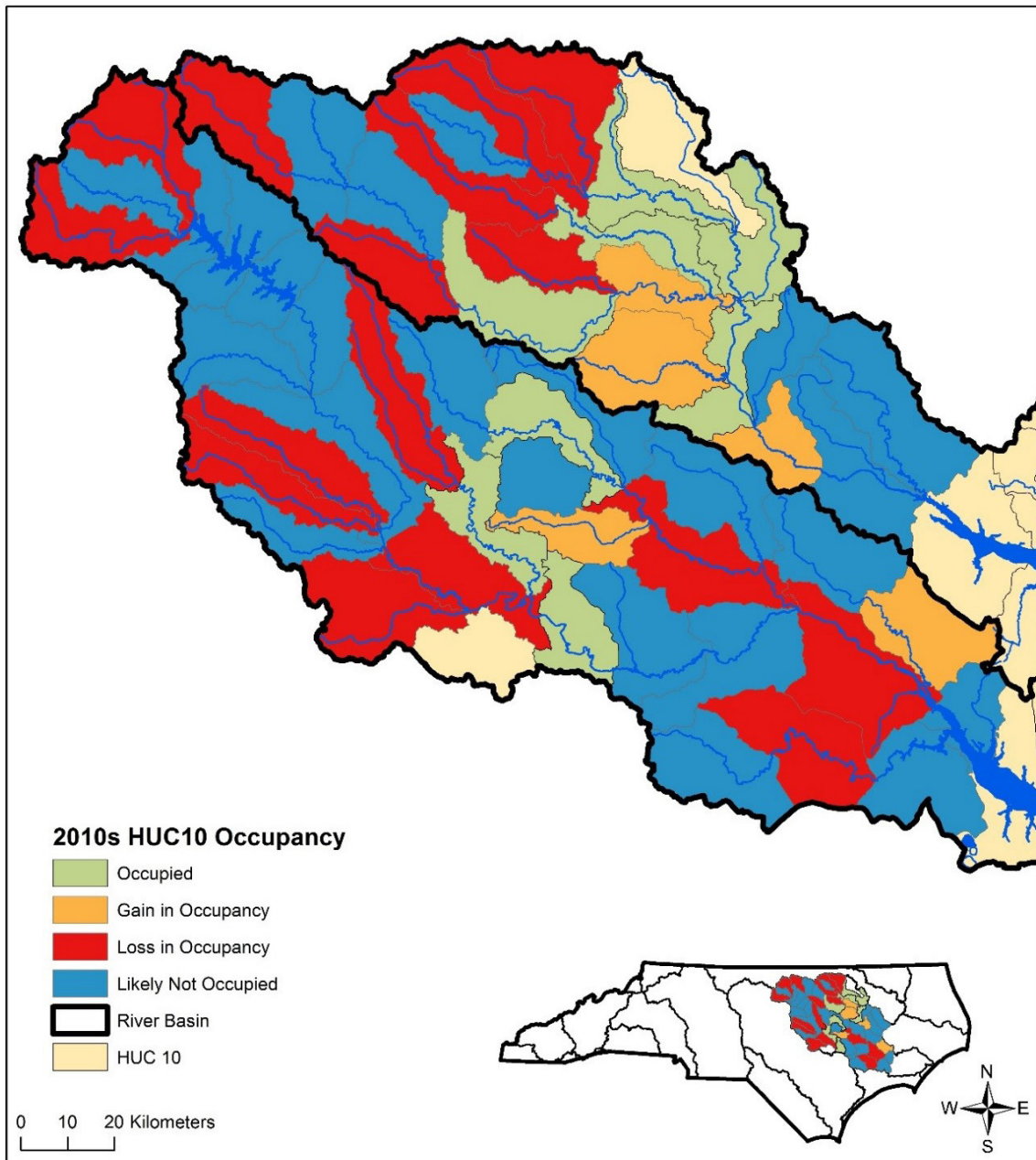


Figure 10. Historical surveys for Neuse River Waterdog (*Necturus lewisi*) from Braswell and Ashton (1985). Closed circles indicate species presence and open circles indicate species absence.

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.

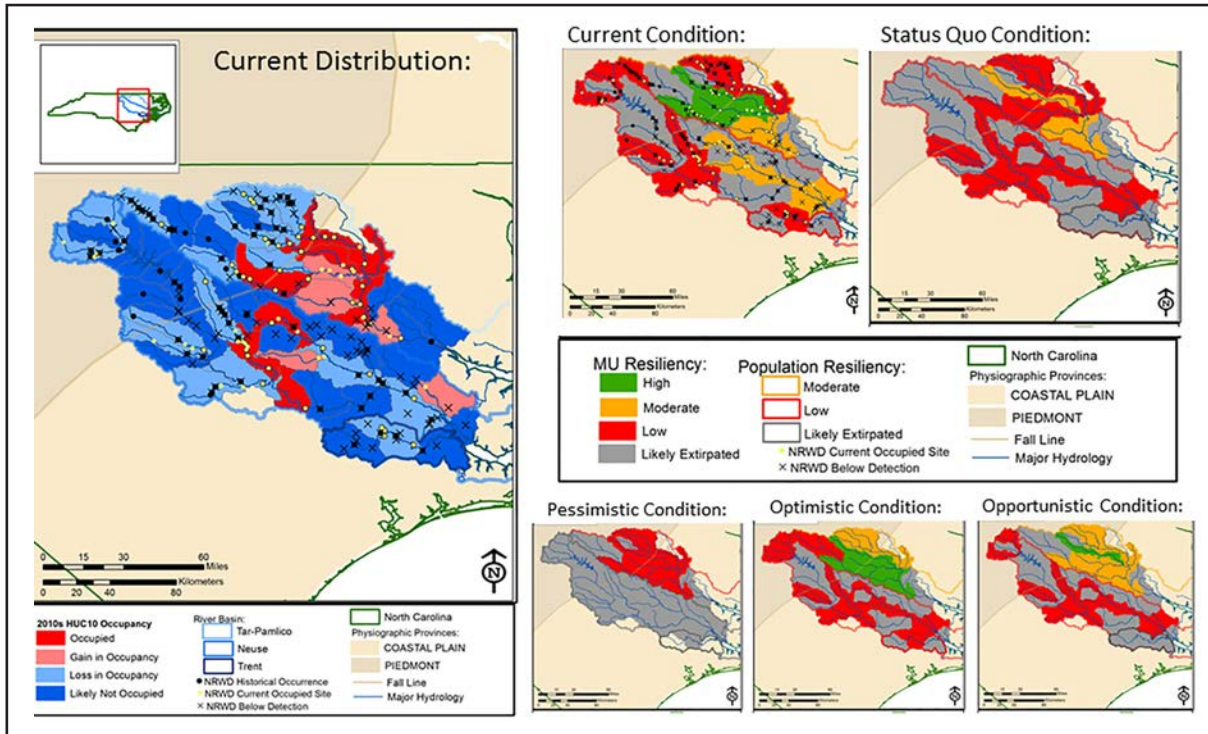


Figure 12. Current distribution and possible future scenarios concerning the status of the Neuse River Waterdog (USFWS 2017).

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 Spiny mussel, 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.

ECONOMIC IMPACTS

Potentially Affected Parties

Implementation of this conservation plan primarily will affect the N.C. Wildlife Resources Commission. The Commission will be responsible for virtually all population management, habitat management, monitoring, and research.

To a lesser extent, parties applying for development permits may also be affected.

Agency Costs

Costs for implementing the conservation actions outlined in this plan are estimated to be approximately \$3,513,000 over a 10-year period. It is impossible to estimate how many projects Commission staff will review where these species may be affected, but permit review requires approximately two hours of staff time per project and incurs an estimated \$74 per project.

Costs to Others

Developers may be required by NCDEQ or USCOE to assess projects for any potential impacts to listed species as part of the permit application process for development. All currently available species data is available free of charge on the Natural Heritage website and applicants can request free assistance in interpreting data. However, if data do not exist on a species, a survey may need to be completed, at the developer's expense, before the project begins. A site survey for a species is nominal to a developer compared to the total expense of a project. The costs associated with the survey are typically absorbed into other scoping, survey or environmental fees that developers incur as part of the site development.

Efforts to Minimize Costs and Adverse Economic Impacts

The Wildlife Commission will utilize two main strategies for minimizing the economic impacts of implementing this plan. First, the Commission will utilize federal grant funding to carry out most of the plan's actions. These activities are eligible for funding through the State Wildlife Grants (SWG) Program or Endangered Species (Section 6) grants. SWG will cover 65% and Section 6 will cover 75% of the costs of most plan actions.

Second, the Commission will not stock federally listed species or species likely to become federally listed without a mechanism in place such as a Safe Harbor Agreement or Candidate Conservation Agreement with Assurances to reduce the potential regulatory burden associated with the Endangered Species Act.



Yellow Lance

EXHIBIT L

April 25, 2019



Proposed Changes to 10H .0900. Game Bird Propagators Rules Recommended by Agency Staff for Public Notice, Hearing and Comment

Title 15A NCAC 10H .0900. Game Bird Propagators

These rules are part of the 2016 periodic review, with a re-adoption deadline of December 31, 2019. Technical and terminology changes are proposed for all subsections to clarify requirements, use standard language, and make terminology consistent throughout the rules.

10H .0901

Updated to clarify rule language, remove repetitive language, incorporate required application information and incorporate technical changes to text.

15A NCAC 10H .0901 Game Bird Propagation License (page 2)

10H .0903

Updated to clarify rule language, remove repetitive language, and incorporate technical changes to text. Title updated to include the term “game birds” for consistency.

15A NCAC 10H .0903 Acquisition of Birds or Eggs (page 3)

10H .0904

Updated to clarify rule language, remove repetitive language and incorporate technical changes to text. Title updated to include the term “game birds” for consistency.

15A NCAC 10H .0904 Disposition of Birds or Eggs (page 4-5)

10H .0905

Updated to clarify rule language, remove repetitive language and incorporate technical changes to text.

15A NCAC 10H .0905 Transportation (page 6)

10H .0906

Updated to clarify rule language, remove repetitive language and incorporate technical changes to text.

15A NCAC 10H .0906 Records (page 7)

10H .0907

Updated to clarify rule language, remove repetitive language and incorporate technical changes to text.

15A NCAC 10H .0907 Quail Call-Pen Traps (page 8)

1 **15A NCAC 10H .0901 GAME BIRD PROPAGATION LICENSE**

2 (a) The game bird propagation license ~~authorizes~~ shall authorize the purchase, possession, propagation, sale,
3 ~~transportation~~ transportation, transfer, and release of propagated upland game birds, except wild turkey, and migratory
4 game birds and their eggs, subject to the following limitations and conditions:

- 5 (1) The sale of dead pen-raised quail for food is governed by the regulations of the North Carolina
6 Department of Agriculture; and
7 (2) The purchase, possession, sale, transportation, and transfer of migratory game birds and their eggs
8 is subject to additional requirements ~~contained~~ in Title 50 of the Code of Federal Regulations.
9 (3) ~~No propagation license shall be issued for wild turkeys.~~

10 (b) Application for a game bird propagation license shall be made on a form available from the Commission at
11 www.ncwildlife.org or at the Commission headquarters located at 1751 Varsity Drive, Raleigh, NC 27606-2576.

12 Information required from the applicant shall include:

- 13 (1) The applicant's name, mailing address, residence address, telephone number, and date of birth;
14 (2) The facility site address;
15 (3) Any organizational affiliation, if applicable; and
16 (3) The species of animal to be propagated.

17 (c) The game bird propagation license shall be conspicuously posted and displayed at the propagation facility at all
18 times.

19
20 *History Note: Authority G.S. 106-549.94; 113-134; 113-273; 50 C.F.R., Part 21;*
21 *Eff. January 1, 1981;*
22 *Amended Eff. July 1, 1988; July 1, 1987;*
23 *Temporary Amendment Eff. July 1, 2001;*
24 *Amended Eff. June 1, 2005; July 18, 2002.*
25

1 **15A NCAC 10H .0903 ACQUISITION OF GAME BIRDS OR GAME BIRD EGGS**

2 ~~(a) A game bird propagator license under this Section~~ propagation license holder shall not take no game birds or game
3 bird eggs from the wild for the purpose of propagation or sale, sale, but

4 (b) License holders may purchase or acquire live game birds, or the eggs thereof, birds or game bird eggs from any
5 other licensed game bird propagator. propagators. Upon such acquisition, he

6 (c) The license holder shall obtain a copy of a receipt or other written evidence of the transaction showing the date,
7 the names names, and license numbers of both parties, and parties as well as the species and quantity of the game
8 birds, or eggs, so birds or game bird eggs acquired. This receipt shall be retained by the licensee as part of his records
9 license holder as provided by Rule .0906 of this Section.

10

11 *History Note: Authority G.S. 113-134; 113-273;*

12 *Eff. January 1, 1981.*

13

1 **15A NCAC 10H .0904 DISPOSITION OF GAME BIRDS OR GAME BIRD EGGS**

2 (a) ~~Diseased Birds. No game bird propagator licensed under this Section shall~~ It shall be unlawful for a game bird
3 propagation license holder to knowingly sell or otherwise transfer possession of any live game bird that shows
4 evidence of any a communicable disease, except that such transfer may be made for transfers to a veterinarian or
5 pathologist for examination and ~~diagnosis.~~ diagnostic purposes. Disposition of any game bird ~~having with~~ a
6 communicable disease in a manner not likely to infect wild game bird populations is ~~shall be~~ the responsibility of the
7 licensee. ~~license holder.~~

8 (b) Sale of Live Birds or Eggs. Subject to the limitations set forth in Rule .0901 of this Section, any ~~healthy~~ game
9 birds ~~which that~~ are authorized to be propagated under this Section, or the eggs thereof, may be sold or transferred
10 alive by any a licensed game bird propagator to any other another licensed game bird propagator. propagator or
11 ~~Licensed game bird propagators may also sell or transfer healthy live game birds to~~ licensed controlled shooting
12 preserve operators operator or to any person ~~who that~~ holds a valid state license or permit to possess the same. that
13 authorizes possession.

14 (c) Receipt Required. Upon ~~any such~~ sale or transfer, a written receipt or other written evidence of the transaction
15 shall be prepared in duplicate showing the date, the names and license or permit numbers of both parties, and the
16 species and quantity of the game birds or game bird eggs transferred. A copy of ~~such the~~ receipt ~~or writing~~ shall be
17 retained by each of the parties ~~as a part of his records~~ as provided by Rule .0906 of this Section.

18 (d) Bird Marking. Any live migratory waterfowl sold or transferred to any person for use in training retrievers or
19 conducting retriever trials ~~must~~ shall be marked by one of the methods provided by ~~50 C.F.R. 21.13.~~ 50 CFR 21.13.
20 ~~Each pheasant~~ All other domestically raised game birds sold or transferred for such the same purposes shall be banded
21 prior to the transfer with a metal leg band which is shall be individually marked on one leg with a band imprinted with
22 the number of the propagator's license. ~~license number.~~

23 (e) (e) Sale of Dead Game Birds as Food. Subject to ~~the limitations and conditions indicated in~~ Rule .0901 of this
24 Section and to any applicable laws and regulations relating to pure foods, public ~~health~~ health, and advertising,
25 game birds produced by licensed game bird propagators ~~licensed under this Section~~ may be killed at any time in any
26 manner, except by shooting during the closed ~~season on the species concerned, and~~ season. Dead game birds, except
27 for dead pen-raised quail, and game bird eggs may be sold for food purposes as provided by the following
28 Subparagraphs: ~~as follows:~~

29 (1) Sale Direct to Consumer. Unprocessed dead game birds may be sold directly to a consumer when
30 accompanied by a receipt showing the name of the consumer, the name and license number of the
31 propagator, and the quantity and species of the game birds sold. A copy of ~~such the~~ receipt shall be
32 retained by the ~~propagator as part of his records.~~ propagator for at least one year after the transaction.
33 No such bird shall be resold by any such consumer. It shall be unlawful for the consumer to resell
34 unprocessed dead game birds.

35 (2) Sale to or Through a Processor. Unprocessed dead Game game birds may be sold to ~~any a~~
36 commercial food processor ~~who that~~ holds a permit to possess them or delivered transferred to such
37 a commercial food processor for processing and packaging prior to sale. In either case, the transfer
38 Sale or transfer shall be evidenced by a ~~duplicate receipt~~ written receipt retained by each party for
39 a year after the sale or transfer, that includes the following information:

- 1 (A) ~~identifying the processor by~~ the processor's name and permit number and number;
2 (B) ~~the propagator by propagator's~~ name and license number, number; and
3 (C) ~~indicating the number and species of game birds transferred.~~ sold or transferred. A copy of
4 ~~such receipt shall be retained by each of the parties as part of his records.~~

5 ~~The processed carcasses of the birds~~ Game bird carcasses processed by a commercial food processor
6 ~~for wholesale or retail sale shall be enclosed in a wrapper or container~~ marked with the following:

- 7 (A) the number and species of game birds contained;
8 (B) the license number of the propagator; and
9 (C) the words "domestically raised".

10 ~~on the outside of which is indicated the number and species of birds contained, the license number~~
11 ~~of the propagator, and the fact that such birds were domestically raised. When so packaged, such~~
12 ~~processed game birds may be sold at wholesale or at retail through ordinary channels of commerce.~~
13 ~~This Paragraph does not apply to dead quail marketed for food purposes under the regulations of the~~
14 ~~North Carolina Department of Agriculture.~~

- 15 (3) ~~The eggs of propagated game birds may~~ Propagated game bird eggs shall not be sold for food or
16 food purposes.

17
18 *History Note:* *Authority G.S. 113-134; 113-273; 50 C.F.R., Part 21.13;*
19 *Eff. January 1, 1981;*
20 *Amended Eff. August 1, 2010; May 1, 2008; June 1, 2005.*
21

1 **15A NCAC 10H .0905 TRANSPORTATION**

2 (a) Live Game Birds or Game Bird Eggs

3 (1) Private Carriers. Live propagated game birds or ~~the eggs thereof~~ game bird eggs may be transported
4 by private carrier when accompanied by a copy of ~~the receipt required by~~ specified in Rule Rules
5 .0903 or Rule .0904(b) or (c)(2) .0904 of this Section.

6 (2) Common Carriers. When live propagated game birds or ~~the eggs thereof~~ game bird eggs are
7 transported by common carrier, each separate container shall be tagged or labeled ~~to show with~~
8 the name, ~~address~~ address, and license number of the shipping ~~propagator,~~ propagator; the name,
9 ~~address~~ address, and license or permit number of the ~~consignee,~~ consignee; and the number and
10 species of game birds or game bird eggs contained therein.

11 (b) Dead Game Birds

12 (1) Private Consumers. Unprocessed dead game birds may be transported by consumers or hunters
13 when accompanied by a ~~copy of the~~ receipt from a licensed game bird propagator required by Rule
14 ~~.0904(e)(1)~~ .904(e)(1) of this Section or by a copy of the receipt from a controlled shooting preserve
15 operator as required by 15A NCAC 10H .0105.

16 (2) Processed Game Birds. The carcasses of processed propagated game birds other than quail may be
17 transported in any manner when packaged in a wrapper or container marked as required by Rule
18 ~~.0904(e)(2)~~ .0904(e)(2) of this Section.

19
20 *History Note: Authority G.S. 113-134; 113-273;*
21 *Eff. January 1, 1981;*
22 *Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December*
23 *6, 2016.*
24

1 **15A NCAC 10H .0906 RECORDS**

2 ~~Each licensed~~ (a) Licensed game bird propagator propagators shall maintain a ~~chronological~~ file of receipts by
3 ~~calendar-year or copies thereof showing~~ with the following information:

- 4 (1) ~~The~~ The dates and sources of acquisition of game birds and ~~their eggs and~~ game bird eggs;
- 5 (2) ~~the~~ The species and quantities ~~thereof of the~~ game birds and game bird eggs, as required by Rule
6 .0903 of this ~~Section, Section; and~~
- 7 (3) ~~a chronological file of copies of receipts~~ Receipts showing all transfers of propagated game birds,
8 except dead quail sold for food purposes, and ~~their~~ game bird eggs as required by Rule .0904 of this
9 Section.

10 ~~Such records shall be segregated as to each license year,~~

11 (b) ~~Records shall be made available for inspection by any authorized agent at the request of the Wildlife Resources~~
12 ~~Commission, and Commission.~~

13 (c) ~~Records shall be retained for at least one year following the close of the~~ license year to which they pertain.

14
15 *History Note: Authority G.S. 113-134; 113-273;*
16 *Eff. January 1, 1981;*
17 *Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December*
18 *6, 2016.*

19
20

1 **15A NCAC 10H .0907 QUAIL CALL-PEN TRAPS**

2 ~~Any licensed game bird propagator who raises quail and who wishes to release live pen raised quail on his premises~~
3 ~~for dog training purposes may use quail call pen traps for the purpose of recovering such quail subject to the following~~
4 ~~restrictions:~~ Licensed game bird propagators that raise and release pen-raised quail on his or her property for dog
5 training shall be authorized to use quail call-pen traps to recover released quail, subject to the following requirements:

6 (1) All traps shall have a weather-resistant permanent tag attached with the propagator's name and
7 address written ~~legibly on it;~~ legibly;

8 (2) No ~~such~~ trap shall be located ~~with~~ within 100 yards of any ~~outside~~ boundary of the ~~premises;~~
9 property; and

10 ~~(3) All quail released for dog training shall be banded; and~~

11 ~~(4)(3) No trapped, unbanded quail caught in any such trap shall be retained.~~

12
13 *History Note: Authority G.S. 113-134; 113-273; 113-291.1;*

14 *Eff. January 1, 1981;*

15 *Amended Eff. May 1, 2009; July 1, 1987;*

16

EXHIBIT M

April 25, 2019



Proposed Changes to 10H .1100. Furbearer Propagation Rules Recommended by Agency Staff for Public Notice, Hearing and Comment

Title 15A NCAC 10H .1000. Furbearer Propagation Rules

These rules are part of the 2016 periodic review, with a re-adoption deadline of December 31, 2019. Technical and terminology changes are proposed for all subsections, as these rules have not been amended since 1986.

10H .1101

Updated to clarify rule language, remove repetitive language, incorporate requirements from 10H .1102 and .1103, and incorporate technical changes to text. Title updated to clarify that this rule is specific to furbearer propagation licenses.

15A NCAC 10H .1101 Application for License (page 3)

10H .1102

Proposing repeal of rule as requirements pertaining to authorized activities have been incorporated in 10H .1101.

15A NCAC 10H .1102 License Authorization (page 4)

10H .1103

Proposing repeal of rule as requirements pertaining to display of the license have been incorporated in 10H .1101.

15A NCAC 10H .1103 Posting and Display of License (page 5)

10H .1104

Updated to clarify rule language, remove repetitive language, incorporate rule language from 10H .1105, provide more specific detail to caging and care requirements and incorporate technical changes to text. Title updated to include minimum standards and care.

15A NCAC 10H .1104 Cages (page 6-7)

10H .1105

Proposing repeal of rule as information pertaining to animal care has been incorporated in 10H .1104.

15A NCAC 10H .1105 Sanitation and Care (page 8)

10H .1106

Updated to clarify rule language, remove repetitive language and incorporate technical changes to text.

15A NCAC 10H .1106 Humane Treatment (page 9)

10H .1107

Updated to clarify rule language, incorporate rule language from 10H .1108 and incorporate technical changes to text. Title updated to include Inspections.

15A NCAC 10H .1107 Records (page 10)

10H .1108

Proposing repeal of rule as information pertaining to inspection of facilities has been incorporated in 10H .1107.

15A NCAC 10H .1108 Inspections (page 11)

1 **15A NCAC 10H .1101 APPLICATION FOR LICENSE ~~FURBEARER PROPAGATION LICENSE~~**

2 Application for a license to propagate any species of furbearing animal or red foxes (*Vulpes vulpes*, including all color
3 phases) for use as fur shall be made to the Wildlife Resources Commission on a form which is available from the
4 Commission upon request. All pertinent information required on the application form shall be filled in to include the
5 nature and name of the applying entity, mailing address, telephone number, species of animal to be propagated, and
6 physical location of the propagation facility. The application must be accompanied by the annual license fee in the
7 amount of twenty five dollars (\$25.00) and mailed or otherwise delivered to the Wildlife Resources Commission, 512
8 N. Salisbury Street, Raleigh, North Carolina 27611.

9 (a) The furbearer propagation license shall authorize the propagation of furbearing animals and red foxes, including
10 all color phases, for use as fur. Furbearer propagation license holders shall be authorized to do the following:

- 11 (1) Breed the species of animal designated on the license;
- 12 (2) Acquire live specimens authorized on the license from permitted ranch-raised breeding stock;
- 13 (3) Raise live specimens for the production of marketable fur;
- 14 (4) Sell domestically produced fur to a licensed fur dealer; and
- 15 (5) Buy and sell live specimens from or to a furbearer propagation license holder, a captivity license
16 holder, or a licensed non-resident producer of ranch-raised breeding stock.

17 (b) Application for a furbearer propagation license shall be made on a form available from the Commission at
18 www.ncwildlife.org or at the Commission headquarters located at 1751 Varsity Drive, Raleigh, NC 27606-2576.

19 Information required from the applicant shall include:

- 20 (1) The applicant's name;
- 21 (2) The applicant's residence or mailing address;
- 22 (3) The physical address of the propagation facility;
- 23 (4) The applicant's telephone number; and
- 24 (5) The species of animal to be propagated.

25 (c) The furbearer propagation license shall be conspicuously posted at the propagation facility at all times.

26
27 *History Note: Authority G.S. 113-134; 113-273;*

28 *Eff. April 1, 1986;*

29 *Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December*
30 *6, 2016.*

1 ~~15A NCAC 10H .1102~~ **LICENSE AUTHORIZATION**

2 The furbearer propagation license authorizes the breeding of the species designated thereon, the acquisition of live
3 specimens obtained from lawful sources, the raising of same to maturity for the production of marketable fur, and the
4 selling of domestically produced furs to licensed fur dealers. The furbearer propagation license authorizes the buying
5 and selling of live specimens of the animals from or to a holder of either a furbearer propagation license or a captivity
6 license.

7
8 *History Note: Authority G.S. 113-134; 113-273;*
9 *Eff. April 1, 1986;*
10 *Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December*
11 *6, 2016.*

12
13

1 ~~15A NCAC 10H .1103~~ **POSTING AND DISPLAY OF LICENSE**

2 The furbearer propagation license shall be conspicuously posted and displayed at the propagation facility at all times
3 during which the facility is in use for the propagation of furbearers.

4

5 *History Note:* Authority G.S. 113-134; 113-273;

6 Eff. April 1, 1986;

7 Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December

8 6, 2016.

9

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1 **15A NCAC 10H .1104 ~~CAGES~~ MINIMUM STANDARDS FOR CAGING AND CARE**

2 ~~(a) Types of Cages. Cages for holding the animals being propagated shall be of two types:~~

3 ~~(1)(a)~~ Breeder cages shall be used to hold a pair of animals for breeding and to hold the female and her
4 litter from the time the litter is born until weaning;

5 ~~(2)(b)~~ Pelter cages shall only be used ~~only~~ to hold single animals.

6 ~~(b) Sizes of Cages. (c) The minimum dimensions of cages in depth (d), width (~~w~~) (w), and height (h) measured in~~
7 feet shall be as follows depending on the species of animals being held:

8	9 SPECIES	10 BREEDER CAGE (d x w x h)	11 PELTER CAGE (d x w x h)
12	Beaver	3 x 6 x 2.5	3 x 4 x 2.5
13	Bobcat	3 x 6 x 2.5	3 x 4 x 2.5
14	Fox	3 x 6 x 2.5 <u>5.0 x 3.0 x 3.0</u>	2.5 x 4 x 2.5 <u>2.5 x 3.0 x 3.0</u>
15	Mink	2 x 3 x 1.5 <u>2.0 x 0.8 x 1.0</u>	2 x 2 x 1.5 <u>2.0 x 0.5 x 1.0</u>
16	Nutria	3 x 3 x 2.0	3 x 2 x 2.0
17	Opossum	3 x 3 x 2.0	3 x 2 x 2.0
18	Otter	3 x 5 x 1.5	3 x 3 x 1.5
19	Raccoon	3 x 4 x 2.0	3 x 2 x 2.0
20	Skunk	3 x 3 x 1.5	3 x 2 x 1.5
21	Weasel	2 x 2 x 1.5	1 x 2 x 1.5

22
23 ~~(e) Cage Construction. The cages must be sturdily constructed of appropriate materials sufficient to retain the animals~~
24 ~~without tethers or chains, which may be used to restrain the animals only during the transfer of the animals from one~~
25 ~~cage to another. Cages must be provided with den areas in which the animals can retire from view and which are large~~
26 ~~enough to permit the animals to turn around and lie down.~~

27 ~~(d) Cage Arrangement. All cages must be maintained within a larger escape proof enclosure that must also be~~
28 ~~designed to prevent access by domestic dogs and cats. The cages must provide protection of the animals from excess~~
29 ~~exposure to the sun and inclement weather. The cages must be solidly based at least two feet above ground or floor~~
30 ~~level to facilitate cleaning.~~

31 (d) Each license holder shall comply with the following general cage requirements:

32 (1) cages shall be constructed of non-toxic, corrosion-resistant materials sufficient to retain animals
33 without tethers or chains;

34 (2) cages shall have a den area large enough for all the animals in that cage to turn around and lie down;

35 (3) cages shall be housed in an area that provides protection from direct sunlight, precipitation, wind,
36 and other weather conditions;

37 (4) cages shall be designed to minimize extreme heat build-up and provide sufficient light to maintain
38 the animal's circadian rhythms;

39 (5) caging shall be ventilated;

40 (6) cages shall be solidly based at least two feet above ground or floor level to facilitate cleaning;

41 (7) cages shall be arranged in rows to allow visual and physical inspection of all areas and all species
42 and to allow space for operations and cleaning; and

43 (8) a perimeter fence shall be maintained around the housing area and shall include a dig barrier
44 designed to prevent escape and access by domestic and wild animals.

1 (e) Each license holder shall comply with the following general care requirements:

2 (1) water: clean drinking water shall be provided. All pools, tanks, water areas, and water containers
3 provided for swimming, wading, or drinking shall be clean. Enclosures shall provide drainage for
4 surface water and runoff;

5 (2) sanitation: water disposal and waste disposal shall be in accordance with all applicable local, State,
6 and federal laws.

7 (3) food: food shall be of a type and quantity that is appropriate for the particular species and shall be
8 provided in an unspoiled and uncontaminated condition; and

9 (4) waste: fecal and food waste shall be removed from inside, under, and around enclosures and
10 disposed of in a manner that prevents noxious odors or pests

11 (5) ectoparasites: a program for the control of ectoparasites and vermin shall be established and
12 maintained. Methods to control insects shall be employed and only EPA approved insecticides shall
13 be used. Biological pest control methods may be used where appropriate.

14
15
16
17 *History Note: Authority G.S. 113-134; 113-273;*

18 *Eff. April 1, 1986;*

19 *Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December*
20 *6, 2016.*

1 ~~15A NCAC 10H .1105~~ **SANITATION AND CARE**

2 ~~Clean water must be made available to the animals at all times. Fresh food shall be provided daily. An effective~~
3 ~~program for control of insects, ectoparasites, and odor shall be established and maintained.~~

4
5 *History Note: Authority G.S. 113-134; 113-273;*

6 *Eff. April 1, 1986;*

7 *Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December*
8 *6, 2016.*

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1 **15A NCAC 10H .1106 HUMANE TREATMENT**

2 ~~No act or omission shall be allowed to occur nor any circumstance to continue which shall result in the infliction of~~
3 ~~unnecessary harassment or physical discomfort on any furbearing animals or fox.~~ Animals shall be observed daily for
4 signs of poor health or injury. Animals that are visibly sick, injured, in pain or suffering shall be provided prompt
5 medical care or euthanized as soon as possible. ~~The killing euthanization of the animal in preparation for marketing~~
6 ~~the fur shall be by a method which is quick and effective to the end that the animal is not subjected to prolonged~~
7 ~~harassment or physical abuse.~~ designed to cause minimal distress and pain as well as rapid, irreversible loss of
8 consciousness and cardiac arrest. The license holder shall confirm death by ensuring respiration has ceased.

9

10 *History Note: Authority G.S. 113-134; 113-273;*

11 *Eff. April 1, 1986.*

12

13

1 **15A NCAC 10H .1107 RECORDS AND INSPECTIONS**

2 (a) The licensee Furbearer propagation license holders shall maintain accurate records reflecting records containing
3 the following information:

- 4 (1) the numbers and species of furbearing animals or foxes ~~acquired,~~ acquired;
5 (2) the dates and sources of ~~acquisition,~~ acquisition;
6 (3) the numbers of animals produced by breeding and the numbers successfully raised for ~~market,~~
7 market; and
8 (4) the numbers of animals or pelts sold or otherwise disposed ~~of of,~~ together with the dates of
9 ~~disposition~~ disposition, and the identities of the ~~recipients.~~ recipients, if sold alive.

10 ~~Such records shall be maintained on a calendar year basis concurrent with the license year and shall be retained on the~~
11 ~~licensed premises for at least one year following the year to which they pertain.~~

12 (b) The records required by this Rule shall be maintained by calendar-year and shall be retained for at least one year
13 following the end of the calendar year to which they pertain. The records required pursuant to this rule shall be
14 available for inspection at the request of the Commission.

15 (c) Representatives of the Commission shall be permitted to enter the premises of a license holder's furbearer
16 propagation facility upon request or during business hours for inspection, enforcement, or scientific purposes.

17
18 *History Note: Authority G.S. 113-134; 113-273;*

19 *Eff. April 1, 1986;*

20 *Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December*
21 *6, 2016.*

1 ~~15A NCAC 10H .1108~~ — **INSPECTIONS**

2 The records required by Rule .1107 of this Section and the physical facilities of the licensee shall be made available
3 for inspection by authorized agents of the Wildlife Resources Commission at any time during business hours.

4
5 *History Note:* Authority G.S. 113-134; 113-273;

6 Eff. April 1, 1986;

7 Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December
8 6, 2016.

9

EXHIBIT N

April 25, 2019



Proposed Changes to 10H .1300. Reptiles and Amphibians Rules Recommended by Agency Staff for Public Notice, Hearing and Comment

Title 15A NCAC 10H .1300. Reptiles and Amphibians

These rules are part of the 2016 periodic review, with a re-adoption deadline of December 31, 2019. Technical and terminology changes are proposed for both subsections, as these rules have not been amended since 2009.

10H .1301

Updated to clarify restrictions and allowances for commercial take of certain turtles. Removed the word terrapins from title and rule text to accurately reflect native turtles. Clarify that native turtles cannot be bought or sold except snapping turtles with a curved carapace length of 11 inches or greater. Incorporated technical changes to text.

15A NCAC 10H .1301 Commercial Take of Certain Turtles Prohibited (page 2)

10H .1302

Updated to clarify rule language, remove repetitive language and incorporate technical changes to text. Removed the word terrapins from rule text to accurately reflect native turtles.

15A NCAC 10H .1302 Possession of Reptiles and Amphibians (page 3-4)

1 **15A NCAC 10H .1301 COMMERCIAL TAKE OF CERTAIN TURTLES ~~AND TERRAPINS~~**
2 **PROHIBITED**

3 (a) For the purposes of this Rule, "commercial taking" means the taking, possession, collection, transportation,
4 purchase or sale of five or more individual turtles or any turtle part, per person in a calendar year. It is unlawful to
5 engage in the commercial taking of any native turtle or terrapin species in the families Emydidae or Trionychidae,
6 except the public may obtain possession permits from the Wildlife Resources Commission for possession,
7 transportation, purchase or sale of these turtles and terrapins as described pursuant to Rule .1302 of this Section.

8 (b) For purposes of this Rule, "commercial taking" is defined as the taking, possession, collection, transportation,
9 purchase or sale of five or more individual turtles or terrapins, or any part thereof, per person in any given year. It
10 shall be unlawful to engage in the commercial taking of any native turtle species in the families Emydidae or
11 Trionychidae.

12 (c) The prohibition on collection in this Rule shall not apply to the following:

- 13 (1) A licensed veterinarian when holding for purposes of medical treatment;
- 14 (2) A holder of a valid ~~rehabilitation~~ captivity permit for the purposes of rehabilitation;
- 15 (3) A publicly-financed zoo, scientific research facility or institution of higher education, or any state
16 or federal agency;
- 17 (4) Any person who accidentally collects five or more turtles ~~or terrapins~~ incidental to any lawful
18 activity, and who immediately returns them to the wild; or
- 19 (5) Property owners who legally apply for and receive depredation permits from the Wildlife Resources
20 Commission, or one of its Wildlife Damage Control Agents.

21 ~~(d) Any person who was in lawful possession of five or more native turtles or terrapins in aggregate at the time of the~~
22 ~~effective date of this Rule shall apply for a possession permit to retain them. The permit to retain these animals shall~~
23 ~~be applied for before January 1, 2008. No native turtles or terrapins turtle shall be purchased or sold without a permit.~~
24 ~~Permittees are subject to all requirements and conditions described in Rule .1302 of this Section. sold, except snapping~~
25 ~~turtles (Chelydra serpentina) with a curved carapace length of 11 inches or greater.~~

26 (e) Violators are subject to a replacement cost per individual turtle that shall equal the replacement cost for "species
27 with no open season" as set forth in 15A NCAC 10B.0117(c) until such time as replacement costs for each genus of
28 turtle in these families is established by the Wildlife Resources Commission.

29
30 *History Note: Authority G.S. 113-333(a)(6);*

31 *Eff. May 1, 2007;*

32 *Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December*
33 *6, 2016.*

1 **15A NCAC 10H .1302 POSSESSION OF REPTILES AND AMPHIBIANS**

2 (a) ~~Permits required.~~ Possession permits are required for the possession, importation, transportation, purchase, and
3 sale of:

- 4 (1) 25 or more individuals of any combination of native amphibian species; or
- 5 (2) five or more individuals of native reptile species.

6 (b) ~~Permits not required.~~ Possession permits ~~are not~~ shall not be required for the possession, importation,
7 transportation, purchase, and sale of:

- 8 (1) 24 or fewer individuals of any combination of native amphibian species; or
- 9 (2) four or fewer individuals of native reptile species, ~~except snapping turtles (Chelydra serpentina) less~~
10 ~~than 11 inches (curved carapace length) shall not be possessed. Individuals in possession of snapping~~
11 ~~turtles (Chelydra serpentina) less than 11 inches (curved carapace length) prior to May 1, 2017 are~~
12 ~~exempt from this restriction. species.~~

13 (c) ~~Unauthorized activities.~~ Nothing in this Rule shall be construed to authorize the collection of any wildlife resources
14 from the wild or the taking, possession, transportation, sale, purchase, or release to the wild of any wildlife resources
15 or their parts in violation of State or federal laws or regulations.

16 (d) At no time shall permitted animals be released to the wild, except under situations of research or rehabilitation
17 with written permission from the Wildlife Resources Commission.

18 (e) The sale of native turtles shall be unlawful, except for snapping turtles (Chelydra serpentina) with a curved carapace
19 length of 11 inches or greater.

20 (d) ~~Denial of possession permits. Circumstances for which, and persons to whom a~~ (f) A possession permit shall not
21 be issued ~~include: for:~~

- 22 (1) ~~for the purpose of~~ holding reptiles and amphibians that were acquired unlawfully;
- 23 (2) ~~for the purpose of~~ holding reptiles and amphibians for unlawful sale or trade;
- 24 (3) ~~for the purpose of possessing or selling~~ snapping turtles (Chelydra serpentina) less than 11 inches
25 (curved carapace length) length, ~~however, individuals in possession of snapping turtles (Chelydra~~
26 ~~serpentina) less than 11 inches (curved carapace length) prior to May 1, 2017 are exempt from this~~
27 ~~restriction;~~
- 28 (4) ~~to persons who collect~~ collecting five or more individual native turtles ~~or terrapins~~ from the families
29 Emydidae or Trionychidae from the wild in a given year, except those entities exempted from
30 collection in Paragraph (c) of Rule .1301 of this Section;
- 31 (5) ~~to persons who collect~~ collecting five or more individuals in aggregate from other native reptile
32 families or 25 or more individual amphibians from the wild in a given year without first having
33 secured a valid Collection License;
- 34 (6) ~~to persons~~ individuals found to be in violation of Collection License, Endangered Species Permit,
35 or Possession Permit requirements as provided in 15A NCAC 10B .0119, 10I .0100, and 10H .1300.
- 36 (7) ~~to persons~~ individuals who do not first obtain possession permits prior to acquiring the following
37 wildlife resources ~~unless the acquisition of these animals was made prior to May 1, 2007 and a~~
38 ~~permit was acquired within 12 months of that date:~~ resources:

- 39 (A) 25 or more individuals of any combination of native amphibian species; or

1 (B) five or more individuals of native reptile species.

2 ~~(e) Term of Permit.~~ (g) The permit shall be valid from January 1 through December 31 of the applicable year.

3 ~~(f) Reports on Permitted Animals. Each individual~~ (h) Individuals permitted under this Rule shall submit a report to
4 the Wildlife Resources Commission within 15 days following the date of ~~expiration of the permit.~~ permit expiration.

5 The report shall ~~show~~ contain the numbers of each species held under the permit and the use or disposition thereof.
6 ~~The Executive Director may require additional information for statistical purposes such as the source and date of~~
7 ~~acquisition of additional animals and the sex, size, weight, condition, reproductive success and approximate age of~~
8 ~~each animal in possession.~~

9 ~~(g) Other Requirements and Restrictions. The Executive Director may, pursuant to G.S. 113-274(e), impose such~~
10 ~~other requirements and restrictions on persons permitted under this Rule as he may deem to be necessary to the~~
11 ~~efficient administration of the wildlife conservation statutes and rules.~~

12
13 *History Note: Authority G.S. 113-274(c)(1c);*
14 *Eff. May 1, 2007;*
15 *Amended Eff. August 1, 2017; May 1, 2009.*