

1 Conservation Plan for the Brook Floater (*Alasmidonta*  
2 *varicosa*) in North Carolina  
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9 North Carolina Wildlife Resources Commission

10 February 2, 2018

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41 **EXECUTIVE SUMMARY**

42 The Brook Floater (*Alasmidonta varicosa*) is a small mussel which is typically found in well oxygenated,  
43 free-flowing rivers and streams in gravel riffles along the Blue Ridge Escarpment and into the upper  
44 Piedmont. It is sporadically distributed in streams and rivers of the Atlantic coastal region, from Georgia  
45 north to Nova Scotia and New Brunswick (Canada). In North Carolina it is found in three river basins:  
46 the Catawba, Yadkin-Pee Dee, and Cape Fear. The strongest populations exist in the Upper Catawba  
47 and Upper Yadkin river basins, including the Linville River, Mulberry Creek, Johns River, Roaring River,  
48 Mitchell River, and the mainstem Yadkin River. Habitat loss and impaired water quality resulting from  
49 sedimentation (agricultural and urban runoff), nutrient loading, loss of riparian forests, sewage and  
50 industrial discharges, development and increased impervious surfaces, and watershed development are  
51 all threats to the Brook Floater. In order to maintain Brook Floater populations, the North Carolina  
52 Wildlife Resources Commission (NCWRC) will support and contribute to permit reviews, current  
53 regulations, habitat protection, and habitat management. The primary conservation strategy moving  
54 forward is to maintain the Brook Floater in the Catawba, Yadkin-Pee Dee, and Cape Fear river basins and  
55 reestablish populations where once extirpated. Currently in NC there are 14 known populations, with  
56 varying degrees of viability; within the next decade we plan to reestablish six populations, three in each  
57 the upper Catawba and Yadkin River basins. The ultimate goal is to maintain 20 viable populations in  
58 NC.



59

60 **BIOLOGICAL INFORMATION**

61 **Description and Taxonomic Classification**

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

67 **Life History and Habitat**

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

76 **Distribution and Population Status**

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

90

91 Until recently, surveys for the Brook Floater in NC have been sporadic at best. Some initial mussel  
92 surveys by E.P Keferl in the late 1980s found the mussel in six streams; four in the Catawba River Basin  
93 and two in the Yadkin-Pee Dee. Throughout the 1990s, surveys primarily by the NC Department of  
94 Transportation and the NCWRC found the range of the Brook Floater was much larger than initially  
95 thought. In 1990, the first population was discovered in the Cape Fear River Basin, in the Rocky River,  
96 but only one individual was observed. Throughout the 1990s the Brook Floater was still only known

97 from 12 streams in NC. In 1993, populations in Upper Creek and the Linville River in the Catawba River  
98 Basin were considered the best in the state (catch per unit effort [CPUE] 20.7 and 25.3 individuals per  
99 person-hour, respectively). Yet, regardless of river basin the majority of observations in the 1990s were  
100 between one and three individuals and the average CPUE was 1.0. The highest density in any population  
101 was observed in 1998, in the Linville River (CPUE 31.5).

102  
103 From 2000-2017 mussel surveys throughout NC increased and more Brook Floater populations were  
104 discovered. By the end of 2009, 21 streams had known Brook Floater populations; still, CPUE was highly  
105 variable. The majority of sites ranged from 1-3 individuals and CPUE was usually less than one mussel  
106 per hour. The highest population numbers were observed in the Yadkin River Basin; Roaring, Yadkin,  
107 and Mitchell rivers (CPUE 25.5, 14, and 13.8, respectively). From 2010-2017, more focused monitoring  
108 surveys were conducted for Brook Floaters. Over the past seven years, 16 streams have had recorded  
109 Brook Floaters in NC. However, recent surveys have revealed new populations, larger distributions, and  
110 some streams have been found to have much higher densities than originally thought. The highest  
111 density population in NC was discovered in 2015 in Mulberry Creek in the upper Johns River basin with  
112 CPUEs ranging from 38.3 to 48.0 at various sites. In 2011, a population was discovered in the Catawba  
113 River, extending upstream of Lake James for ~14 river miles. The population in the Linville River was  
114 considered to be small and only inhabited a two-mile reach upstream of Lake James, yet now the known  
115 range is extended three additional miles into the Linville River gorge. Prior to 2010, the population in  
116 the Roaring River was only known from one locality. Following surveys in 2014-2017 the population  
117 currently occupies ~24 river miles in the Roaring River watershed, and has consistently high CPUEs in the  
118 mainstem Roaring River and at various sites (CPUE=10.3, 11.7, 14.8, and 32.0).

119  
120 Recent surveys (2015-2017) have provided sufficient data to generate population estimates for Brook  
121 Floaters throughout their known range in the Upper Catawba and Upper Yadkin-Pee Dee river basins  
122 (Table 1). Population estimates were calculated using the following formula:  $E = (n/A_s)A_o$  where  $E$  = the  
123 population estimate;  $n$  = the number of animals recovered;  $A_s$  = a function of the number of sites  
124 surveyed, the mean length of surveyed sites, and the mean width of surveyed sites; and  $A_o$  = a function  
125 of the total segment length between sites with detected animals and the mean width of the segment  
126 (COSEWIC, 2009). Lower and upper estimates were determined by substituting total number of sites  
127 surveyed (lower estimate) and total number of sites where the species was detected (upper estimate).  
128 It is important to note that these estimates assume the area of occupied habitat is homogenous and  
129 thus the animals are uniformly distributed; the true Brook Floater population size is likely smaller. These  
130 numbers are most useful for providing possible comparative estimated values between surveyed  
131 populations.

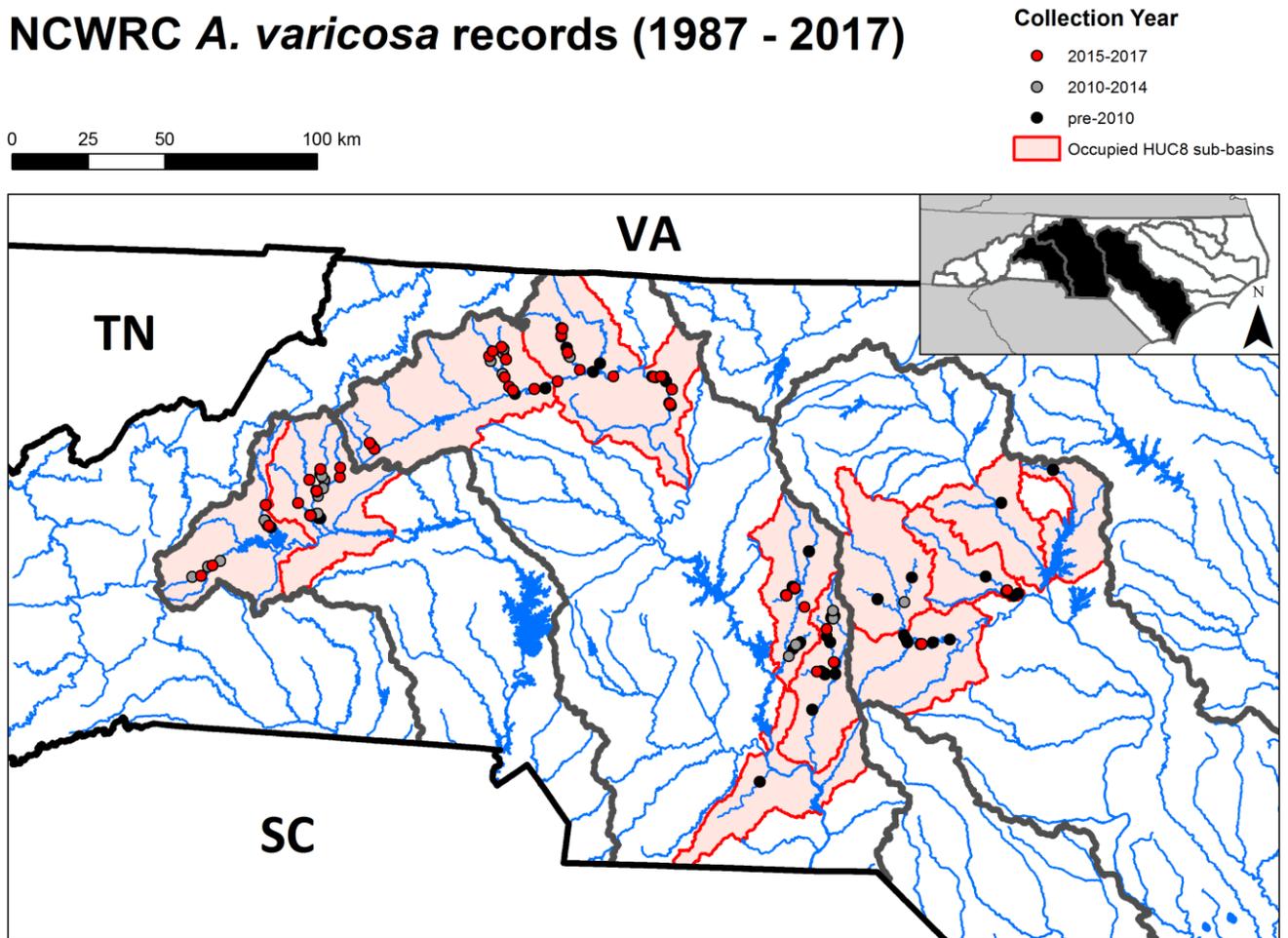
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134 **Table 1. Population estimates of the Brook Floater (*Alasmidonta varicosa*) in the Catawba and Yadkin**  
 135 **River basins in North Carolina. Values have been rounded to the nearest hundred.**

<b>Population</b>	<b>Estimated N</b>
<b><i>Catawba River Basin</i></b>	
Catawba River (upstream of Lake James)	500 - 800
Linville River	600 - 1100
Mulberry Creek	2,200 – 2,900
Upper Creek	200 - 300
Wilson Creek	900 – 2,300
<i>Total</i>	<i>4,400 – 7,400</i>
<b><i>Upper Yadkin-Pee Dee River Basin</i></b>	
Mitchell River	900 – 1,400
Roaring River	3,400 – 5,500
Yadkin River (downstream of Kerr Scott)	5,800 – 9,500
<i>Total</i>	<i>13,600 – 21,800</i>
<b>Cumulative Total</b>	<b>18,000 – 29,000</b>

136  
 137  
 138 The NCWRC currently classifies the Brook Floater as Endangered. The NC Natural Heritage Program  
 139 (NCNHP) categorizes the Brook Floater as S2, G3 – Imperiled. “Imperiled” as defined by the NCNHP  
 140 states, “Imperiled in North Carolina due to rarity or some factor(s) making it very vulnerable to  
 141 extirpation from the state. Typically, 6 to 20 occurrences or few remaining individuals (1,000 to 3,000).”  
 142 The NC Natural Heritage Program currently recognizes 17 confirmed occurrences in the state (Judy  
 143 Ratcliffe pers. comm.). In 2010 the Center for Biological Diversity filed a petition with the US Fish and  
 144 Wildlife Service (FWS) to federally designate the Brook Floater as either Threatened or Endangered (US  
 145 District Court for Washington, D.C. 2011). This resulted in a positive 90-day finding. The FWS is now  
 146 conducting a 12-month review for this species to determine if it merits listing as a candidate species; this  
 147 review should conclude in 2018 (USFWS 2011).  
 148  
 149

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



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151  
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153  
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**Figure 1. Distribution and collections of Brook Floater in North Carolina.**

## 155 **Historic and Ongoing Conservation Efforts**

156 Historic efforts to conserve Brook Floaters have resulted, tangentially, through the Clean Water Act,  
157 1972, which limited pollution from point source effluents, and from the creation of Pisgah National  
158 Forest which provided water quality protection in the headwaters of the Catawba River Basin. Recent  
159 water quality protection in the Upper Catawba and Yadkin river basins have resulted from the purchase  
160 and/or expansion of Johns River Game Lands, Stone Mountain State Park, Thurmond-Chatham Game  
161 Lands, Mitchell River Game Lands, and Pilot Mountain State Park. In addition, the following streams are  
162 either considered a High Quality Water or Outstanding Resource Water (HQW/ORW): Linville River,  
163 Warrior Fork, Wilson Creek, Mulberry Creek, and Mitchell River. This designation is the highest level the  
164 state of North Carolina provides for water quality protection (NCDENR 2011). These designations confer

165 stringent erosion and sediment controls, buffer widths, dictate the use of best management practices,  
166 and restrict new waste water discharges.

167  
168 Recently, a host fish study for Brook Floater was completed and found Margined Madtoms (*Noturus*  
169 *insignis*) to be the most suitable host in NC (Eads 2008). This information provided the propagation  
170 tools to support ongoing efforts to conserve Brook Floaters via translocation and augmentation of  
171 extirpated populations such as the Catawba River downstream of Lake James, Upper South Fork  
172 Catawba River (Henry and Jacob Forks), and the Upper Yadkin River upstream of Kerr Scott Reservoir.  
173 Other recent efforts have focused on limiting vehicular traffic in streams occupied by Brook Floaters,  
174 biological assistance focusing on new HQW/ORW water quality classification in occupied rivers such as  
175 the Roaring River, technical guidance to land protection organizations purchasing tracts of land adjacent  
176 to occupied streams, and initiation of a mark-recapture study in core populations in order to track  
177 temporal changes.

## 178 179 **THREAT ASSESSMENT**

### 180 **Reason for Listing**

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

### 185 **Present and Anticipated Threats**

186 Habitat loss and impaired water quality resulting from sedimentation (agricultural and urban runoff),  
187 nutrient loading, loss of riparian forests, sewage and industrial discharges, development and increased  
188 impervious surfaces, and watershed development are all threats to the Brook Floater (NCWAP 2015,  
189 COSEWIC 2009). In addition, existing populations are highly fragmented by impoundments, hydropower  
190 facilities, and stream crossings in all three currently occupied river basins (Nedeau 2008). Some of these  
191 threats have been abated or halted to some degree; there are no new large impoundments currently  
192 planned and point source pollution of conventionally considered contaminants is reasonably regulated  
193 in NC. However, it is anticipated that non-point source problems will continue in the future, and  
194 enforcement and compliance actions are critical to maintenance or improvement of water quality. A  
195 class of emerging contaminants, including pharmaceutical, agricultural, and industrial byproducts that  
196 pass-through wastewater facilities largely untreated and are often unregulated, pose a threat to many  
197 aquatic species. Some compounds act as endocrine-disrupters, others have poorly understood effects  
198 on aquatic life; these can reduce juvenile development or survival, limit adult reproductive success,  
199 among other detrimental impacts (Adamson *et al.* 2017, Lee Pow 2016, Hinck *et al.* 2009, Gagné 2004).  
200 These pollutants may negatively affect both Brook Floater and host fish populations through multiple  
201 pathways.

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

## 213 **CONSERVATION GOAL AND OBJECTIVES**

### 214 **Conservation Goal**

215 The conservation goal for the Brook Floater is to prevent the extinction of this species and ensure its  
216 long-term viability as a member of the fauna of North Carolina for the next 100 years.

### 217 **Conservation Objectives**

218 The primary conservation strategy is to maintain the populations of Brook Floater in the Catawba,  
219 Yadkin-Pee Dee, and Cape Fear river basins and reestablish populations where once extirpated.

- 220 1) Maintain a total of 7 populations in the Catawba River Basin. Four current populations include:  
221 Upper Catawba River, Linville River, Warrior Fork, Johns River (Wilson's Creek and Mulberry  
222 Creek). Reestablish three populations: Upper South Fork Catawba River (Henry and Jacobs  
223 Fork), Catawba River downstream of Lake James, and North Fork Catawba River (Armstrong  
224 Creek).
- 225 2) Maintain a total of 10 populations in the Yadkin-Pee Dee River Basin. Seven current populations  
226 include: Buffalo Creek, Roaring River, Mitchell River, Fisher River, mainstem Yadkin River,  
227 Uwharrie River (Barnes Creek and other small tributaries), Little River (Densons Creek), West  
228 Fork Little River (Uwharrie River and Little River populations may represent a currently  
229 undescribed species). Reestablish three populations: Upper Yadkin River mainstem, Elk Creek,  
230 and Reddies River.
- 231 3) Maintain three viable populations in the Cape Fear River Basin populations: Deep River, Rocky  
232 River, and New Hope Creek.

233

## 234 **CONSERVATION ACTIONS**

### 235 **Habitat Protection and Habitat Management**

236 Protecting wide forested riparian corridors, minimizing construction and fill in the 100-year floodplain,  
237 using effective sediment and erosion control, and adequately managing storm water quality and  
238 quantity in development areas are essential to protect water quality and aquatic habitat for Brook  
239 Floaters. Staff will utilize the permit review process to minimize the effects of development on this and  
240 other aquatic species, generally following guidance provided in the NC Wildlife Resources Commission's  
241 Guidance Memorandum to Address and Mitigate Secondary and Cumulative Impacts to Aquatic and  
242 Terrestrial Wildlife Resources and Water Quality (NCWRC 2002).

243 Riparian buffers of at least 100 feet for perennial streams and 50 feet for intermittent streams will be  
244 recommended for most project settings. Where federally listed species are present, larger buffers and  
245 more stringent protection measures may be recommended. Where instream work is proposed,  
246 recommendations will focus on minimizing stream bed disturbance, such as working outside of live  
247 flows. Staff may also recommend that projects incorporate more stringent sediment and erosion  
248 control measures than are ordinarily required, such as stabilizing soils within 5 working days or 7  
249 calendar days, whichever is shorter, and using advanced settling devices. The NCWRC will evaluate  
250 recommending flow improvements in reaches where flow is regulated by upstream reservoirs such as  
251 the reach downstream of Kerr Scott Reservoir as the opportunity arises. The NC Division of Water  
252 Resources and several nongovernmental organizations are working towards resolving some water  
253 quality issues on the Rocky River. The NCWRC will support these efforts as necessary and appropriate.

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

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

### 263 **Population Management**

264 Augmenting existing populations or establishing new populations in suitable areas can be a powerful  
265 tool for conservation. However, establishing new populations of a species that may become federally  
266 listed can be problematic as it can introduce regulations inherent in the Endangered Species Act. All the  
267 management actions described below must be approved individually and separately from endorsement  
268 of this management plan by the Habitat, Nongame, and Endangered Species (HNGES) Committee of the  
269 North Carolina Wildlife Resources Commission. Before these actions take place, the HNGES may require  
270 tools that minimize regulatory burden such as Candidate Conservation Agreement with Assurances or  
271 Safe Harbor Agreement.

272 Utilize captive propagation and/or translocations to establish and augment populations of Brook Floater  
273 in the Catawba River downstream of Lake James, the Upper South Fork Catawba River (Henry and Jacob  
274 Fork), North Fork Catawba River, Upper Yadkin River upstream of Kerr Scott Reservoir, Elk Creek,  
275 Reddies River, and Fisher River.

276 Establish connectivity and gene flow between existing and established populations by either  
277 translocating individuals or dam removal. Meta-populations can be reconnected to currently extirpated  
278 populations. All four populations in the Catawba River are isolated due to Lake James and its  
279 hypolimnetic discharge; these populations may need genetic augmentation to prevent inbreeding and  
280 boost outbreeding. The upper Reddies River is cut off from the Roaring and Yadkin River population via  
281 a dam; the water quality and habitat upstream of the dam has recovered, however Brook Floater cannot  
282 reestablish naturally. The only population upstream of W Kerr Scott Reservoir is isolated in Buffalo  
283 Creek. In addition, this population is bisected by the Patterson Dam which is currently breached and  
284 acts as a sediment release valve during random events. Populations in the Deep and (if extant) Haw  
285 River are also fragmented by dams. The Haw River is isolated from the rest of the Cape Fear river basin  
286 by Jordan Lake, a large reservoir managed for hydropower generation and recreation by the US Army  
287 Corps of Engineers at B. Everett Jordan Dam; if suitable habitat and water quality are located, this could  
288 be a receiving system for reintroduction material. The Deep River has a chain of dams extending from  
289 Lockville Dam near Jordan Lake up to the headwaters at Oak Hollow Lake in the City of High Point.  
290 Opportunities to restore connectivity, particularly in the middle reach between Lockville Dam and  
291 Coleridge Dam, should be evaluated and pursued where appropriate.

#### 292 **Catawba River Basin**

293 In 2018 Brook Floater propagation will begin at the NCWRC's Conservation Aquaculture Center. Pending  
294 approval by the HNGES, individuals from this cohort will be stocked in 2020 in the Upper South Fork  
295 Catawba River (Henry and Jacobs Fork) and/or in the Catawba River downstream of Lake James. We  
296 estimate initial stocking numbers at ~1,000 individuals per stream. These stockings should continue at a  
297 minimum of five years but be completed by year 2030. In addition, translocated adults may be stocked  
298 in each target stream to increase the genetic viability of the reestablished populations. Selected  
299 stocking sites will be monitored yearly for success, by 2030 success or failure will be confirmed.

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

#### 303 **Yadkin River Basin**

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

308 populations; however, this will follow propagation efforts in the Catawba River Basin. Augmentation  
309 sites will be monitored for ten years. In 2028 success or failure of augmented sites will be confirmed.

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

312

### 313 **Cape Fear Basin**

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

### 316 **Incentives (Tax break)**

317 NCWRC biologists will encourage private landowners in Brook Floater habitat to participate in the  
318 property tax incentive program. This program allows qualifying landowners whose property contains  
319 state listed species to get a property tax credit for implementing conservation actions.

### 320 **Monitoring and Research**

321 Mark-recapture studies in the Catawba and Yadkin river basins should continue in 2017-18 in order to  
322 establish baseline population levels. These surveys should be replicated on a defined schedule, along  
323 with general distribution surveys to track the range within specific streams. Particular attention should  
324 be paid to the Catawba River upstream of Lake James to determine if the population is starting to  
325 decline in that basin. In addition, the populations in the Fisher and Ararat rivers appear to have declined  
326 and been extirpated recently; more distribution surveys are needed in these watersheds.

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

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

### 334 **Education and Outreach**

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

### 338 **Regulations**

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

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

351

## 352 **ECONOMIC IMPACTS**

### 353 **Potentially Affected Parties**

354 Implementation of this conservation plan will predominately affect the North Carolina Wildlife  
355 Resources Commission. The NCWRC will be responsible for virtually all the population management,  
356 habitat management, monitoring, and research.

357

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

359

### 360 **Agency Costs**

361 Monitoring and survey costs associated with this plan are anticipated to be approximately \$35,000  
362 through 2030. Costs related to propagation of the Brook Floater are estimated at approximately  
363 \$30,000. Staff time to develop a Candidate Conservation Agreement with Assurances or Safe Harbor  
364 agreement are expected to be approximately \$3000. There is no way to estimate how many projects  
365 NCWRC staff will review where the Brook Floater may be affected, but permit review requires  
366 approximately two hours of staff time per project and would cost an estimated \$74 per project. Cost for  
367 land acquisition depends on size of tract. Costs typically range from \$200,000 to \$5,000,000. However,  
368 tracts will be put in the Game Lands program and serve multiple purposes so cost must be spread across  
369 multiple programs and benefits. Costs to produce outreach materials and conduct educational events  
370 should not exceed \$5,000.

371

### 372 **Costs to Others**

373 Developers will be required to assess projects for any potential impacts to listed species as part of the  
374 permit application process for development. All currently available species data is available free of  
375 charge on the Natural Heritage website and applicants can request free assistance in interpreting the  
376 data at any time. However, if data do not exist on a species, a survey may need to be completed, at the

377 developer's expense, before the project begins. A site survey for a species is nominal to the developer  
378 compared to the total expense of a project. The costs associated with the survey are typically absorbed  
379 into other scoping, survey or environmental fees that developers plan for as part of the site  
380 development.

381

### 382 **Efforts to Minimize Costs and Adverse Economic Impacts**

383 The NCWRC will utilize two main strategies for minimizing the economic impacts of implementing this  
384 plan. The first strategy is that the NCWRC will utilize federal grant funding to carry out most of the  
385 actions called for in this plan. These activities are eligible for funding through the State Wildlife Grants  
386 (SWG) Program. SWG will cover 65% of the costs of virtually all the actions called for in this plan.

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

### 391 **LITERATURE CITED**

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