

Conservation Plan for the Gopher Frog (*Rana capito*)  
in North Carolina



North Carolina Wildlife Resources Commission

May 16, 2018

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1 **Conservation Plan for the Gopher Frog (*Rana capito*) in North Carolina**

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4 **EXECUTIVE SUMMARY**

5

6 The United States Fish and Wildlife Service (USFWS) is evaluating the need to list the Gopher

7 Frog (*Rana capito*) under the federal Endangered Species Act. In North Carolina, this species

8 exists in low numbers across the southern Coastal Plain. Known populations have suffered

9 major losses which are likely not recoverable. Only 7 of the historical 23 populations remain

10 (70% reduction); only 14 of the original 53 pond sites remain. Egg mass data suggest that the

11 total population of Gopher Frogs is 200-300 individuals; those populations are fragmented and

12 face numerous threats including disease, severe weather, especially long periods of drought,

13 development, and lack of proper management. To maintain the Gopher Frog, the North

14 Carolina Wildlife Resources Commission (NCWRC) will augment populations, where possible,

15 through head-starting efforts; work with partners to establish goals for each population; and

16 determine and implement Best Management Practices for wetland and upland restoration and

17 maintenance, including appropriate application of prescribed fire. NCWRC will also continue to

18 pursue land acquisition and other land conservation practices in areas where Gopher Frogs

19 exist, or where appropriate habitat can be restored, managed, or created where new

20 populations may be introduced or re-introduced. Finally, NCWRC will continue genetic analyses

21 of Gopher Frog populations. NCWRC may work to establish connectivity and gene flow

22 between existing populations, potentially through translocation.

23

24

## 25 **BIOLOGICAL INFORMATION**

### 26 **Description and Taxonomic Classification**

27 The Gopher Frog (*Rana capito*) is a medium-sized frog (7.2-9.4 cm in snout-vent length) with a  
28 gray to brownish dorsum containing many small dark gray to black spots. The venter is white,  
29 cream, or yellowish with dark speckling or mottling. This frog has a warty skin texture unlike  
30 that of most other North American *Rana*. Tadpole identification is difficult without experience;  
31 key characteristics for North Carolina tadpoles were presented by Braswell (1993). Published  
32 keys to tadpole identification (e.g., Altig 1970 and Travis 1981) are virtually useless when trying  
33 to separate North Carolina *R. capito* from the Southern Leopard Frog (*R. sphenocephala*) and  
34 the Pickerel Frog (*R. palustris*). *Rana capito* was formerly known as the Carolina Crawfish Frog  
35 (*Rana areolata capito*) and the Carolina Gopher Frog (*Rana capito capito*), but no subspecies  
36 are currently recognized (Young and Crother 2001). Various accounts of this species are found  
37 in Beane et al. (2010), Altig and Lohofener (1983), Jensen and Richter (2005), and Dorcas et al.  
38 (2007).

### 39 **Life History and Habitat**

40 Isolated, fish-free, ephemeral wetlands are the normal breeding grounds for the Gopher Frog in  
41 North Carolina (Braswell 1993). Adult frogs remain in upland burrows (Gopher Tortoise  
42 burrows – where Gopher Tortoises occur –, stumpholes, or mammal burrows) during the non-  
43 breeding season. Adult frogs in North Carolina are known to travel as far away as 3.5 km from  
44 their breeding pond to a stumphole – a hole in the ground resulting from the decay of a tree’s  
45 roots – and can use the same stumps as refugia from year-to-year (Humphries and Sisson  
46 2012). This species is associated with the Longleaf Pine ecosystem in the southeastern United  
47 States. That ecosystem is considered critically endangered, having been reduced by more than  
48 98% (Noss et al. 1995). The Gopher Frog requires both appropriate breeding ponds and upland  
49 terrestrial habitat. Breeding ponds must be large enough to retain water throughout the  
50 tadpole stage, but shallow enough to dry periodically, as the Gopher Frog does not tolerate fish.  
51 Additionally, these ponds must be relatively open-canopy and have a heavy herbaceous  
52 component. Gopher Frogs deposit their egg masses on the stems of herbaceous vegetation,  
53 and developing tadpoles graze along these same herbaceous stems. Upland habitats utilized in  
54 more southern localities include preexisting refugia such as Gopher Tortoise burrows,  
55 stumpholes, and other naturally occurring holes (Blihovde 1999, 2000; Bailey 1991). Recent  
56 research showed similar terrestrial habitat usage in North Carolina (Humphries and Sisson  
57 2012). Breeding in North Carolina typically occurs from mid-February to mid-April, with March  
58 being the month when most breeding occurs. Fall breeding has also been documented in North  
59 Carolina (Alvin Braswell field notes, WRC staff database). The breeding call is a loud snore that  
60 lasts up to two seconds (Wright and Wright 1949). Larvae develop over 3-4 months, and

61 transformation usually occurs from May to July, when tadpoles grow larger than 85 mm in total  
62 length (Braswell 1995). The juveniles and adults occupy terrestrial habitats except for the  
63 intervals when adults migrate to breeding ponds. Longevity information is scant; one captive  
64 male reported in Snider and Bowler (1992) was from North Carolina and lived for 9+ years.  
65 Gopher frogs in Mississippi are known to live at least 15 years in the wild (M. Sisson, pers.  
66 comm.). Based on one observation from Florida (Franz et al. 1988), Gopher Frogs can range up  
67 to 2.0 km from their breeding sites. Research in North Carolina corroborates long-distance  
68 travel to breeding sites, with telemetered animals traveling an average of 1.3 km away from a  
69 Sandhills breeding site, and a maximum of 3.5 km (Humphries and Sisson 2012). In addition,  
70 during a separate project, a Gopher Frog from this same Sandhills breeding site was detected  
71 by drift fence 5.2 km away. Thus, this species requires large tracts (typically >5000 acres) of  
72 fire-maintained upland Longleaf Pine forest with embedded isolated ephemeral wetlands.  
73 Tadpoles are herbivorous, while adults eat a wide variety of invertebrates and possibly some  
74 smaller vertebrates. Preliminary work with acidity tolerances/preferences of amphibians in  
75 ephemeral ponds in North Carolina (Smith and Braswell 1994) suggests Gopher Frogs prefer an  
76 aquatic acidity range from approximately 4.3 – 5.2 pH.

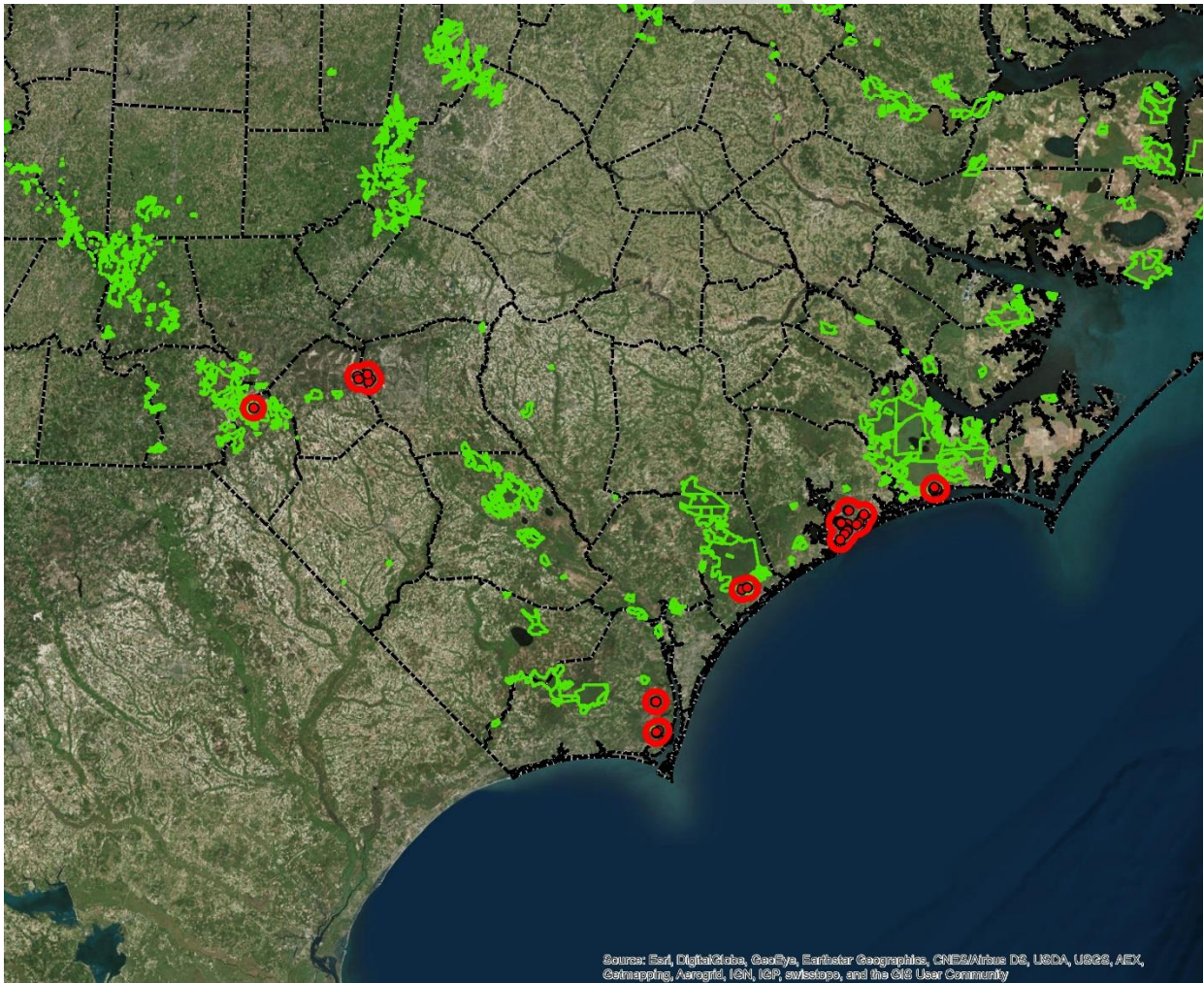
#### 77 **Distribution and Population Status**

78 The northern limit to the range of *Rana capito* occurs in southeastern North Carolina, where it  
79 has been reported from 53 pond localities, representing 23 populations (Braswell 1993),  
80 historically (over the past 100 years). The historical range of this species extends from Beaufort  
81 County on the coast and Cumberland County on the inner Coastal Plain south to southern  
82 Florida, and west along the Gulf Coast to Louisiana (see Conant and Collins 1998; Jensen and  
83 Richter 2005). The current northern extent of the range in North Carolina appears to be in the  
84 Croatan National Forest, Carteret County. Sites farther north in Beaufort County have been  
85 destroyed (Braswell 1993; Dorcas et al. 2011). Historically, populations of Gopher Frogs were  
86 composed of multiple, small sub-populations connected across the landscape (Semlitsch et al.  
87 1995; Palis 1998; Greenberg 2001; Richter et al. 2009). As habitats have become fragmented  
88 and otherwise altered, extirpations have occurred, preventing recolonization due to lack of  
89 connectivity and uninhabitable landscapes.

90 Through survey work for the past ten years, NCWRC staff currently recognize seven distinct  
91 populations of Gopher Frogs (Figure 1): 1) Croatan National Forest, 2) Camp Lejeune, 3) Holly  
92 Shelter Game Land (GL), 4) Military Ocean Terminal at Sunny Point (MOTSU), 5) Boiling Spring  
93 Lakes, 6) Sandhills GL, and 7) Fort Bragg. Due to landscape scale separation and fragmentation,  
94 these populations are now isolated from one another and do not function as a metapopulation.  
95 Several of these populations are supported by only 1-3 appropriate breeding wetlands, and  
96 only one population is considered somewhat secure. Egg mass data from 2016 confirmed that

107 at least 96 females deposited eggs across all surveyed breeding sites. These data suggest a  
108 total adult population of only 200-300 animals. However, data at Camp Lejeune was not  
109 complete, so the estimate for the total population is likely higher. The most robust population  
110 known in NC, obtained using drift fence data and corresponding with egg mass counts, numbers  
111 approximately 120 adults. Several populations appear to consist of fewer than 50 adults.

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



116  
117 Figure 1. Distribution of known breeding ponds of *Rana capito* in North Carolina, depicted as  
118 red dots. Currently, there are only seven populations, depicted as red circles around the dots.

119 **Historical and Ongoing Conservation Efforts**

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

120 Because many of these populations consist of few adults, NCWRC began head-starting efforts  
121 to bolster local population numbers. These efforts were piloted in 2011 at Holly Shelter GL (in a  
122 year when only seven females laid eggs), and then continued at that location from 2015-2018.  
123 Additionally, head-starting efforts were established at Sandhills GL from 2015-2018, MOTSU  
124 from 2015-2018, and Boiling Spring Lakes in 2017. Head-starting involves collecting small  
125 portions of egg masses during breeding season, raising them to metamorphosis in outdoor  
126 cattle tanks, and then releasing them back at the sites of capture. These head-starting efforts  
127 were made possible through collaborations with the North Carolina Aquarium at Fort Fisher  
128 and the North Carolina Zoo. Fort Fisher Aquarium has assisted with head-starting at Holly  
129 Shelter GL, MOTSU, and Boiling Spring Lakes, while the North Carolina Zoo has assisted with the  
130 Sandhills GL population. Attempts have also been made to head-start eggs from Fort Bragg,  
131 but no eggs have been found since these efforts began. Future head-starting efforts will  
132 continue for all of these populations, as well as the possibility of adding Croatan National  
133 Forest.

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

139 Along with head-starting and genetics analysis, significant efforts have been made towards  
140 habitat management and restoration. Specifically, NCWRC staff have worked on game lands, as  
141 well as on other public lands with external partners to fine-tune the timing and intensity of  
142 application of prescribed fire on the landscape. Summer, late growing-season, hot fires are  
143 important to maintaining the landscapes needed for this species. These fires are important for  
144 both the upland and wetland habitats. Fires later in the year mimic more closely the historical  
145 fire regime, when lightning from thunderstorms would have started large fires hundreds of

146 years ago. Fires such as these encourage the growth of herbaceous vegetation in both the  
147 uplands and the wetlands, as well as creating new stumpholes by burning them out.  
148 Additionally, prescribed fire is most effective for these sites, if conducted once breeding ponds  
149 dry down. This allows fire to carry across the entire wetland, encouraging herbaceous grasses  
150 critical for egg deposition and tadpole herbivory patterns, as well as reducing organic material  
151 build-up and subsequent lowering of pH in the ponds. Proper management for Gopher Frogs  
152 also benefits other species of conservation concern (e.g., Ornate Chorus Frog, Tiger  
153 Salamander, Mabee's Salamander, etc.). Gopher Frog breeding sites routinely support as many  
154 as 15 - 20+ other amphibian species, not to mention a host of invertebrates and rare plant  
155 species.

156 NCWRC staff and partners have also made great strides in wetland restoration and creation.  
157 Gopher Frogs prefer open canopy wetlands, which allow for greater herbaceous growth in the  
158 wetland. In sites that have experienced infrequent fires or fires outside of the late growing  
159 season, wetland canopies often develop. NCWRC staff on Sandhills GL and Holly Shelter GL, as  
160 well as DoD staff on MOTSU, and USFS staff on Croatan, have all worked towards opening the  
161 canopies of wetlands by harvesting trees, and in some cases removing heavy duff layers in  
162 unburned wetlands. NCWRC staff on Sandhills GL also created a new pond in October of 2013  
163 specifically targeting use by the Gopher Frog. As of 2018, Gopher Frogs have bred in this  
164 artificially constructed wetland in at least two separate years.

165 NCWRC staff have pursued land acquisition and conservation for lands supporting Gopher  
166 Frogs. Two tracts were acquired adjacent to the MOTSU population, and one new breeding  
167 pond was discovered on these tracts. NCWRC staff have also reached out to landowners with  
168 lands that appeared suitable for Gopher Frogs, and have gained access to several additional  
169 parcels – two of these held newly discovered breeding ponds. Survey work for new sites will  
170 continue, but few suitable areas appear to remain.

171

## 172 **THREAT ASSESSMENT**

### 173 **Reason for Listing**

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



181 original historical 23 populations, only 7 populations remain (70% reduction). Of the 53 original  
182 pond sites, only 14 are still used by Gopher Frogs (most have been destroyed or altered  
183 significantly, e.g. stocked with fish). Furthermore, lost populations are not likely to be  
184 recoverable. Remaining populations face numerous threats including severe weather,  
185 especially long periods of drought, development, and lack of proper management. Thus, in  
186 2017, the NCWRC elevated the Gopher Frog from Threatened to Endangered status.

### 187 **Present and Anticipated Threats**

188 Surveys of Cherry Point Marine Base properties in Carteret, Jones, and Craven counties during  
189 1992-1993 did not locate any Gopher Frogs in habitats where the frog should have occurred  
190 historically. Additional survey efforts in New Hanover County, where the species was once  
191 common, continue to find no Gopher Frogs. Threats to the population on and near MOTSU in  
192 Brunswick County have increased over those reported by Braswell (1993) with the additional  
193 threat of sand mining and water treatment spray fields in prime Gopher Frog breeding and  
194 terrestrial habitats. A breeding site in Scotland County was purchased by the Department of  
195 Transportation to mitigate wetlands loss, but much of the adjoining terrestrial habitats have  
196 been severely degraded. The site appears to no longer support the Gopher Frog. Coastal  
197 development continues to erode habitat. Drought and groundwater draw-down have reduced  
198 breeding and recruitment potential. Disease threats of at least three pathogens have been  
199 identified, two of which (chytrid fungus and ranavirus) have been found in North Carolina.  
200 Gopher Frog populations have yet to overcome the negative effects of human population  
201 growth and exploitation of natural resources in North Carolina.

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

213 Availability of refugia, such as stumpholes and mammal burrows, may be a limiting factor at  
214 some sites. The process of "natural" stumphole formation can take many years, as a tree's  
215 roots slowly rot away, although fires can somewhat shorten stumphole formation time. While,  
216 historically, extraction of sap from living Loblolly Pines was the initial strategy for supplying the

217 naval stores industry that rose in the 1800s, this was replaced in the mid-1900s with the easier  
218 “stumping” method, extracting spirits and rosin from the stumps of Longleaf Pines (Earley  
219 2004). Thus, much of the North Carolina landscape within the Longleaf Pine ecosystem  
220 experienced stump removal, leading to fewer stumphole refugia. This varies greatly across the  
221 various Gopher Frog populations, but appears to be one potential threat at several sites.

222 Populations of Gopher Frogs are very fragmented from one another, due to limitations on the  
223 landscape, such as development and large bodies of water, with no chance of genetic  
224 interchange between populations. A significant risk for these small isolated populations is loss  
225 of genetic diversity leading to bottlenecks and potential loss of response plasticity in the face of  
226 a complex, dynamic environment. Richter and Hinkson (2015) sought to assess the population  
227 genetics of gopher frogs in North Carolina with an emphasis on quantifying the amount of  
228 genetic variation in each wetland surveyed, and the degree of differentiation among these  
229 wetlands. Overall, genetic variation in North Carolina populations was lower, and amount of  
230 historical inbreeding ( $F_{IS}$ ) was much higher, than in populations of *R. capito* in other states,  
231 including Alabama and Florida, or in populations of a related species, *Rana sevosia*, in  
232 Mississippi. In summary, this research revealed low population genetic diversity and limited  
233 gene exchange between populations of Gopher Frogs in North Carolina. The authors  
234 recommended future additional genetics work be undertaken to assess how the NCWRC might  
235 mitigate for some of this loss through movement of individuals across the landscape using  
236 head-starting efforts.

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

242 Climate change effects have the potential to negatively impact Gopher Frog breeding success  
243 via changes to seasonal rainfall (more extreme weather events—droughts and floods), as well as  
244 extreme temperatures (NCDENR 2010). How these climatic changes may affect Gopher Frogs is  
245 unclear, but it may lead to ponds drying at times when they would normally have water, and  
246 ponds containing more water when they would normally be dry. These circumstances would  
247 likely result in poor breeding (if at all), and significant degradation of habitats (e.g. reduced  
248 ability to burn through wetlands if they remain wet during the summer and/or introduction of  
249 fish during flood events).

250

251

252 **CONSERVATION GOAL AND OBJECTIVES**

253 **Conservation Goal**

254 The conservation goal for the Gopher Frog is to prevent the extinction of this species and  
255 ensure its long-term viability as a member of the fauna of North Carolina for the next 100 years.

256 **Conservation Objectives**

257 Conservation objectives for the Gopher Frog:

- 258 1) Maintain all seven current populations of Gopher Frog and augment those, where  
259 possible, through head-starting efforts.
- 260 2) Work with partners to establish goals for each population, and determine and  
261 implement Best Management Practices for wetland and upland restoration and  
262 maintenance, including appropriate application of prescribed fire.
- 263 3) Once all current populations are thought to be sustainable and resilient (>100 breeding  
264 adults), attempt to reestablish extirpated populations using head-starting from nearby  
265 populations where possible (e.g. Carolina Beach State Park).
- 266 4) Continue to pursue land acquisition and other land conservation practices in areas  
267 where Gopher Frogs exist, or where appropriate habitat can be restored, managed, or  
268 created where new populations may be introduced or re-introduced.
- 269 5) Continue genetic analyses of Gopher Frog populations, and, where advisable, establish  
270 connectivity and gene flow between existing populations. Translocation of frogs  
271 between sites is one potential technique to manage for genetic diversity.

272

273 **CONSERVATION ACTIONS**

274 **Habitat Protection and Habitat Management**

275 In general, steps that can be taken to improve the status of the Gopher Frog include: (1)  
276 incorporate management strategies favoring this species on properties in public and, where  
277 possible, private ownership; (2) seek recovery of the Longleaf Pine ecosystem in areas that  
278 would increase the size of favorable habitat blocks for the Gopher Frog; and (3) provide better  
279 protection for the relatively small, ephemeral wetland habitats the species uses for breeding.  
280 In some areas, creation of breeding habitat might be an option available to help the species  
281 (Braswell 1995).

282 Specifically, staff within various divisions of NCWRC will coordinate regularly as to the proper  
283 timing and use of prescribed fire on NCWRC game lands properties. Artificial refugia have been  
284 constructed on Sandhills GL to mimic stumpholes, and these will be utilized at other sites as  
285 well, where stumpholes may be a limiting factor. NCWRC will continue to survey for and  
286 restore potential breeding wetlands found on game lands, as well as consider creation of new  
287 wetlands. Additionally, NCWRC staff will continue to pursue acquisition of available lands  
288 either already sustaining Gopher Frogs or containing appropriate habitats that would support  
289 the potential for their reintroduction.

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

### 293 **Population Management**

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

### 303 **Incentives (Tax break)**

304 The NCWRC will encourage private landowners with Gopher Frog habitat on their property to  
305 participate in the property tax incentive program. This program allows qualifying landowners  
306 whose property contains state listed species to get a break in property taxes for implementing  
307 conservation actions.

### 308 **Monitoring and Research**

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

314 (2) Conduct telemetry studies to determine the fate of head-started Gopher Frog metamorphs  
315 in both Sandhills GL and Holly Shelter GL populations. Telemetry will be considered at other  
316 sites. A study has begun of head-started juvenile frogs on Sandhills GL, with initial results  
317 showing very low survival. Continued studies of head-started Gopher Frogs should consider the  
318 timing and location of released frogs, along with considerations of the effects of invasive  
319 species such as fire ants, etc.

320 (3) Continue egg mass collections (2 eggs per mass) for genetic analyses to determine diversity  
321 and relationships between populations, and examine gene flow between them.

### 322 **Education and Outreach**

323 The NCWRC will continue to contribute to reports, educational materials, and other  
324 publications about the Gopher Frog, as well as distribute public information about the species  
325 and associated projects through channels such as the newsletters of North Carolina Partners in  
326 Amphibian and Reptile Conservation (NCPARC), the North Carolina Herpetological Society  
327 (NCHS), and the NCWRC. Additionally, presentations on Gopher Frog natural history,  
328 management, research, and surveys will be given to academic, professional, and public citizen  
329 groups.

### 330 **Regulations**

331 Take or possession of this species without a valid permit is currently prohibited under NC law  
332 and administrative code (15A NCAC 10I .0102) and is considered a Class 1 misdemeanor (§ 113  
333 337b). Additionally, NCWRC regulations (15A NCAC 10B .0123) prohibit import, transport,  
334 export, purchase, possession, sale, transfer, or release into public or private waters or lands of  
335 the State, any live specimen(s) of Tongueless or African Clawed Frog (*Xenopus* spp.; known  
336 carriers of the chytrid fungus *Bd*), and several genera of Asian newts (*Cynops*, *Pachytriton*,  
337 *Paramesotriton*, *Laotriton*, *Tylototriton*; all known carriers of the chytrid fungus *Bsal*).

338

## 339 **ECONOMIC IMPACTS**

### 340 **Potentially Affected Parties**

341 Although Gopher Frogs can be found on several NCWRC game lands (Holly Shelter, Sandhills,  
342 and Swain Tract), many are located on other public lands or on private lands. Partnerships with  
343 many agencies, both state and federal, as well as private landowners, will be required to  
344 maintain Gopher Frogs on the landscape in North Carolina. Agencies and/or municipalities with  
345 lands sustaining current populations of Gopher Frog include: US Forest Service (Croatan  
346 National Forest); Department of Defense (Camp Lejeune, Fort Bragg, and MOTSU); North

347 Carolina Plant Conservation Program (Boiling Spring Lakes); and the town of Southport  
348 (MOTSU). Agencies participating in head-starting efforts include: North Carolina Aquarium at  
349 Fort Fisher, North Carolina Aquarium at Pine Knoll Shores, and North Carolina Zoo. In addition,  
350 the North Carolina Division of Parks and Recreation (Carolina Beach State Park) has offered  
351 lands for collection of head-starting materials, habitat management, and potential future  
352 releases.

### 353 **Agency Costs**

354 Research, monitoring and survey costs associated with this plan could reach \$70,000 annually  
355 involving 4-6 staff. Costs related to head-starting of the Gopher Frog are relatively minimal, as  
356 these costs are primarily incurred by partner agencies. Staff time to develop a Candidate  
357 Conservation Agreement with Assurances or Safe Harbor agreement are expected to be  
358 approximately \$3,000. There is no way to estimate how many projects NCWRC staff will review  
359 where the Gopher Frog may be affected, but permit review requires approximately two hours  
360 of staff time per project and would cost an estimated \$74 per project.

### 361 **Costs to Others**

#### 362 Private

363 If private landowners are interested in providing funds for Gopher Frog habitat management,  
364 they can do so, but otherwise all costs will be covered by NCWRC, other partners, and  
365 conservation grants. All activities on private land will be completely voluntary and landowners  
366 will incur no expenses unwillingly.

#### 367 Municipalities

368 If municipalities are interested in providing funds for Gopher Frog habitat management, they  
369 can do so, but otherwise all costs will be covered by NCWRC, other partners, and conservation  
370 grants. All activities on municipal land will be completely voluntary and will not incur any  
371 expenses unwillingly.

#### 372 Other State Agencies

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

377 Any of the state agencies that have Gopher Frog populations on their property may incur costs  
378 for labor, supplies, and equipment for habitat management. This includes NC Division of Parks

379 and Recreation, NC Plant Conservation Program, and possibly NC Forest Service. Potential costs  
380 could involve costs for fee-simple purchase of properties for conservation protection.

381 The NC Aquariums at Fort Fisher and at Pine Knoll Shores, as well as the North Carolina Zoo will  
382 incur costs associated with head-starting efforts for the Gopher Frog. However, all partners  
383 participate at their discretion, and only do so willingly. This can include field survey work, egg  
384 mass collection, egg mass hatching, tadpole rearing, juvenile frog marking, and eventual  
385 releases, as well as all supplies necessary for the various stages of head-starting.

386 Personnel from several state agencies (including the NC Zoo, NC Museum of Natural Sciences,  
387 Natural Heritage Program, etc.) participate routinely in various aspects of field work at times, as  
388 well as office/lab work cataloguing specimens and/or records of Gopher Frogs. These activities  
389 present costs to these agencies, but are typical aspects of their missions.

#### 390 Federal Agencies

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

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

#### 398 NGOs

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

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

403 The NCWRC will utilize two main strategies for minimizing the economic impacts of  
404 implementing this plan. The first strategy is that the NCWRC will utilize federal grant funding to  
405 carry out many of the actions called for in this plan. These activities are eligible for funding  
406 through the State Wildlife Grants (SWG) Program. SWG will cover 65% of the costs of some of  
407 the actions called for in this plan.

408 To reduce adverse economic impacts related to potential restrictions of Endangered Species Act  
409 should the Gopher Frog get listed as Endangered or Threatened by the US Fish and Wildlife  
410 Service, the NCWRC will only introduce Gopher Frogs into new areas if listing is deemed not

411 warranted or a Candidate Conservation Agreement with Assurances or Safe Harbor can be  
412 implemented.

413 NCWRC's work to achieve the goals presented in this Conservation Plan will be reduced by the  
414 many partners interested in Gopher Frog conservation. Proactive conservation before federal  
415 listing will greatly reduce management costs as compared to the costs under Endangered  
416 Species Act protection. It benefits both public and private landowners to conserve Gopher  
417 Frogs before listing.

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