

STATUS OF THE OZARK HELLBENDER, *CRYPTOBRANCHUS BISHOPI* (URODELA: CRYPTOBRANCHIDAE), IN THE SPRING RIVER, FULTON COUNTY, ARKANSAS

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ABSTRACT

We conducted a tag and release study of the Ozark hellbender along a 26 km stretch of the Spring River from mid-July through mid-November, 1991, to determine current population levels. Salamanders were collected by hand with the aid of scuba diving equipment. Thirteen visits (36 dive hrs.) to 10 se access sites yielded 20 animals. Compared to previously published data of the early 1980's which indicated large, thriving populations of *C. bishopi* (in some cases, > 300 individuals) in the Spring River, our study found perilously low numbers of salamanders. This drastic decline may be attributed to overcollection of specimens for scientific or other purposes and habitat alteration related to recreational activities. Other contributing factors for this decline could be the inadvertent killing of animals during human activity (seining, swimming, canoeing, and fishing), the elimination of riparian habitats leading to an increase in the silt burden, and water pollution associated with human occupation and development along the river.

INTRODUCTION

The Ozark hellbender, *Cryptobranchus bishopi*, is a large, long-lived, aquatic salamander endemic to several river drainage systems in the Ozark Mountains of southern Missouri and northern Arkansas (Conant and Collins, 1991; Dundee, 1971). Prior to impoundment of the White River, the known distribution of this species (formerly *C. alleganiensis bishopi*; see Collins, 1991) in Arkansas included the North Fork of the White River in Baxter County as well as portions of the Spring and Black rivers in Fulton, Randolph, and Sharp counties (Dundee, 1971). Although Dundee (1971) indicated on his distributional map the presence of *C. bishopi* along the Arkansas-Missouri border in Arkansas, no mention is given to any specific localities other than the Spring River. At present, the only documented populations of *C. bishopi* in Arkansas are those that occur in the upper reaches of the Spring River (Dundee and Dundee, 1965; Nickerson and Mays, 1973b; Peterson, 1985). However, recent sightings suggest that the salamander may still occur in the White River and smaller tributaries feeding the Black, Current, Eleven Point, and Spring rivers of Arkansas.

Dundee and Dundee (1965) and Nickerson and Mays (1973a) provided the earliest ecological studies of the Ozark hellbender; Dundee (1971) and Nickerson and Mays (1973b) summarized the literature on the species. Significant recent investigations into the biology of *C. bishopi* include works on comparative demography with *C. alleganiensis* (Peterson, 1985), food habits (Peterson *et al.*, 1989a), fecundity and reproductive biology (Ingersoll *et al.*, 1991; Topping and Ingersoll, 1981), winter breeding (Peterson *et al.*, 1989b), nests and nest site selection (Nickerson and Tohulka, 1986), release of captive animals (Nickerson, 1980), and current management needs (Williams *et al.*, 1981).

Recent purported declines in amphibian populations worldwide have prompted an increased awareness and concern regarding population trends in native United States species (Pechmann *et al.*, 1991). Williams *et al.* (1981) reported that hellbender populations in the United States had undergone population declines throughout its range, although they also stated that large populations of *C. bishopi* were still present in the Spring

River in Arkansas. Peterson (1985) confirmed the presence of these large aggregates while performing a mark and recapture on two populations in the Spring River from 1980 to 1982; he captured and tagged 370 animals. However, in recent years, reported sightings of *C. bishopi* have decreased dramatically.

The objectives of the present study were to determine the current population level of *C. bishopi* in the Spring River, assess the habitat use, and identify factors affecting the welfare of this species in Arkansas. Recommendations concerning the status of populations derived from this preliminary study are presented herein.

MATERIALS AND METHODS

Field Technique.—A mark and recapture study began on 8 July 1991 and ended on 9 November 1991; 13 visits to 10 selected access sites along approximately 26 km of the Spring River in Fulton County, Arkansas (Fig. 1), were conducted. The source of the Spring River is Mammoth Spring which discharges 152 million gallons per hr. (Peterson, 1985) and maintains a temperature of $15 \pm 2^\circ$ for several km downstream. Scuba diving gear was donned in all but one collecting area. Salamanders were searched for by overturning rocks or by surveying open water habitats to 3.5 m in depth. Air and water temperatures as well as time of collection were recorded at each access site. Captured salamanders were permanently marked with Aoy tags following the technique of Nickerson and Mays (1973b). Salamanders were not anesthetized prior to or during the tagging and mensural procedures, but were retained in five gallon containers of cold water. The total length and the snout-vent length of each animal were measured to the nearest mm on a standard fish board; mass (to the nearest g) was taken with a spring scale. Salamanders were also closely examined for external parasites or injuries. After photographing the animals, they were released at the approximate site of collection.

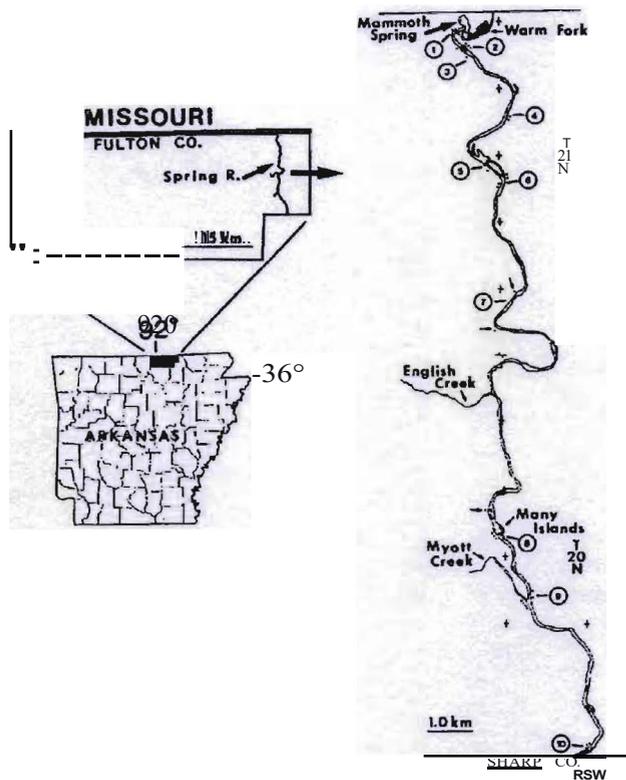


Figure 1. Map of the Spring River, Fulton County, Arkansas showing the access sites 1-10 (discussed in text). Closed circles along river denoted surveyed regions.

RESULTS

Only 20 hellbenders were observed (19 tagged) during the study which included 36 dive hrs. The following summarizes activities at the 10 Spring River access sites. Data compiled for salamanders are found in Appendix I.

Access Site 1.-The U.S. Highway 63 access point is located approximately 0.46 km downstream from the springhead of Mammoth Spring. The site was visited on four separate occasions for a total of 10 dive hrs. Diving was conducted in an area starting at the spillway below dam #1 and continuing downstream for approximately 200 m. The habitat just below dam #1 consisted of vents which extended beneath the dam on both sides of the spillway. Small-to-medium sized rocks were present in the whitewater areas. No salamanders were found at dam #1. Warm Fork enters the Spring River just upstream from the U.S. Highway 63 bridge and approximately 100 m downstream from dam #1; the bottom open-water habitat in this area was mostly devoid of large rocks. No salamanders were observed in this area. Three salamanders, however, were observed (two tagged) on the downstream side of the U.S. Highway 63 bridge. The habitat here consisted of many loose as well as piled rocks; visibility at depths over 1 m was from 1-1.5 m. Water temperature during the dives in July averaged around 18°C.

Access Site 2.-This access point is located approximately 1.4 km downstream from the springhead and is the same access point utilized by Peterson (1985; his site 2). An island divides the river into a deeper western flow and a very shallow eastern flow. Two dive hrs. were devoted to an area including the eastern flow and portions of the upper and lower western flow. Peterson (1985; his Table 8) indicated that 60 hellbenders were marked at this site. No salamanders were found at this site during the present study.

Access Site 3.-This site can be observed from access site 2 and is approximately 0.4 km downstream from the island. Two dive hrs. were spent here. The river is fairly broad and shallow here and exhibits isolated large rocks and snags. No salamanders were observed.

Access Site 4.-The Cold Springs access point is located approximately 3.6 km downstream from the springhead. The river is narrow and deep (> 3m) on either side of a bridge that crosses here. One dive hr. was spent here to investigate habitats beneath large vegetation mats in the river. No salamanders were found.

Access Site 5.-This site, hereafter referred to as Dam Site #3, is located 5.6 km downstream from the springhead. The habitat searched included the spillway area below the dam (Fig. 2), a waste-water discharge area from the Spring River State Fish Hatchery (Arkansas Game & Fish Commission) situated at the anterior end of a large island, and portions of both the western flow and eastern flow around the posterior end of the island. Four dive hrs. were spent in these habitats; in addition, four hrs. were devoted to searching for hellbenders following a drawdown of the western flow at the dam (Fig. 2). With the assistance of Mr. Richard Shopen, an employee at the hatchery, the western flow was reduced to a minimum on 9 November 1991. This would allow the exposed mid-water habitats to be easily searched and would induce hellbenders to leave their shelters from beneath a wire-supported riprap area (Fig. 28). A total of nine salamanders emerged from beneath the riprap in less than 30 min. following the drawdown; an additional two were taken from shallow rocky water several m away from the riprap. Although the spillway habitat had extensive cover, only these two salamanders were observed for the duration of the drawdown.

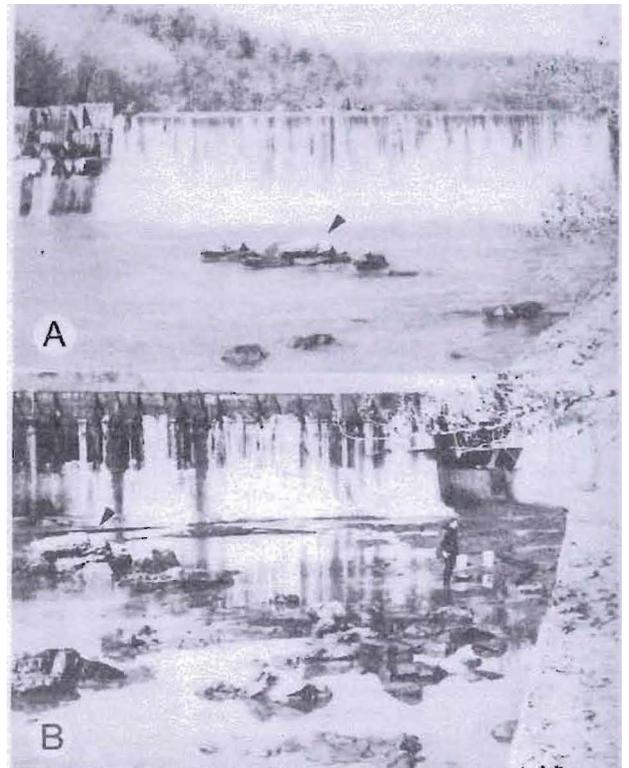


Figure 2. Dam site #3 at Spring River State Fish Hatchery. A. Access site 3 prior to drawdown; riprap wall at the right. B. Same as above drawdown; riprap wall at right. Pointer in A and B the same rock pile.

Access Site 6.-This collection site is located less than 1 km downstream from the end of the large island at Access Site 5. Peterson (1985) collected and marked 310 animals at end of this large island (site 1). From October 1985 to September 1986, Peterson *et al.*

removed an additional 62 hellbenders from both of Peterson's original Spring River sites (1 and 2). Again, Peterson *et al.* (1989b) returned to collect in the Spring River on 31 January 1987, but they provided no data on the numbers of hellbenders collected on that day. A total of 5 dive hrs. was devoted on two occasions at this site during the present study. On 5 October 1991, the first dive at this site yielded six hellbenders; five of these were released untagged. The other animal was returned to the lab for observation. Three of its feet were totally missing, and the limb stubs **appeared as open wounds** (see Pfingsten, 1990). On 12 October 1991, the animal was tagged and released at the collection site. Further diving that day resulted in only five hellbenders (the same five as above?) being tagged. The river is very swift at this site and exhibits both a rocky as well as a solid bedrock substrate. In addition, this region of the river is heavily utilized by wading fishermen. The salamanders were discovered in the open and not under rocks.

Access Site 7.-This **area**, Connally called Bayou Access by the Arkansas Game & Fish Commission, is located approximately 9.6 km downstream from the springhead. The site was visited once, but because of the heavy use by canoeists, no dives were attempted. However, two sightings of hellbenders were reported to me from riffle areas above and below this access point (see arrows on Fig. 1). One of the hellbenders was caught by a fisherman on 1 August 1991, and the other was spotted by a scuba diver in fall of 1991. Both reports are reliable ones.

Access Site 8.-The Many Islands access region of the Spring River is found approximately 18.3 km downstream from the spring headwaters. This region of the river is a common exit point for canoeists who use the Dam Site #3 as an entrance point. Downstream from this exit region are a group of small islands with many riffles and falls around them. Five dive hrs. were devoted to this downstream area with two hrs. considered as night dives. No salamanders were observed here during the present study; however, personnel of the Many Islands Canoe Rental services provided insight into the numbers of hellbenders that at one time were found in this area. One person observed large numbers of larvae at one falls (see arrow on Fig. 1) near an island, and the same person noted that sometime during the mid-1980's, commercial collectors took over 100 hellbenders in two days from the Many Islands area.

Access Site 9.-This access point, commonly referred to as the Myau Creek access, is situated 20.3 km downstream from the springhead. Maximum water depth below fall **areas** was around 3 m. Four divers spent four dive hrs. within several stretches of the river, and no hellbenders were observed.

Access Site 10.---**Camp Kier!** access, located approximately 25 km downstream from the springhead, is the last easy access to the Spring River in Fulton County. A low-water bridge crosses the river at this point. Four dive hrs. (four divers) failed to find hellbenders at this site. The habitat above the bridge lacked large numbers of rocks and was relatively shallow throughout the **area**. No searching was conducted downstream from the bridge.

DISCUSSION AND RECOMMENDATIONS

The results of the present study indicate that populations of the Ozark hellbender, *Cryptobranchus bishopi*, within the upper reaches of the Spring River in Fulton County, Arkansas, are at very low densities compared to their numbers less than a decade ago. Putative reasons for this drastic decline are the removal of specimens for scientific or other purposes and habitat alteration related to extensive recreational activities (canoeing, fishing, swimming, etc.). Other contributing factors directly associated with human activity include the accidental killing of specimens by seining, swimming, and fishing practices. A spillage of diesel fuel directly into the river just below Access Site 4 following a rain mishap (July, 1982) or a natural disaster (100 yr. flood of December, 1982) could have significantly reduced the numbers of salamanders (Richard Shopen, pers. comm.). Increasing the silt burden of the river due to the latest clearing of riparian habitats for fanning/agricultural **purposes**, industrial uses, and human occupation and development poses **an** additional major threat. Water pollution from various sources has also created eutrophic conditions along the river. As stated ever so poignantly in a regional newspaper, the Spring River is

being literally 'loved to death' (*TM Jonesboro Sun*, 26 September 1991).

Field investigations are currently underway to attempt to locate additional populations of Ozark hellbenders in northern Arkansas in order to substantiate undocumented sightings (especially in the White River and its tributaries); yet, thus far, information from White River fishing and boating enthusiasts and four dive hrs. at Calico Rock and Red's Landing access point have failed to provide any confirmation that hellbender populations exist in the river.

The Spring River populations of *C. bishopi* may soon be unable to continue to survive and thrive under the present onslaught which threatens their critical habitat. Therefore, we propose that the Ozark hellbender in **Arkansas** be immediately placed on the state/federal list of threatened or endangered species.

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LITERATURE CITED

- COLLINS, J. T. 1991. Viewpoint: a new taxonomic arrangement for some North American amphibians and reptiles. *Herpetol. Rev.* 22:42-43.
- CONANT, R., and J. T. COLLINS. 1991. A field guide to reptiles and amphibians of eastern and central North America. Houghton Mifflin Co., Boston, 450 pp.
- DUNDEE, H. A. 1971. *Cryptobranchus*, and *C. alleganiensis*. *Cat. Amer. Amph. Rept.* 101:1-101.4.
- DUNDEE, H. A., and D. S. DUNDEE. 1965. Observations on the systematics and ecology of *Cryptobranchus* from the Ozark Plateaus of Missouri and Arkansas. *Copeia* 1965:369-370.
- INGERSOL, C. A., R. F. WILKINSON, C. L. PETERSON, and R. H. INGERSOL. 1991. Histology of the reproductive organs of *Cryptobranchus alleganiensis* (Caudata: Cryptobranchidae) in Missouri. *Southwest. Nat.* 36:60-66.
- NICKERSON, M. A. 1980. Return of captive Ozark hellbenders, *Cryptobranchus alleganiensis bishopi*, to site of capture. *Copeia* 1980:536-537.
- NICKERSON, M.A., and C. E. MAYS. 1973a. A study of the Ozark hellbender *Cryptobranchus alleganiensis bishopi*. *Ecology* 54:1164-1165.
- NICKERSON, M.A., and C. E. MAYS. 1973b. The hellbenders: North American "giant salamanders." *Milwaukee Public Mus. Pub. Biol. Geol.* 1:1-106.

- NICKERSON, M.A., and M. D. TOHULKA. 1986. The nests and nest site selection by Ozark hellbenders, *Cryptobranchus alleganiensis bishopi* Grohman. Trans. Kansas Acad. Sci. 89:66-69.
- PECHMANN, J. H. K., D. E. SCOTT, R. D. SEMLITSCH, J. P. CALDWELL, L. J. VITI, and J. W. GIBBONS. 1991. Declining amphibian populations: the problem of separating human impacts from natural fluctuations. Science 253:892-895.
- PETERSON, C. L. 1985. Comparative demography of four populations of the hellbender, *Cryptobranchus alleganiensis*, in the Ozarks. Ph.D. Dissertation, Univ. Missouri, Columbia, 158 pp.
- PETERSON, C. L., J. W. REED, and R. F. WILKINSON. 1989a. Seasonal food habits of *Cryptobranchus alleganiensis* (Caudata: Cryptobranchidae). SouthwesL Nat 34:438-441.
- PETERSON, C. L., C. A. INGERSOL, and R. F. WILKINSON. 1989b. Winter breeding of *Cryptobranchus alleganiensis bishopi* in Arkansas. Copeia 1989:1031-1035.
- PFINGSTEN, R. A. 1990. The status and distribution of the hellbender, *Cryptobranchus alleganiensis*, in Ohio. Herpetol. Rev. 21:4.
- TOPPING, M. S., and C. A. INGERSOL. 1981. Fecundity in the hellbender, *Cryptobranchus alleganiensis*. Copeia 1981:873-876.
- WIWAMS, R. D., J.E. GATES, C.H. HOCUTT, and G. J. TAYLOR. 1981. The hellbender: A nongame species in need of management. Wildl. Soc. Bull. 9:94-100.

APPENDIX I
SPECIMENS EXAMINED

The following data were compiled for 19 hellbenders tagged during the present study and include in sequence [Date; Access Site; Tag #; Total Length (mm); Snout-vent Length (mm), and Mass (g)]: 8 July 1991, 1, IOI, 500, 360, 950; 13 July 1991, 1, 104, 440, 310, 650; 12 October 1991: 6,105,460,320,600; 6,108,440,270,400; 6, 111,510, 330, 800, 6, 112, 515, 350, 1150; 6, 113, 540, 375, 1725; 6, 114, 525, 400, 2001; 9 November 1991: 5, 115,565, 360, 1375; 5, 116, 580, 350, 900; 5, 117, (no additional data); 5, 118, 510, 360, 1125; 5, 119, 620, 400, 1350; 5, 120, 480, 350, 1125; 5, 125, 455, 310, 675; 5, 126, 460, 310, 700; 5, 127,430,280, 725; 5, 128,430,295,650; 5, 129,470,310, 750; 5,130,460,300,750.