

Status Survey for the Greensboro Burrowing Crayfish

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Abstract: A survey in North Carolina was undertaken to determine the distribution and relative abundance of the Greensboro burrowing crayfish (*Cambarus caitagius*). Public input was solicited for search locations and a methodology was devised to capture the species. The species was collected at 16 locations in North Carolina from Greensboro to Lexington and southeast to the Uwharrie National Forest. Many other observational data on the species, its habitat, and its relative abundance were also collected.

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The Greensboro burrowing crayfish was known in the literature as existing in only one area, the lawns and yards of the properties on East Whittington Street in Greensboro, North Carolina (Adams 1992). The species was described in 1967, and additional specimens were collected from the Greensboro site in March 1992 (R. Thomas, pers. commun.). The only historical information on the habitat of the species was that they were collected from sandy-clay soils where the water table depth was between 5 and 60 cm (Hobbs and Perkins 1967). The U.S. National Museum collection consisted of 8 lots of the species.

The Greensboro burrowing crayfish is a small, dark brown crayfish approximately 5 to 7.5 cm long. It can sometimes be slightly greenish with tan flecks scattered about the dorsum. The lateral margins of the rostrum are straight and convergent, with a distinct acumen. There are no spines on the carapace, and the areola is long and narrow. The chelae are triangular, have 2 rows of tubercles along the inner margin of the palm, and the tips of the dactyls are orange. The first pleopod of first form males has a central projection that is angled greater than 90° and slightly curved, and the mesial projection is bulbous, tapering to a point. A detailed description can be found in Hobbs and Perkins (1967).

There is little information available on the life history of this species, other than it is a primary burrower (Hobbs 1989). Primary burrowers, according to Hobbs (1989), are crayfish that are largely restricted to burrows. Although there

is some information about the life histories of several non-burrowing species of crayfish (Smart 1962, Boyd and Page 1978), and some secondary burrowers (Smart 1962), there is little published information on the life history of primary burrowers.

Burrowing crayfish generally construct complex burrows that vary in diameter and depth. The depth of the burrow system is usually dependent upon water table depth. In many cases the burrow systems are found in areas where water tends to collect, such as depressions, drainages, and ditches. However, Schuster (1976) recorded them from non-drainage areas where the water table was 1.5 m below the surface. They have been found in soils that range from sands to hard packed clays (Hobbs 1981). Some species of burrowing crayfish construct chimneys, or piles of burrow materials that can be 15 to 29 cm high around the opening of the burrow. Other species pile burrow materials without building a structure. It is not possible to distinguish the species of crayfish based upon the presence, absence, or style of chimney that is constructed (Hobbs 1981).

Typically, primary burrowers construct complex burrow systems and they usually do not have connections to a surface water source like secondary or tertiary burrowers sometimes do (Hobbs 1981). Primary burrowers are usually found as individuals in separate burrow systems with the exception of females who share their burrow with their young after hatching.

Crayfish consume all types of plant and animal tissues including decaying plants and animals, various periphyton, vascular plants, and many macrobenthic organisms. Some species tend to consume more of one type of food than others. *Cambarus bartonii bartonii* reportedly preferred animal foods whereas *Cambarus diogenes* consumed large quantities of dead leaves (Chidester 1912). Aquatic insects comprised the largest portion of stomach contents for *Orconectes kentuckiensis* (Boyd and Page 1978), while Prins (1968 in Boyd and Page) reported that all parts of terrestrial plants were consumed by *Orconectes rusticus*. There is no information available on the specific food habits or preferences of the Greensboro burrowing crayfish.

There is virtually no information on the historical population trends and habitat of the Greensboro burrowing crayfish. The species was known from only one location within the city limits of Greensboro, North Carolina. It was considered a threatened species by Cooper and Cooper (1977) because its known range was restricted and impacted by urban development. The only known habitats of the species were areas that had been altered by human development.

This project would not have been possible without the generous assistance of Dr. Horton H. Hobbs, Jr., of the U.S. National Museum of Natural History, Dr. Richard Thomas of the Piedmont Environmental Center, Taft Wirebach of the Greensboro News and Record, Ken Taylor of the North Carolina Wildlife Resources Commission, and the many citizens who took the time and effort to respond and allow digging of crayfish specimens on their property. Many thanks are expressed to all.

Methods

The development of a survey methodology for this species was an evolutionary process. Several types of traps were devised to capture the crayfish as they emerged from their burrows. For example, PVC pipes were fitted with doors that would close when crayfish entered the tube. Another type of trap used a bucket with a hole and trap door in the bottom. Both types of traps were tested in an area where crayfish burrows were abundant; however, neither type of trap caught any crayfish.

Based upon these tests and others, I concluded that the best way to capture specimens was to dig them up. An article was published in the Greensboro News and Record (March 1993) that solicited public input on the locations of crayfish burrow concentrations. Over 200 responses were received from citizens who indicated that they had burrowing crayfish on their properties or were familiar with locations that had them. Approximately 180 of the responses were within the upper Piedmont of North Carolina. A subset of those locations was selected for examination. The subset was selected by taking into account many factors including location relative to other sites, accessibility (time, permission to dig), and site characteristics (number and location of burrows, physical parameters). The subset was composed of sites spread across a 7-county region in North Carolina from Rockingham County to Davidson County and eastward to Chatham County.

Each site was visited between April and June 1993. The data recorded at each site included the date, location, approximate number and location of the burrows, proximity to streams, structures, and other habitat features, and general soil description.

The excavation process began by selecting a burrow which appeared active due to the presence of fresh mud at its entrance. A hole about 0.7 m in diameter and in contact with the crayfish burrow was dug down to the groundwater level. When water was reached, the digger waited. Usually within a few minutes, the antennae of a crayfish appeared in the water and the digger quickly and carefully grabbed the specimen.

The goal of collecting at each site was to collect at least a single form I (reproductively active) male crayfish to identify the species. It was possible to identify both form II males and females of Greensboro burrowing crayfish with some experience.

In spring 1993, crayfish were collected from many streams in Chatham, Randolph, Montgomery, Guilford, and Orange counties, North Carolina, to determine if the species might occur in lotic habitats of the region as some burrowing species do (Hobbs 1981). Hand collecting was done at bridge crossings of streams and included recording location, time spent, and habitat available.

During the course of this survey, I discovered that burrowing crayfish could be captured in pitfall traps. Pitfall traps utilizing 3.8-l cans were placed in drainage areas at 3 locations. The number of cans at a site varied from 3 to 21.

Results and Discussion

Field Surveys

Crayfish were collected from 50 locations in the northern Piedmont of North Carolina. Six species of crayfish were found (Table 1). Representative specimens of each species were verified by Dr. H. H. Hobbs, Jr., U.S. National Museum of Natural History. Three species were stream dwellers, 1 was the Greensboro burrowing crayfish, 1 was *Cambarus reduncus* which occupies both streams and burrows, and 1 was an undescribed species.

The Greensboro burrowing crayfish was collected at 16 locations in Guilford, Randolph, Montgomery, and Davidson counties (Fig. 1). Five of the locations were in the Pee Dee River drainage, and 11 were in the Cape Fear River drainage. At 2 locations, both the Greensboro burrowing crayfish and *Cambarus reduncus* were collected in similar habitats. Unlike *C. reduncus*, however, the Greensboro burrowing crayfish was never found in streams. Greensboro burrowing crayfish are relatively common in this region of North Carolina and there are undoubtedly more locations that support them.

Habitat Requirements

Characterizing the habitat of this species is difficult because there are no clear indications of particular requirements based upon the 16 locations where the species was found. If the type locality, which almost certainly supports a population, is included, then 15 out of the 17 locations were backyards. Some of them were urban, most of them were suburban, and some were rural. They were usually grassed areas which had been cleared at some point in the past. In a few of the suburban areas the yards graded into woods and burrows could be found continuing into the woods. The other locations where the species was found included a bottomland forest along McClean's Creek in Montgomery County and in a field planted to wildlife crops on the Uwharrie National Forest in Montgomery County.

The soils in which the Greensboro burrowing crayfish were collected ranged from sandy and sand-clay mixtures to those composed mostly of clay. Wet clays were common at most of the sites, and were the primary component of the

Table 1. Crayfish species collected during the Greensboro burrowing crayfish survey.

Species	N Lots	N Locations
<i>Cambarus acuminatus</i>	17	14
<i>Cambarus bartonii</i>	6	6
<i>Cambarus catagius</i>	17	16
<i>Cambarus reduncus</i>	22	20
<i>Cambarus</i> sp.	2	2
<i>Procambarus acutus acutus</i>	4	4

mately 1.2 m before ground water was reached. At 2 locations the burrows were located under or adjacent to a property owners' deck.

Threats to the Continued Survival of the Species

Since the majority of the locations in which the species was found were areas that had been developed to some degree, it is difficult to conclude whether development poses a threat to the species. If much of the area is converted to impervious surfaces, then there could be a threat to the specie's continued existence. However, there may be many areas such as parks and utility corridors within an urbanized setting that could still support populations.

Population Status

Because there is no accurate census methodology, it is difficult to determine the population status of this species. Given the types of habitats that support the species, the numerous locations in which the species was found, the abundance of burrowing activity at those locations, and the potential for the species to be present in uninvestigated sites, the species may be doing well.

The potential for future research on this species is great. Possibilities include determining detailed life history and habitat requirements and continuing to determine locations in which the species exists. There are many more potential sites within and outside the current known range which could support populations of this species. Given what is currently known about the species, I assume that the species is in no danger of becoming extinct in the near future.

Life History

The life history of the Greensboro burrowing crayfish is still not completely known although the field work did provide some bits of information. First form males were collected in April and June. Including the lots curated at the Smithsonian, first form males have now been collected in February, April, and June. However, that does not mean that they could not be found in that form during any other months.

Males and females have separate burrows that do not differ in design or detail. In all cases except 4, only 1 crayfish was found in a particular burrow. The exceptions were those in which females were sharing their burrows with newly hatched crayfish, which was observed in April and June. This suggests that egg-laying occurs in the spring for this species.

There were no patterns to the burrows except that at no sites was there every a chimney around the burrow entrance. This species does not construct such a structure, it merely piles the burrow spoils near the entrance. The burrows showed a wide range of variability in design. Some were simple and straight down, others had subsurface chambers and lateral tunnels.

At most of the lotic sites, more than 1 species of crayfish was collected. At sites with burrowing crayfish, usually only 1 species was found. However, there were 2 sites at which more than 1 species of burrowing crayfish were found. In

both cases, the species were the Greensboro burrowing crayfish and *Cambarus reduncus*. Since all of the burrows were not dug up at each site, it is possible that there were more locations with multiple species present. There were no external characteristics of the burrows that indicated multiple species at any of the locations sampled.

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