Distocambarus youngineri: White Paper

Prepared for

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by

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December 1, 2006

Introduction

Thirteen crayfish genera occur in the United States, six genera are either monotypic or are small in terms of taxonomic diversity (Taylor 2002). *Distocambarus*, one of these six genera, is composed of five primary burrowing species in two subgenera, *Distocambarus* and *Fitzcambarus* (Hobbs 1983). Four of the species, *D. carlsoni, D. crockeri, D. hunteri* and *D. youngineri* are endemic to South Carolina (Hobbs 1983, Hobbs and Carlson 1983, 1985, Fitzpatrick and Eversole 1997). *Distocambarus (Fitzcambarus) youngineri* originally described by Hobbs and Carlson (1985) does not have synonyms in the literature. Although the common name, Saluda crayfish appears in some literature, Newberry crayfish was proposed for *D. youngineri* by Taylor et al. (200x) because of its distribution is restricted to a few localities in Newberry County (Fig. 1).

Members of *Distocambarus* can be distinguished from other genera in South Carolina by the presence of two terminal elements on the first pleopod of form I male and a caudomesial boss on the fourth pereiopod. Specifically, the mesial margin of chela palm with a row of tubercles < 7 is shorter than palm width and cheliped carpus length, aerola length > 15 times the width, cervical spines are absent and the central projection of first pleopod broad but not bladelike in form I male *D. youngineri*. Hobbs and Carlson (1985) detailed description of *D. youngineri* is in attachment A. Eversole and Jones (2004) provide the only taxonomic key for the South Carolina crayfish species. Hard copy can be requested or downloaded at www.fs.fed.us/r8/fms/forest/publications/Crayfish.pdf

Status

All members of *Distocambarus* have restricted distributions and in addition, *D. youngineri* appear to have disjunct populations which would be sensitive to perturbations. For example, Eversole (1995b) failed to find *D. youngineri* at the type locality following a clear cut in the area. For these reasons the recommended conservation status for *D. youngineri* was endangered by Taylor et al. (1996, 200x), critically imperiled globally by NatureServe (2004), vulnerable by IUCN (2006) and critically imperiled state wide (SC DNR 2005). The species was not listed for protection under the U. S. Endangered Species Act of 1978.

Distribution

Surveys found *D. youngineri* in 14 localities, all within Newberry County, South Carolina (Attachment B). Hobbs and Carlson (1985) collected *D. youngineri* at two localities, the type locality and a site just 14.4 air km from the type locality. Four new localities were found by Eversole (1989, 1990, 1995a); three of the four new records for the species were within 0.8-km radius of one of Hobbs and Carlson's (1985) sites. The fourth collection site was approximately 16 air km from the type locality. In a follow-up three county survey, Eversole

(1995b) added four more sites records to the distribution. Three of these sites were within 0.5 km of each other and 1 km of Hobbs and Carlson's (1985) record. The fourth site was 5.5 air km east of the type locality. Unfortunately 7 of the 10 *D. youngineri* sites were clustered around the town of Silverstreet in southeastern Newberry County. Eversole (1989, 1990, 1995b) surveyed historical *D. youngineri* sites before expanding the survey to include "similar habitats" in the Saluda River drainage (hydrounit 03050109) and adjacent drainage systems. The protocol used in these survey protocols failed to significantly increase the range of *D. youngineri*.

Welch and Eversole (2002) because of the conservation concerns for *D. youngineri* and the destructive nature of burrow excavations; *D. crockeri* distribution in the Sumter National Forest was used to model the *D. youngineri* distribution in Newberry County. Distribution data for 107 of *D. crockeri* sample sites and GIS soil data, coded areas as perched and apparent water tables or without a water table (areas with water tables > 2m), were used to examine the relationship between water table categories and the probability of *D. crockeri* presence. Logistic regression analysis indicated a significant positive relationship between perched water tables and a negative relationship with apparent water tables and *D. crockeri* presence. No relationship was detected between areas without a water table and *D. crockeri* presence. Assuming the habitat preference was similar for the two species, the investigators tested the model at 13 perched-water sites. *Distocamnbarus youngineri* was absent at five sites outside the known species range and four sites with perched water tables were not surveyed because of private property restrictions. However, new populations of *D. youngineri* were found at three of the four remaining perched-water sites. One of the new sites, the power line site (Attachment B), was on the periphery of the Enoree River drainage (03050108). Although the survey did not test the model prediction of both presence and absence at sites, the model did indicate *D. youngineri* preference for soils with perched water tables. A good first step in future *D. youngineri* surveys would include soil and water tables characteristics as part of the sample protocol.

Habitat

Distocambarus youngineri were found, in most cases, in poorly drained areas where the ground was saturated during the wet raining part of the year (Nov – Mar). These sites were not associated with floodplains or streams and only the type locality had standing water, a small (4 x 15m) adjacent un-named woodland pool (Hobbs and Carlson 1985). Sampling of the woodland pool at the type locality on several occasions failed to yield crayfish (Hobbs and Carlson 1985, Eversole 1989, 1990, 1995b). Some of the *D. youngineri* localities were in low moist areas near the headwaters of streams (colluvial valleys) while others were not, e.g., one site was low sloping lawn in Silverstreet and the other site, a machine maintained power line (Eversole 1995b, Welch and Eversole 2002). Water was encountered in burrows during excavations and the depth varied with the seasonal hydroperiod. It is not clear if *D. youngineri* experience long periods without burrow water, similar to that observed with *D. crockeri* (Welch and Eversole 2006), or store burrow water during dry periods.

Several soil types were identified at *D. youngineri* localities including Chewacla, Worsham, Toccoa-Cartecay, Enon, and Sedgefield (Eversole 1995b). Perched water table model of *D. crockeri* presence developed by Welch and Eversole (2002) was successful in locating *D. youngineri* sites within the species range. Characteristically these soils and water-table type hold moisture and had a soil horizon which restricts water drainage. The water barrier horizon was relatively close to the surface and therefore, water was encountered in burrows shortly after starting excavation during the wet season. Since free water is necessary for crayfish reproduction, soil conditions that retain water should be considered an essential habitat characteristic for *D. youngineri*.

Detailed vegetation analysis has not been done across the *D. youngineri* habitats. The type locality was wooded area of pine, oak and gum species (Hobbs and Carlson 1985). The dominant trees in five *D. youngineri* localities were willow and water oaks in mixed pine-hardwood over story and sweet gum, American elm and red maple in the mid-story forest (Eversole 1995b). The understory included vine species (e.g., honeysuckle, poison ivy, wild grape and *Similax*), privet and blackberry in natural sites and grasses in the maintained site (Eversole 1995b). *Distocambarus youngineri* was not observed in pure pine stands or pine-needle covered forest floors (Eversole 1995b). The soil surface was covered with a noticeable layer of decaying vegetation and leaf litter (Eversole 1989, 1990).

Biology

Hobbs (1981) defined three burrowing crayfish categories: primary, secondary and tertiary burrowers. Primary burrowing crayfish such as *D. youngineri* spend almost their entire life in and around burrows. Burrows connected the surface at several locations; and one or more of these openings were sealed with a capped turret. A series of galleries beneath the surface connected the openings, and one or two subvertical tunnels extended as much as one meter below the surface ending in an enlarged chamber. Burrows were in sandy-clay (70%: 30%) soil containing roots in the wooded areas. Hobbs and Carlson (1985) reported that these tunnels penetrate the water table and Eversole (1989, 1990, 1995b) encountered free water in those burrows *D. youngineri* were collected. In the dry season free water may not be present in burrows at perched water table sites if *D. youngineri* burrowing behavior is similar to that of *D. crockeri* (see Welch and Eversole 2002). *Distocambarus youngineri* were routinely collected in burrows with water so it may not be as much of a terrestrial habitat specialist as *D. crockeri* where 80% of the burrows (n = 55) excavated from July to November that contained live crayfish were dry (Eversole 1989, 1990, 1995b, Welch and Eversole 2002, 2006).

Frequently more than one crayfish are encountered in burrow excavations. Hobbs and Carlson (1985) observed a form I male and female together in a burrow, a female with attached early instars and a female with several juvenile individuals in the same burrow. It is not clear how long juveniles remain in the parent's burrow, but large older juveniles have been collected from burrows with an adult female (Hobbs and Carlson 1985). Juveniles appear to construct simple burrows emanating from the female burrow. Constructions of these side burrows may serves as a juvenile dispersal mechanism for *D. youngineri* because considerable danger and difficulty is associated with surface travel and burrow construction, especially during dry periods. *Distocambrus crockeri* cannibalized their young less than tested other aquatic crayfish species (Welch unpublished data); partially explaining the lack of urgency to leave the parent's burrow.

No other crayfish species were found in burrows with *D. youngineri*; however, other primary burrowing crayfish (e.g., *Cambarus reflexus*) were excavated from nearby burrows. Detail records of burrow associates and commensals are lacking.

Very little is known about the population biology of *D. youngineri*. A summary of collection records revealed that juveniles comprised a major of the collected specimens, and that first form males and females with attached young were collected were collected in February and March. Females bearing sperm plugs were observed in February, but no ovigerous females were collected

(Hobbs and Carlson 1985). Although there was no clutch size data, one female had 14 young were attached. These data, albeit limited, indicate that *D. youngineri* reproduction occurred in late winter/early spring, the wetter part of the year, similar to that observed for *D. crockeri* reproductive period (Welch and Eversole, unpublished data). If other life history traits for these two species are similar, then *D. youngineri* would have the classic K-selected species traits of slow growth, late maturity, low fecundity, and longevity observed for *D. crockeri* (Welch and Eversole, unpublished data).

Future Directions

We realized, after several surveys and studies, that our initial survey protocols were flawed and that these crayfish primary burrowers were more terrestrial than originally thought. The progression of sampling techniques used to develop a landscape model for *D. crockeri* presence illustrated the problems associated with an aquatic sampling bias in primary burrowing crayfish surveys (Welch and Eversole 2006). If we limited our sampling to aquatic and semi-aquatic habitats then *D. crockeri* distribution would have been poorly understood and rare. For this reason future surveys should include terrestrial GIS variables (e.g., perched water table) to widen the scope of the sampling protocol. It would be also important to expand the survey beyond the known range of *D. youngineri*, because this part of South Carolina is the center of *Distocambarus* diversity. A new species, *D. hunteri*, was discovered in the Saluda River basin

(03050109) near Lake Murray in an early survey (Fitzpatrick and Eversole 1997). Unfortunately, the current collection data indicate *D. hunteri* occurs in only a few localities and is in danger of extirpation. Finally, a terrestrial paradigm (i.e., how these organisms interact with terrestrial environment) needs to be addressed with *Distocambarus* and primary burrowing crayfish as a group in future research.

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Attachment A

Distocambarus youngineri description from Hobbs and Carlson (1985)

Distocambarus youngineri has pigmented body and eyes. Eyes are small but well developed. Rostrum without marginal spines, tubercles and median carina. Carapace with one to several small cervical spines. Aerola 13 -24 times as long as broad and constituting 37.6 – 41.9% of the entire carapace length and 41.9 – 46.6% of postorbital length. Ventral surface of ischium of the third maxilliped only partly obscured by plumrose setae. First three pairs without conspicuous ventral brush of setae extending from basis to merus, although second pereiopod with distoventral half of merus and margins of more distal podomeres with fringe of long setae. First pleopods of first form male with small but distinct cephalic shoulder at base of conspicuous, corneous, subquadrangular, platelike caudodistally and somewhat mesially directed central projection; cephalic process vestigial at best, not clearly defined; mesial process broad basally, tapering distally in long pointed element directed caudodistally and slightly laterally. Mesial ramus of uropod with distomedian spine very small but almost or quite reaching margin of ramus. Female with anterior part of annulus ventralis membranous across which hinge-like motion accomplished; postannular sclerite not half so long as annulus; first pleopods rudimentary, in from of small tuberculiform prominences.

Attachment B

Site localities of *D. youngineri* collections (CR = county road and SC = state road) by source. GPS readings were not available for the earlier collections (E = easting and N = northing).

Hobbs and Carlson (1985)

Type locality: An area adjacent to a woodland pool along the west side of CR 22 approx. 0.1 km southwest of CR 58.

Senn Tucking Co.: A moist site on the west side of SC 121 about 0.5 km north of SC 34 and SC 121 junction.

Eversole (1989, 1990)

Senn Tucking, Co.-West: A moist wooded site on the west side of SC 121 adjacent to an auxiliary parking lot about 0.5 km north of SC 34 and SC 121 junction.

Senn Trucking Co.-East: A moist wooded site on the west side of SC 121 about 0.7 km north of SC 34 and SC 121 junction.

Road side: A moist site on the west side of SC 121 about 0.2 km south of the junction of SC 34 and 121.

George’s Loop: A moist, wooded area near the headwaters of a stream off a dirt road about 0.3 km south of CR 83 and 1.6 km southwest of SC 395.

Eversole (1995b)

Bush River Road: A wooded area on the west side of CR 64 across from Bush River Church about 0.1 km south of the intersection with CR 56.

Private residence: An open site on the north side of Church Street across the street from church property and the graveyard in Silverstreet.

Road side: A moist wooded area on the south side of SC 34 about 0.2 km northwest of junction with SC 121.

Road side: A moist wooded area on the south side of CR 83 about 0.2 km northwest of junction with SC 121.

Road side: A moist wooded area on the south side of CR 83 about 0.3 km northwest of Beaverdam Creek.

Welch and Eversole (2002)

Road side: A moist area 434,992.88E 3,792,300.81N

Road side: A moist area 439,256.95E 3,800,489.13N

Power line: An open are 429,994.39E 3,795,315.25N

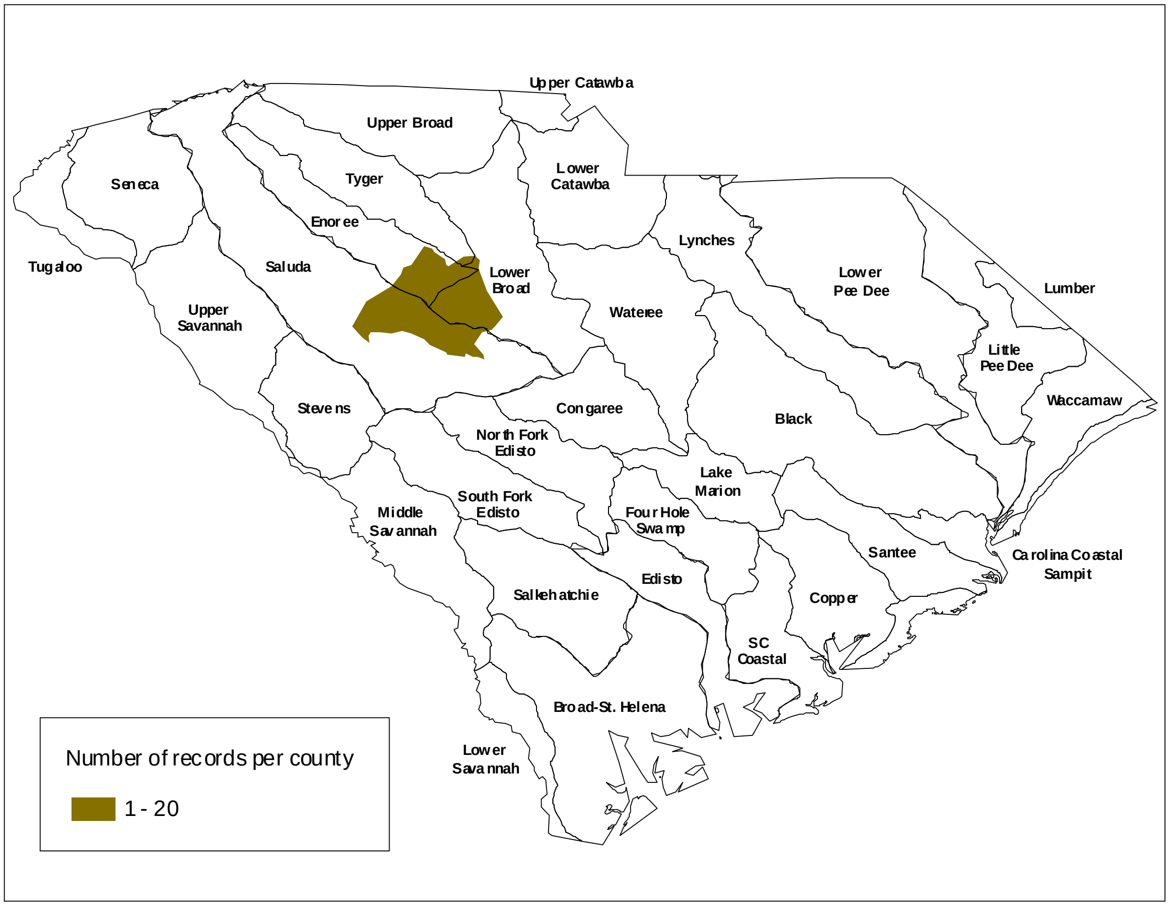

Figure 1. Collection records for *Distocambarus youngineri* in Newberry County, South Carolina.