CRAYFISH IDENTIFICATION WITH DICHOTOMOUS KEYS

As the name implies, a dichotomous key includes a series of paired choices called couplets. Each couplet contains alternative identification characteristics that allow you to advance step by step through the key, until you reach an endpoint (species). Once you reach your endpoint, read through the associated species account, and review the range map to make sure it fits what you found. If after reviewing the account and the map, you think you reached the species in error, go back to the key, and think about where you had to make a difficult decision on which way to proceed in the key. Then, try the opposite choice to see if it leads you to a better answer.

When starting out, using dichotomous keys can be frustrating. Sometimes the characteristics presented in the key are straightforward, while other times the differences are extremely subtle. Seldom will every characteristic presented in a couplet match your specimen exactly. Be patient, choose the "best" answer, and as mentioned above, be ready to try alternative routes within the key. Keep in mind also that the photo included within a given species account represents a single, clean individual. There will often be variability in color and size depending on the sex and age class of the individual you are attempting to identify. You will see a good example of this when you are using one of the keys where *Cambarus latimanus* is present. The common name of this species is Variable Crayfish, and the name is fitting. This species is so variable that in some keys it appears in two places. When that happens, you will see the phrase "in part" at the end of the couplet; "in part" simply means the species occurs in more than one place in the key. As a general rule (if possible), use the largest male individual of any species that you encounter for identification purposes. The last statement stems from the fact that historically almost all crayfish classification was based on adult males. Thus, the keys presented on this website focus on males, but in some cases female characteristics are used as well. In many instances, smaller individuals will be difficult to impossible to identify. Go ahead and give them a try though as some species are rather small as adults.

Everything said thus far assumes that you have a crayfish specimen in hand. Now that virtually everyone has a camera at the ready at all times, the use of photographs can be a good option when trying to make an identification. If this is the case, you must get good close-up photos of various parts of the crayfish to enhance your chances of making a positive identification (e.g. Fig. 1). At a minimum you need a close-up of the back, side, and claw of the specimen. More photos are better than fewer.

Figure 1. Examples of photos needed when attempting to identify crayfish. A shot of the entire animal from above and directly below would also be helpful.

Keep in mind that we continue to gain new knowledge of crayfish distributions in Georgia and you may find that your crayfish does not have a record within the drainage area where you observed/captured it. If you document a potentially new distributional record of a crayfish, please email photographs of the specimen and its habitat along with a detailed locality description to gabiodata@dnr.ga.gov.

On the pages that follow, you will find a series of photographs and illustrations along with text that depict and explain basic anatomy and some of the more important characteristics used for identifying crayfishes. These features are the same ones that will be referred to in the dichotomous keys. Good luck with your identification!

General Anatomy

Crayfish are composed of two main parts; the front half is the cephalothorax and the rear half is the abdomen (Fig. 2). The hard, outer covering of the cephalothorax is called the carapace. The walking legs (also called pereiopods) are attached to the cephalothorax and smaller feathery appendages called pleopods (swimmerets) are attached to the underside of the first five segments of the abdomen. In males, the first two pleopods are modified for sexual reproduction with the first pleopod (gonopod) being the sperm transfer organ. At a glance, these pleopods resemble small legs (Figs. 3, 4). All the pleopods look similar on females, which have a sperm receptacle called the annulus ventralis between their fourth and fifth walking legs (Fig. 5).

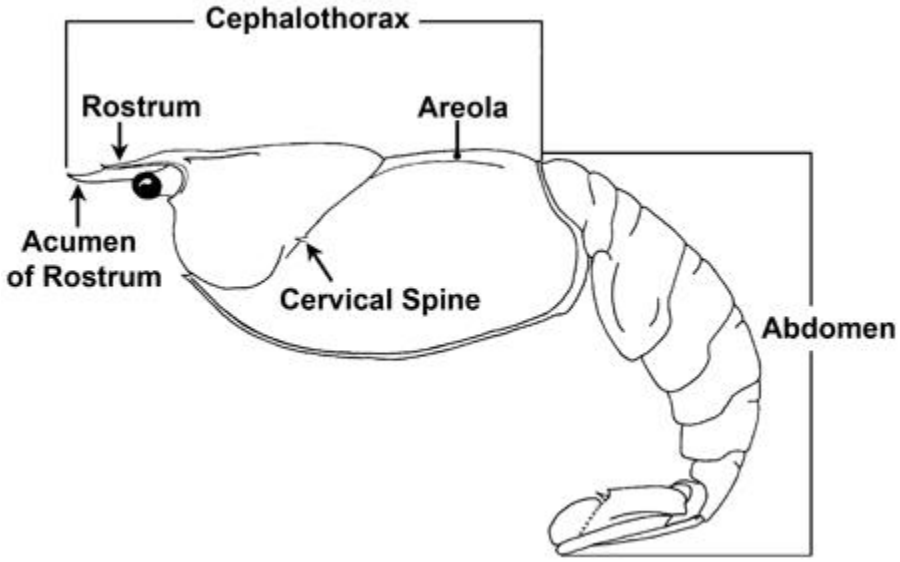

Figure 2. Lateral view of crayfish. Modified from Hobbs (1981) and Eversole and Jones (2004).

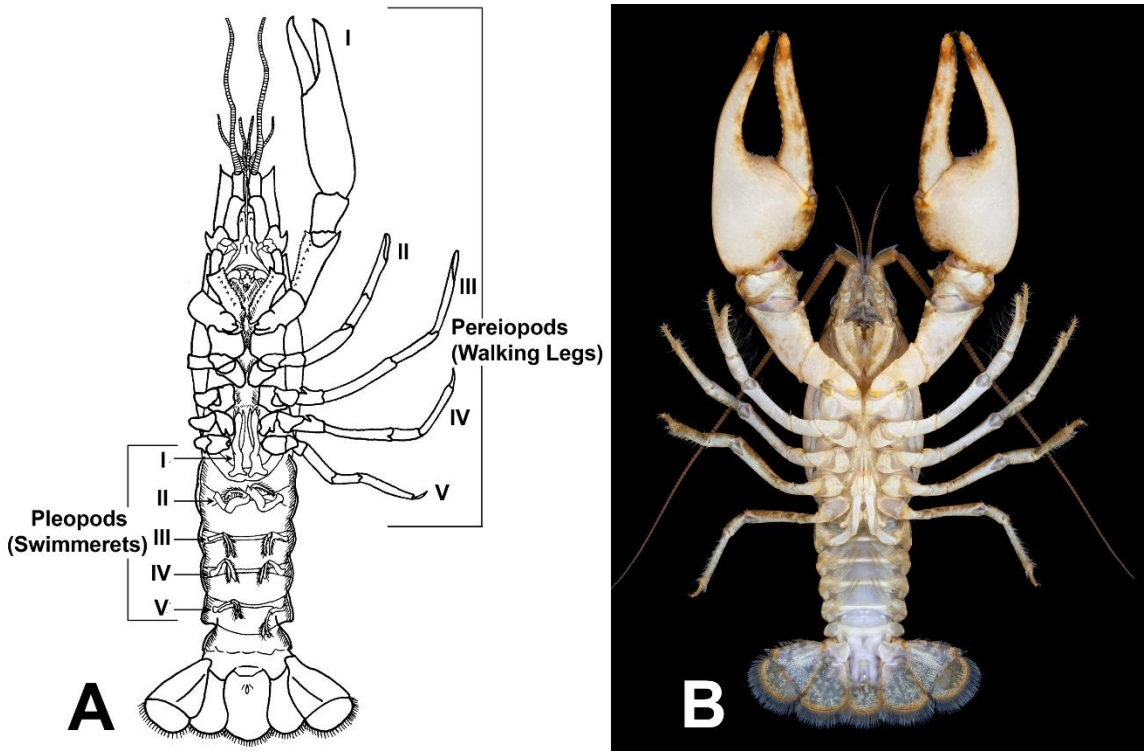

Figure 3. Ventral view of male crayfish. A) modified from Hobbs (1981); B) Photo by Carl Williams. Photo may be subject to copyright.

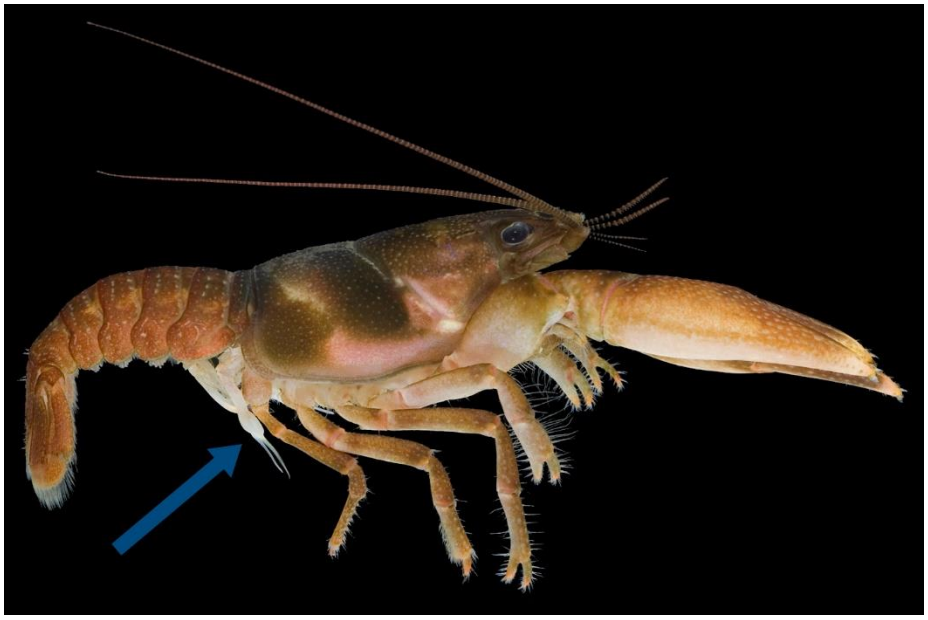

Figure 4. Lateral view of Form I male *Faxonius* showing the male reproductive structure (gonopod=pleopod I from Fig 2.). Photo by Carl Williams. Photo may be subject to copyright.

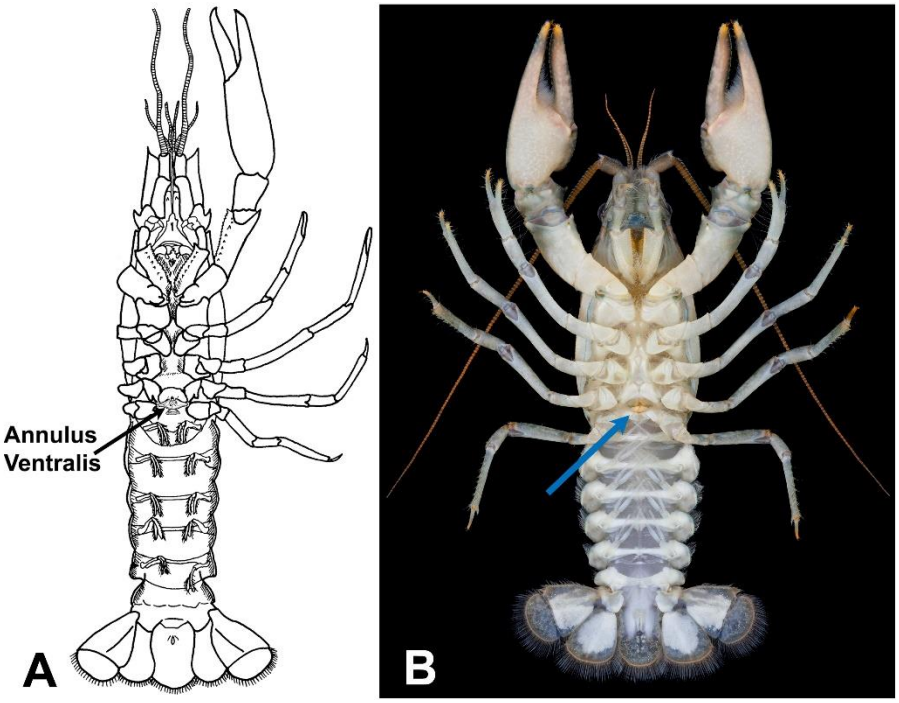

Figure 5. Ventral view of female crayfish. A) modified from Hobbs (1981); B) Photo by Carl Williams. Photo may be subject to copyright.

Claws

The most obvious feature of the crayfish has got to be the claws (Fig. 6). You may see the word chela (plural chelae) written for claw, and some people call them pincers. The claws are really just another pair of legs that have a moveable segment at the end (dactyl) which allows the animal to grab things. When you look closely at the other crayfish legs, you will notice that the second and third pairs of legs have small claws at the end as well. The claws can be an important feature for species identification. As you gain experience, you will often be able to put your crayfish into the genus level based on the claws, which will greatly speed the identification process. Important features of the claw are the length of the moveable finger (dactyl) relative to the length of the mesial margin of the palm and the number of rows of tubercles along the mesial margin of the palm. Claw coloration can also be a useful characteristic in live individuals. Although the claws can help with identification, they can also be very confusing. Crayfish frequently lose appendages during their life, but like many invertebrates, they can re-grow a claw or another leg. The claw they re-grow (called regenerated) can look quite different from the original claw (Fig. 7). You will know for sure if you have at least one regenerated claw if one is much larger than the other. It becomes a problem when both were lost at the same time and then regenerated; they will look identical to one another but may have odd proportions or a different number of tubercles relative to a normal claw. Another possibility is that one may have been lost early in the life of the crayfish and is virtually the same size as the original claw. Again, the regenerated claw will likely have a shorter palm and the wrong marginal tubercle count relative to the normal claw. These last two situations can be tough to ascertain, which emphasizes the importance of basing final identifications on multiple characteristics.

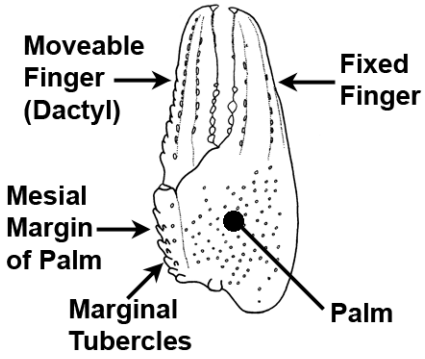

Figure 6. Dorsal view of crayfish claw. Modified from Eversole and Jones (2004) and Prins and Hobbs (1972).

Figure 7. Dorsal view of Etowah Crayfish (*Cambarus fasciatus*) indicating one normal (left) and one regenerated claw (right).

Areola

Another useful feature for identification is the areola (Fig. 8A). The word areola means "space" and this refers to the space on the dorsal surface of the crayfish carapace (outer shell) that is bounded by shallow (usually curved) grooves oriented longwise on the body. It often has an hourglass-shaped appearance. These grooves mark the dorsal boundary of the branchial chambers which house the gills. The width and length of the areola are usually very similar among individuals of a species (and often different between species) and can help quickly narrow the field of suspects. The areolae of some species are said to be obliterated because there is no open space between the grooves (Fig. 8B).

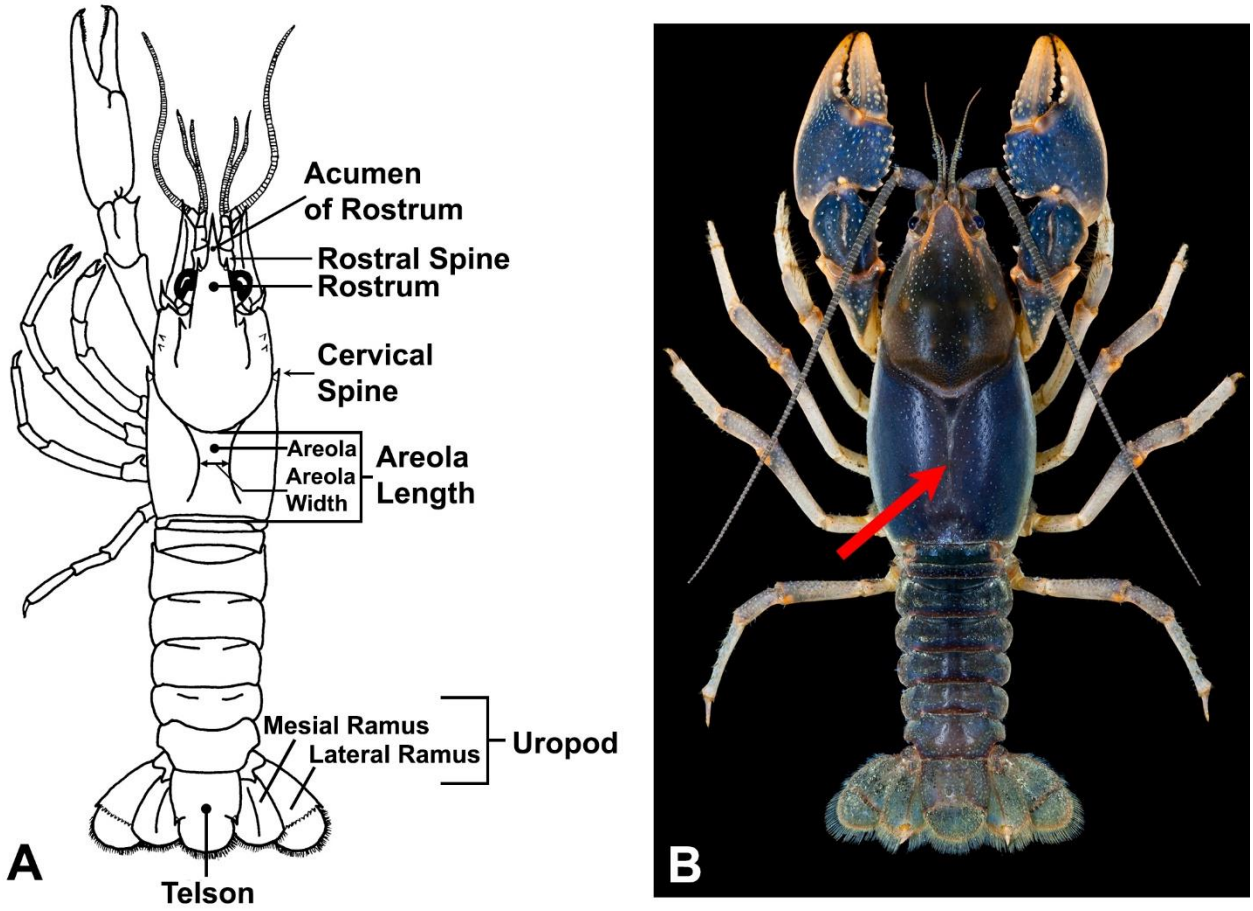

Figure 8. A) dorsal view of crayfish indicating features useful for identification (modified from Hobbs (1981). B) dorsal view of the Conasauga Blue Burrower (*Cambarus cymatilis*) with obliterated areola (Photo by Carl Williams. Photo may be subject to copyright.)

Rostrum

The next characteristic that is fairly easy to observe is the rostrum (Fig. 8A). The rostrum is the "nose" of the crayfish. Depending on which species you are looking at, it can be long and pointed, rounded, have an extra extension called an acumen, or be with or without marginal spines or tubercles.

Cervical Spines

One of the easier characteristics that helps with identification is whether or not the animal possesses cervical spines. These projections are found on both sides of the body (cephalothorax) and can be a good clue for identification (Figs. 2, 8A). One group in GA, consisting of five species, has two cervical spines on each side of the body; many other species will have one distinct cervical spine while others will have only a tubercle or nothing at all.

Gonopods

Arguably the most difficult features to learn concerning crayfish identification relates to the study of the male reproductive structures (gonopods). Some species that are encountered will only be separable by examining these structures. With a little practice, you will be able to easily place your specimen into the correct genus just by looking at the terminal projections of the gonopods. Using the gonopods to differentiate between species of the same genus can be more difficult.

The gonopods are the paired first pleopods and are attached to the first segment of the abdomen (Figs. 3, 4, 9, 10). Except during the reproductive process, these appendages are oriented anteriorly and lie (sometimes hidden by setae) between the fourth and fifth legs of the male crayfish (Fig. 3). The gonopods of all species in Georgia have at least two terminal elements, the central projection and the mesial process (Fig. 9). These are easy to pick out on the genera *Cambarus* and *Faxonius* but are much more difficult on the complex gonopods of *Procambarus*. Further complicating matters is the fact that adult male crayfish molt back and forth between a reproductive form called Form I, and a subadult, non-reproductive form termed Form II. In juvenile and Form II males, the gonopod appears to be the same color and consistency throughout its length and has more blunt and rounded features (Figs. 9A, C, E; 10A). In Form I males, the terminal elements are better defined and the central projection is partly or wholly corneous (appears yellowish and brittle, Figs. 9B, D, F, G; 10B). The most complex gonopods are found on some species in the genus *Procambarus*. The *Procambarus* gonopod typically has several terminal projections and they are often hidden by long setae (hair-like structures; Fig. 9G). Most illustrations of *Procambarus* gonopods do not show the setae (e.g. Fig. 9F). You can use fine tipped forceps to remove the setae if you need to see the detailed structures of the *Procambarus* gonopod.

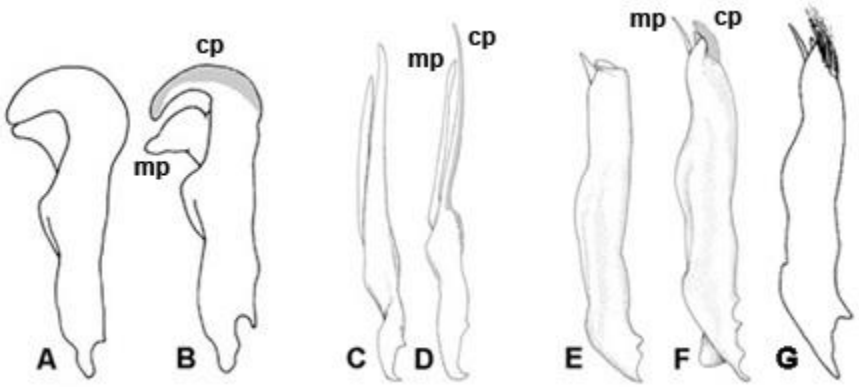

Figure 9. Representative left gonopods of Form I (reproductive) and Form II (non-reproductive) males of the most common Georgia crayfish genera with central projection (cp) and mesial process (mp) indicated for Form I males. A) Form II *Cambarus latimanus*; B) Form I *C. latimanus*; C) Form II *Faxonius spinosus*; D) Form I *F. spinosus*; E) Form II *Procambarus spiculifer*; F) Form I *P. spiculifer* with setae removed; G) Form I *P. spiculifer* with setae present. Modified from Hobbs (1981, 1989).

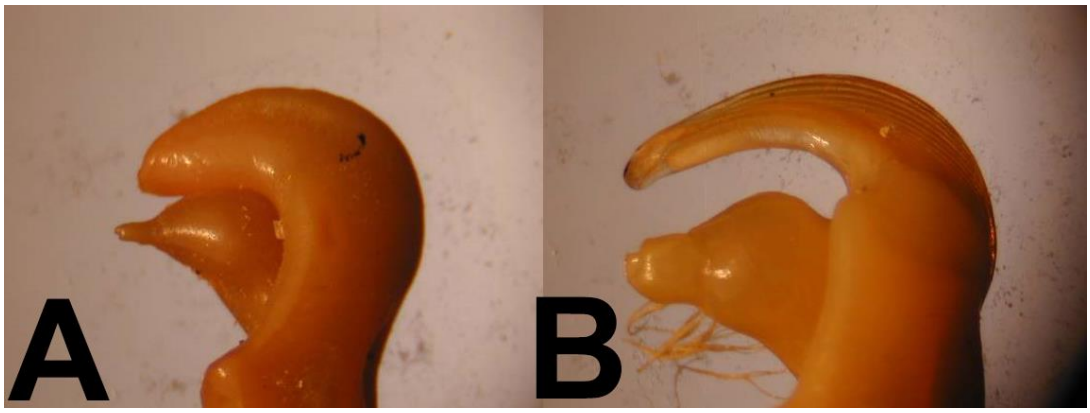

Figure 10. Example terminal elements of the gonopod of the crayfish genus *Cambarus*. A) Form II; B) Form I.

Color

Crayfish color can be an important characteristic(s) but should be used with caution. After crayfish molt, they are at their brightest, and overall color and color pattern may greatly facilitate identification (e.g. Figs. 4, 7, 8B, and 11A). However, as time passes, some specimens may become "encrusted" and appear black (e.g. Fig. 11B). There are no entirely black crayfish in Georgia, so if you encounter something that looks like the animal in Fig. 11B, know that there are colors and patterns that lie beneath the black.

Figure 11. *Procambarus spiculifer* A) recently molted and B) encrusted. Photo A by Chris Lukhaup. Photo may be subject to copyright.

Literature Cited

Eversole, A.G. and D.R. Jones. 2004. Key to the Crayfish of South Carolina. US Forest Service Publication. 79 pp.

Hobbs, H.H., Jr. 1981. The crayfishes of Georgia. Smithsonian Contributions to Zoology 318:1–549.

Prins, R. and H.H. Hobbs, Jr. 1972. A new crayfish of the subgenus *Puncticambarus* from the Savannah River drainage with notes on *Cambarus* (*P.*) *reburrus* Prins (Decapoda, Astacidae). Proceedings of the Biological Society of Washington. 84:411-420.