An Illustrated Key to the Ohio Cambarus and Fallicambarus (Decapoda: Cambaridae) with Comments and a New Subspecies Record

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AN ILLUSTRATED KEY TO THE OHIO CAMBARUS AND
FALLICAMBARUS (DECAPODA: CAMBARIDAE) WITH COMMENTS
AND A NEW SUBSPECIES RECORD

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ABSTRACT. An illustrated taxonomic key is presented using structures of the chela and
carapace to identify the 4 species and 2 subspecies of Cambarus, and one species of
Fallicambarus known to occur in Ohio. Those forms broadly distributed throughout the
state are C. (Lacunicambarus) diogenes diogenes Girard, a primary or secondary burrower;
and C. (Cambarus) bartonii cavatus Hay, a secondary or tertiary burrower; the latter
crayfish has not been previously recorded from the state. Species with restricted distribu-
tions are C. (C.) ortmanni Williamson, a primary or secondary burrower confined to the
Ordovician region of southwestern Ohio; C. (C.) sciotesis Rhoades, a stream dweller
occurring in the Scioto River, Little Scioto River, and tributaries of the Ohio River
in Scioto and Lawrence counties; C. (C.) b. carinirostris Hay, a secondary or tertiary
burrower frequenting streams of the Flushing Escarpment, Mahoning River, and
Grand River drainages in eastern and northeastern Ohio; C. (Puncticambarus) robustus
Girard, a stream inhabitant occupying primarily tributaries to Lake Erie and central and
northern tributaries to the Ohio River, and F. (Creaserinus) fodiens (Cottle), a primary
burrower occurring chiefly in the glaciated regions of northern Ohio. Species with broad
distributions generally have a larger number of species as associates than those with
restricted distributions.

INTRODUCTION

The only published key for the identification of the crayfishes of Ohio (Turner
1926) is now 58 years old and is obsolete for the genera Cambarus and Fallicambarus
due to the significant revision of these genera by Hobbs (1969 and 1973). This paper
presents a new key, with illustrations, to the species of these genera occurring in the
state. Comments on the identification, distribution, habitats, and crayfish associ-
ates of each taxon are provided; a new subspecies of Cambarus from the state is
recorded, and Rhoades’ (1944b) taxonomic list is updated.

The artificial key utilizes structures of the chela and carapace. Therefore, one does
not need a first form male (necessary for most keys and often unavailable) for identi-
fication purposes. For maximum success in using the key, one should have a specimen
with a minimum total carapace length of 4 cm and bearing at least one typical chela.
Atypical chela are usually regenerated appendages which are smaller in size and pos-
sess elongated fingers and shorter palms than do typical chela. Unfortunately, only
experience can be relied upon to determine if a specimen has 2 regenerated chelae.

All Ohio species belonging to the genera Cambarus and Fallicambarus lack spines on
the rostral margins. Males, either first or second form, have both the central projec-
tion and mesial process of the gonopod bent at an angle of 90° or more to the main
shaft. The other genera, Orconectes and Procambarus, will lack the combination of
characters mentioned. The nomenclature of Hobbs (1974) has been followed. Con-
sult Hobbs (1972) for additional information on crayfish anatomical terminology.

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**OHIO CRAYFISH KEY**

<table>
<thead>
<tr>
<th>Species</th>
<th>Key to distinguish it from other species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cambarus bartoni bartonii</td>
<td>Rhoades 1944a 1944b 1962, Jeszerinac 1974; Cambarus bartoni laevius — Rhoades 1944a 1944b 1962; Cambarus ortmanni — Rhoades 1944b (in part-mixed taxa in some collections); Cambarus (Cambarus) bartoni — Clark and Rhoades 1979; Cambarus sp. — St. John 1982; Cambarus (Cambarus) Species A — Thoma and Jeszerinac 1982.</td>
</tr>
<tr>
<td>Cambarus bartoni carinirostris</td>
<td>Rhoades 1944a 1944b; Williamson 1898; Williamson and Engstrom 1979; Mount 1978; Mount and Rhoades 1983; Mount 1983; Mount and Jerger 1982; Mount and Jerger 1985.</td>
</tr>
</tbody>
</table>

**A TAXONOMIC LIST OF THE OHIO CAMBARUS AND FALLICAMBARUS**

**Family Cambaridae Hobbs**

**Subfamily Cambarinae Hobbs**

**Genus Cambarus Erichson**

**Subgenus Cambarus Erichson**

Cambarus (Cambarus) bartonii carinirostris Hay
Cambarus (Cambarus) bartonii cavatus Hay
Cambarus (Cambarus) ortmanni Williamson
Cambarus (Cambarus) sciotensis Rhoades

**Subgenus Lacunicambarus Hobbs**

Cambarus (Lacunicambarus) diogenes diogenes Girard

**Subgenus Puncticambarus Hobbs**

Cambarus (Puncticambarus) robustus Girard

**Genus Fallicambarus Hobbs**

**Subgenus Creaserinus Hobbs**

Fallicambarus (Creaserinus) fodiens (Cottrell)

This revised list differs from previous ones (Turner 1926 and Rhoades 1944b) by including C. (C.) b. carinirostris (recorded by Thoma and Jeszerinac 1982) and C. (C.) b. cavatus and excluding C. (C.) b. bartonii (Fabricius) and C. (Erichicambarus) laevis Faxon. These changes are necessary because all of the specimens that were seen at The Ohio State University Museum of Zoology and the Smithsonian Institution identified as C. (C.) b. bartonii from Ohio were either C. (C.) b. bartonii or C. (C.) b. cavatus, whereas material labeled C. b. laevis was assignable to either C. (C.) ortmanni or to C. (C.) b. cavatus. Cambarus (C.) b. cavatus has not been reported previously from Ohio and was thought to be endemic to the upper Tennessee River drainage. The only significant differences between the syntypes of C. (C.) b. cavatus from Tennessee and the Ohio material is that the former have deeply excavated rostra.

However, one Ohio specimen collected from Blue Rock Creek, Muskingum Co., almost perfectly matches the largest second form males of the syntypes, including its regenerated chela. This subspecies can be distinguished from the nominate species C. (C.) b. bartonii (Fabricius 1798) in that it possesses 2 rows of tubercles on the mesial margin of the palm of the chela, the dorsal row numbering 3-5 and greatly adpressed, and the 2nd or 3rd tubercle on the opposable margin of the propodus is greatly enlarged; moreover the chela has well developed dorsal ridges and a deep lateral impression at the base of the fixed finger. Cambarus (C.) b. bartonii has a single row of palmar tubercles, no enlarged tubercle on the propodus, poorly developed longitudinal ridges, and a shallow lateral impression. These characters are most pronounced in first form males.

Synonymies of C. (C.) b. cavatus in the Ohio literature are as follows: Cambarus bartonii — Osborn and Williamson 1989 (no localities cited), Williamson 1899; Cambarus bartonii — Ortman 1906, Turner 1926 (in part-3 records for C. (C.) b. carinirostris);
FIGURE 1-a. Incised base of dactyl; 1-b. Tufts of elongate setae (F. fodiens); 2-c. Partly closed areola; 3-d. More than 2 rows of palmar tubercles (C. d. digeneus); 4-e. Spine on postorbital ridge; 4-f. Acuminate rostrum 5-g. Two rows of palmar tubercles (C. robustus); 6-h. Truncate rostrum; 6-i. Thickened rostral margins; 7-j. Two rows of palmar tubercles, dorsal row 1/3 height of mesial row (C. sciotensis); 8-k. One row of palmar tubercles; 9-l. Thickened rostral margins; 8-m. Moderate gape of fingers; 8-n. Poorly developed dorsal longitudinal ridges (C. b. carinirostris); 10-o. Obsolete suborbital angle; 11-p. Areola with one row of punctations; 11-q. Rostrum shovel-like (C. ortmanni); 12-r. Acute suborbital angle; 13-s. Areola with 2 rows of punctations across narrowest width; 13-t. Rostrum subtruncated at base of acumen (C. b. casatus); 14-u. Notch under suborbital angle (C. sciotensis).
8-m, n) ... Cambarus (C.) b. carinirostris
5b. Two rows of tubercles on mesial margin of palm, 2nd row numbering 3-5 and greatly adpressed; rostral margins of uniform thickness; chela with fingers straight to slightly gaping and bearing well-developed dorsal longitudinal ridges. [123]

6a. Suborbital angle obsolete; areola with one row of punctations; rostrum shovel-like ... (fig. 10-o, 11-p, q) ... Cambarus (C.) ortmanni
6b. Suborbital angle acute; areola with 2-5 rows of punctations; rostrum usually subtruncated at base of acumen ... (fig. 12-r, 13-s, t) ... Cambarus (C.) b. cavatus

DISCUSSION
Cambarus (C.) b. carinirostris might be confused with C. (C.) b. cavatus but differs from the latter in having a wider areola, usually with 4-5 rows of punctations, and in lacking a second row of 3-5 greatly adpressed palmar tubercles. C. (C.) b. carinirostris appears to be restricted to streams of the Flushing Escarpment, Mahoning River, and headwaters of the Grand River in eastern and northeastern Ohio (Thoma and Jezercic 1982). The 3 records of C. bartoni in Jefferson Co. (Turner 1926) are based upon collections of this subspecies. C. (C.) b. carinirostris is usually found in small streams, less than 4 m in width, with moderate to high gradients. It is a secondary or tertiary burrower and has been captured in one or more sites with C. (P.) robustus, O. rusticus (Girard) and/or O. obscurus (Hagen).

Cambarus (C.) ortmanni can be distinguished from C. (C.) b. cavatus, which it closely resembles, by the absence of an acute suborbital angle, a vaulted carapace, a V-shaped sternum, and its smaller chela. In Ohio, the species is mostly confined to the Ordovician region of the state (a circle with a radius of approximately 90 km centered at Cincinnati). It is a primary or secondary burrower found in small streams, temporary pools, and ditches in the early spring. The species has been found in association with one or more of the following: C. (C.) b. cavatus, C. (L.) d. diogenes, O. rusticus, and/or O. sloani.

Cambarus (C.) sciotensis has a conspicuous notch, with a straight dorsal border, ventral to the acute postorbital angle (fig. 14-u), and thicker, often concave, rostral margins compared with C. (P.) robustus. The species appears to be restricted to the Scioto River, Little Scioto River, and tributaries of the Ohio River in Scioto and Lawrence counties. It is most abundant in the riffles and pools of small (3 m wide) to moderate (15 m wide) size streams and uncommon in the riffles of larger streams. C. (C.) sciotensis has been collected at the same site with C. (C.) b. cavatus, O. rusticus, O. sanbornii sanbornii (Faxon), and O. juvenilis (Hagen).

Cambarus (L.) d. diogenes is a distinct
Ohio species, although 2 forms appear to
be present: a western form which is large,
chestnut in color, with a red band on the
caudal portion of the dorsal abdominal ter-
gites; and an eastern form that is smaller,
greenish to brown in color, with no red
band on the tergites. The taxonomic status
of these forms is unclear. Marlow (1960)
suggests that 3 forms may be present in
Ohio. The demarcation of the range of
these 2 forms in Ohio is not well estab-
lished but the following boundary, based
upon 71 collections from 35 counties,
is approximate: the eastern watershed di-
vides of the Little Miami, Great Miami,
Maumee, and Portage rivers. Western-
type specimens also have been collected
from streams and ditches along the south-
ern shore of Lake Erie as far east as Lorain
Co. This crayfish is a primary or secondary
burrower and is probably present in every
Ohio county (Rhoades 1944b, Thoma and
Jezerinac 1982). It uses the same type of
habitat as C. (C.) ortmanni in the early
spring. Members of the species have been
found in association with one or more
of the other Ohio crayfishes, except
P. (S.) clarkii, O. sloanii, O. propinquus
(Girard), O. virilis (Hagen), C. (C.) scio-
tensis, and C. (C.) b. carinirostris. C. (L.)
d. diogenes is most often associated with
P. (Ortmannicus) acutus acutus (Girard),
O. immunis, and F. (C.) fodiens in north-
western Ohio and with C. (C.) ortmanni in
the southwestern part of the state.

Cambarus (P.) robustus exhibits con-
siderable morphological variation, espe-
cially in the presence or absence of cervical
spines and the number of tubercles in the
palmar rows of the chela. The species is
common in Lake Erie tributary streams
from Conneaut Creek (Ashtabula Co.)
westward to Pickeral Creek (Sandusky Co.),
in the Mahoning River, the middle and upper Muskingum River drainages,
and eastern tributaries flowing directly
into the Ohio River as far south as, but
not including, Duck Creek (Washington
Co.). The species is very uncommon in the
Sandusky River and Maumee River basins
(one collection from the Tiffin River).

Cambarus (P.) robustus is conspicuously
absent in the Lower Muskingum, Duck
Creek, Hocking, and Raccoon Creek
drainages in southeastern Ohio. It is appar-
ently replaced by C. (C.) sciotesis in the
Scioto River basin and is not known to
occur in other streams in southwestern
and western Ohio. Its habitat is similar to
that of C. (C.) sciotesis. Its crayfish associates
at one or more sites include C. (C.)
b. carinirostris, C. (C.) b. carinirostris, C. (L.)
d. diogenes, O. propinquus, O. s. sanbornii,
O. rusticus, O. juvenilis, O. virilis, O. obscurus,
and O. immunis.

Fallicambarus (C.) fodiens has a dorso-
ventrally flattened chela very similar to
that of O. immunis. The limits of its range
in Ohio have not been well determined,
but it is more common in the northern
glaciated region of the state than else-
where. It has been collected by Dr. D. H.
Stansbery (The Ohio State University
Museum of Zoology) from only one locality
(Jackson Co.) in the unglaciated part of
Ohio. Fallicambarus (C.) fodiens is a pri-
mary or secondary burrower. In the gla-
ciated area of the state it is usually found
in swamps and wet woods associated with
Glacial potholes and morainal ridges. F.
(C.) fodiens has been captured at one or
more sites with P. (O.) a. acutus,
O. immunis, O. rusticus, and/or C. (L.)
d. diogenes.

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