

Synopsis of the Families and
Genera of Crayfishes
(Crustacea: Decapoda)

HORTON H. HOBBS, JR.

SMITHSONIAN CONTRIBUTIONS TO ZOOLOGY • NUMBER 164

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ABSTRACT

Hobbs, Horton H., Jr. Synopsis of the Families and Genera of Crayfishes (Crustacea: Decapoda). *Smithsonian Contributions to Zoology*, number 164, 32 pages, 27 figures, 1974.—The subdivisions of the infraorder Astacidea, comprising the lobsters (superfamily Nephropoidea) and crayfishes (superfamilies Astacoidea and Parastacoidea) are briefly discussed and their affinities indicated. This is followed by a key to the superfamilies and of the families and genera of the Astacoidea and Parastacoidea. Two families, the Astacidae and Cambaridae, are recognized as constituting the holarctic Astacoidea, and the Parastacidae as the only family of the Parastacoidea, which is confined to the Southern Hemisphere. Synonymies and diagnoses of these taxa and the genera composing them are presented; in addition, the range, number of species, references to summary treatments, and illustrations of a representative of each genus are included.

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Synopsis of the Families and Genera of Crayfishes (Crustacea: Decapoda)

Horton H. Hobbs, Jr.

Introduction

For a number of years, it has become increasingly apparent to me and to at least some of my colleagues that the assignment of the freshwater crayfishes to two families, the Astacidae restricted to the Northern Hemisphere, and the Parastacidae, to the Southern Hemisphere, does not adequately express the diversity that exists in the holarctic assemblage. The classification of crayfishes at the familial level that seems generally to have been adopted is as follows:

- Family Parastacidae
- Family Astacidae
 - Subfamily Astacinae
 - Subfamily Cambaroidinae
 - Subfamily Cambarinae
 - Subfamily Cambarellinae.

The Parastacidae are distinguished from the Astacidae primarily by the absence of the first pleopod and in the unmodified second pleopod in the male, in lacking bilobed plaited laminae on any of the podobranchiae, and the usual presence of branchial filaments on the epipodite of the first maxillipeds. Among the four subfamilies of the Astacidae, the Astacinae differ from the other three in that the male lacks clasping hooks on the ischia of any of the pereopods, by the loosely rolled or

tubular distal portion of the first pleopod, and, more fundamentally, in the absence of a cyclic dimorphism. The females differ from all except the few species assigned to the Cambaroidinae in lacking a well-developed, functional annulus ventralis. These differences that distinguish the Astacinae from the other crayfishes of the Northern Hemisphere seem to me to be at least as remarkable as those that distinguish them from the Parastacidae, and the recognition of a third family of crayfishes is here proposed.

Considerably greater confidence exists in any classification that is supported by a fossil record in which implied dichotomies can be demonstrated. Unfortunately, the fossil record of the freshwater crayfishes is exceedingly poor. No pre-Pleistocene crayfish fossil, to my knowledge, has been recorded from the Southern Hemisphere. Not only are few fossils from few localities available, but also many features that are considered to be of importance in assessing relationships are not discernible in those that are at hand. The arrangement and structure of the gills cannot be determined in any known fossil assignable to a crayfish family, and the presence or absence, to say nothing of the structure, of the first pleopod of the male cannot be ascertained in those specimens that have been examined by me. Furthermore, characters that would indicate a cyclic dimorphism in males are not evident in any fossil.

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Inasmuch as all male crayfishes that are known to exhibit an alternation of a breeding form with a nonbreeding one possess hooks on the ischia of one or more of the second through fourth pereopods, the apparent absence of such hooks in the known fossils suggests that none of them exhibited this cyclic alternation of forms that in certain crayfishes is unique among decapod crustaceans.

It seems unlikely that the physiological mechanisms that control this cyclic morphology have been independently acquired in the eastern Asiatic (Cambaroidinae) and eastern North American (Cambarinae and Cambarellinae) stocks. Consequently, the existence of a common ancestor more recent than any shared with other crayfish lineages (Astacinae) seems certain (see page 3). In spite of the fact that there is no evidence based on the fossil record of crayfishes that underwent such a cyclic change occurring in the Tertiary, the range of the Cambarinae, one of the species groups in which the cycle is typical, is such that one is almost forced to conclude that a cyclic dimorphism had become established in this lineage before the end of the Miocene (Hobbs, 1967, 1971b).

The fact that the eastern Asiatic crayfishes are in some respects intermediate between the Eurasian-western North American species (possessing similar arrangement of gills and a sclerite corresponding to the annulus ventralis that lacks both a sinus and fossa) and the eastern North American species (bearing hooks on the ischia of the second and third pereopods in the male in which there is also a cyclic dimorphism) does not necessitate the conclusion that the eastern Asiatic mien represents an arrested morphology that at one time served as a transitional form in the evolution of one from the other. Equally likely is the possibility that from some Mesozoic marine nephropoid ancestral stock there developed two lines of evolution: one retaining the primitive absence of cyclic dimorphism and another in which such a dimorphism became fixed along with those characters that accompany it (hooks on the ischia of certain pereopods in the male and an annular sclerite possessing a cavity or fossa for sperm storage in the female).

The more conservative stock, in migrating into a freshwater habitat, gave rise to that from which the present-day Astacinae (Eurasia and western North America) have descended. Those remaining in marine waters were presumably ancestral to modern

Nephropoidea. The other stock, that in which cyclic dimorphism became established, also migrated into fresh water, giving rise to those crayfishes assigned to the Cambaroidinae, Cambarellinae, and Cambarinae. Whether or not the Asiatic Cambaroidinae and the American subfamilies were derived from a common freshwater-inhabiting ancestor, or whether there were separate Asiatic and American invasions of fresh water in post-Jurassic times may never be known; certain possibilities, however, were recently discussed by Holt (1968:85-86) and Hobbs (1969:113-116). A possible origin of the Parastacidae has been discussed by Riek (1959:255-257).

A meaningful taxonomy of the holarctic assemblage must reflect the recognition of a fundamental divergence in the physiology and morphology of two stocks expressed in the presence or absence of the cyclic production of sperm and provisions for its conveyance to the female. The cyclic behavior of the testis of a member of the Cambarinae was shown by Word and Hobbs (1958) to be associated with the alternating first and second forms of the male in which there is also an alternation in the relative size of the grasping hooks on the ischia of one or more of the pereopods and the shape and texture of the terminal elements of the first pleopods. These characters are most assuredly as little, and perhaps less, affected by environmental conditions as are the loss of one or more units of the branchial series. They are also equally as important in assessing relationships as are modifications of the branchial laminae, and of no less importance than the development and variations that occur in the telson and presence or absence of first pleopods. Taking cognizance of these characteristics that, in my opinion, have been inadequately emphasized, together with others cited in the diagnosis presented below, the following restructuring of the Astacuran Infraorder Astacidea is proposed.

Infraorder ASTACIDEA

Superfamily Nephropoidea¹

Superfamily Astacoidea

Family Astacidae

Genus *Astacus*

Austropotamobius

Pacifastacus

¹ The Atlantic Nephropoidea are being revised by L. B. Holthuis, and included in his study will be a review of the generic and familial characteristics.

MAJOR CHARACTERISTICS INVOLVED IN THE EVOLUTION OF CRAYFISHES
FROM A PRO-NEPHROPOID ANCESTOR

CAMBAROIDINE ANCESTOR

FIRST PLEOPOD OF MALE WITH SHALLOW SPERM GROOVE OPENING DISTALLY AMONG TERMINAL ELEMENTS
ANNULAR PLATE IN FEMALE ALWAYS LACKING SINUS AND FOSSA
BRANCHIAL FORMULA 18 + 3R + EP

CAMBARINE ANCESTOR

MALE WITH HOOKS ON ISCHIA OF THIRD, FOURTH, OR THIRD AND FOURTH PEREIOPODS
ANNULUS VENTRAL FIXED, OR, IF MOVABLE, SELDOM THROUGH ARC OF MORE THAN 40 DEGREES
BRANCHIAL FORMULA 17 + EP

CAMBARELLINE ANCESTOR

MALE WITH HOOKS ON ISCHIA OF SECOND AND THIRD PEREIOPODS
ANNULUS VENTRALIS MOVABLE THROUGH ARC OF AT LEAST 75 DEGREES
BRANCHIAL FORMULA 16 + EP

PRO-CAMBARINE ANCESTOR

FIRST PLEOPOD OF MALE WITH DEEP SPERM GROOVE OPENING DISTALLY ON CENTRAL PROJECTION
ANNULAR PLATE IN FEMALE ALWAYS WITH SINUS AND FOSSA
BRANCHIAL FORMULA 17 + EP, OR 16 + EP

ASTACID ANCESTOR

CYCLIC DIMORPHISM ABSENT IN MALE
FIRST PLEOPOD OF MALE SUBTUBULAR DISTALLY AND LACKING ORNAMENTATION OTHER THAN SPOON-LIKE LOBES
ISCHIA OF ALL PEREIOPODS OF MALE LACKING HOOKS
ANNULAR PLATE IN FEMALE WITHOUT SINUS OR FOSSA

CAMBARID ANCESTOR

CYCLIC DIMORPHISM IN MALE
FIRST PLEOPOD OF MALE WITH SHALLOW OR DEEP SPERM GROOVE AND WITH TERMINAL ORNAMENTATION
ISCHIA OF ONE OR MORE PEREIOPODS OF MALE WITH HOOKS
ANNULAR PLATE IN FEMALE WITH OR WITHOUT SINUS AND FOSSA

ASTACOIDEAN ANCESTOR

FIRST PLEOPODS OF MALE EACH WITH SPERM CONDUIT
SECOND PLEOPOD OF MALE WITH SPIRAL ELEMENT ON ENDOPODITE
PODOBRANCHIAE WITH FUSED BRANCHIAL AND EPIPODITIC PORTIONS AND WITH BILOBED PLAITED LAMINAE
STERNUM BETWEEN FIFTH PEREIOPODS NOT FUSED WITH ANTERIOR STERNAL PLATE
EGGS HATCHING AS MINIATURES OF ADULT

NEPHROPOIDEAN ANCESTOR

FIRST PLEOPODS OF MALE SERVING TOGETHER TO FORM SINGLE SPERM CONDUIT
SECOND PLEOPOD OF MALE WITHOUT SPIRAL ELEMENT ON ENDOPODITE
PODOBRANCHIAE WITH DISCRETE BRANCHIAL AND EPIPODITIC PORTIONS
STERNUM BETWEEN FIFTH PEREIOPODS FUSED WITH ANTERIOR STERNAL PLATE
EGGS HATCHING AS LARVAE

PARASTACOIDEAN ANCESTOR

FIRST PLEOPODS ABSENT IN MALE AND FEMALE
SECOND PLEOPOD OF MALE WITHOUT SPIRAL ELEMENT ON ENDOPODITE
PODOBRANCHIAE WITH FUSED BRANCHIAL AND EPIPODITIC PORTIONS BUT WITHOUT BILOBED PLAITED LAMINAE
STERNUM BETWEEN FIFTH PEREIOPODS NOT FUSED WITH ANTERIOR STERNAL PLATE
EGGS HATCHING AS MINIATURES OF ADULT

PRO-NEPHROPOID ANCESTOR

- Family Cambaridae
 - Subfamily Cambarinae
 - Genus *Barbicambarus*
 - Cambarus*
 - Fallicambarus*
 - Faxonella*
 - Hobbseus*
 - Orconectes*
 - Procambarus*
 - Troglocambarus*
 - Subfamily Cambarellinae
 - Genus *Cambarellus*
 - Subfamily Cambaroidinae
 - Genus *Cambaroides*
- Superfamily Parastacoidea
 - Family Parastacidae
 - Genus *Astacoides*
 - Astacopsis*
 - Cherax*
 - Engaeus*
 - Engaewa*
 - Euastacoides*
 - Euastacus*
 - Geocharax*
 - Gramastacus*
 - Paranephrops*
 - Parastacoides*
 - Parastacus*
 - Samastacus*
 - Tenuibranchiurus*

Because of the scattered literature treating the three families of crayfishes—no composite summaries of them have been attempted since those of Faxon (1885a, 1914)—a key to the taxa comprising crayfishes, together with synonymies and diagnosis of each, are presented here. In addition to the diagnoses of the genera, the following are cited: range of each, genus, number of described species and nonnominate subspecies currently recognized, and references to monographic or summary treatments and keys.

The generic structure of the Astacidae utilized is that of Bott (1950), and that of the Parastacidae has been proposed by Riek (1969, 1971, 1972). I have drawn freely from these works in composing the diagnoses. The organization of the Cambaridae

is based primarily on studies of Hagen (1870), Faxon (1885a), Ortmann (1905a, 1906), and Hobbs (1942a, 1969, 1972a).

The illustrations included are depicted as though all of the species were of approximately the same size. They were so scaled as to allow an appreciation of the differences in proportions of the structures included.

Shortly after this manuscript had been completed, Riek's study (1972) on the phylogeny of the Parastacidae appeared—in which not only are representatives of each of the parastacid genera illustrated but also a new genus, *Gramastacus*, is described. The present manuscript has been revised to include the new genus, the treatment of which is based on Riek's diagnosis and illustrations. It is unfortunate that neither of us was aware of the endeavors of the other.

ACKNOWLEDGMENTS.—Among those who have assisted me in this undertaking are Lipke B. Holthuis, who not only placed at my disposal his synonymies of a number of the taxa included herein, but who also critically read an early draft of the manuscript. Fenner A. Chace, Jr., was most helpful in discussing a number of problems that arose during the preparation of the manuscript and in reading the final draft. Without the cooperation of D. J. G. Griffin in lending me specimens in the collection of the Australian Museum, the illustrations of *Astacopsis*, *Engaewa*, and *Tenuibranchiurus* would be incomplete or lacking. Martha R. Cooper, Joseph F. Fitzpatrick, Jr., and Raymond B. Manning offered considerable encouragement and advice, and read a preliminary draft of the paper. To all of these persons, I am most grateful. I also wish to acknowledge, with appreciation, the assistance of Carolyn B. Gast in inking the illustrations, that of Carolyn S. Hahn in obtaining a number of the early publications that were not readily available in the Smithsonian Library, and that of Margaret A. Daniel in all aspects of the preparation of the manuscript.

Key to the Families and Genera of the Infraorder Astacidea Latrielle, 1803, Exclusive of the Superfamily Nephropoidea

1. Carapace with dorsomedian longitudinal suture or with simple or spinous ridge extending from caudal margin of carapace at least to base of rostrum; sternal plate between fifth pereopods fused with that between fourth pair; podobranchiae of first 3 pereopods with discrete branchial and epipoditic parts; first pleopod of male without individual sperm conduit Superfamily NEPHROPOIDEA Dana, 1852

- Carapace never with longitudinal suture nor with ridge extending from caudal margin of carapace to base of rostrum; sternal plate between fifth pereopods never fused with that between fourth pair; podobranchiae of first 3 pereopods with branchial and epipoditic elements united; first pleopod of male each with complete sperm conduit or first pleopod of male absent 2
- 2 (1) . First pleopod of male well developed and serving as organ of sperm transfer, reduced or absent in females; podobranchiae of second and third maxillipeds and first 3 pereopods with bilobed, plaited laminae; epipodite of first maxilliped without branchial filaments; coxopoditic setae acute apically; telson usually (except in *Cambaroides*, *Pacifastacus* and rarely in *Fallicambarus*) divided by transverse suture 3
 Superfamily ASTACOIDEA 3
- First pleopod lacking in both sexes; podobranchiae lacking bilobed, plaited laminae although stem may be alate; epipodite of first maxilliped usually with branchial filaments; coxopoditic setae with apical hooks; telson never completely divided by transverse suture 17
 Superfamily PARASTACOIDEA, Family PARASTACIDAE 17
- 3 (2) . Male never exhibiting cyclic dimorphism; first pleopod with distal portion rolled to form cylinder; ischia of all pereopods without hooks; female lacking annulus ventralis. 4
 Family ASTACIDAE 4
- Male always exhibiting cyclic dimorphism; first pleopod with distal portion either bearing shallow sperm groove cephalomesially or complexly and tightly folded with sperm conduit opening on one of 2 or more terminal elements; male with hooks on one or more of second through fourth pereopods; female with or without annulus ventralis 6
 Family CAMBARIDAE 6
- 4 (3) . Distal part of first pleopod of male contracted to form narrow tube; exopodite of second pleopod shorter than endopodite; merus of third maxilliped with uniform row of spines on mesial margin and strong spine at distal end of row; epistome without spines or ridges posterior to renal papilla *Pacifastacus*
- Distal part of first pleopod of male not contracted but bearing 2 apical lobes; exopodite of second pleopod as long as, or shorter than, endopodite; merus of third maxilliped with mesial margin bearing row of spines or with 1 or 2 distally; epistome with spine or ridges posterior to renal papilla 5
- 5 (4) . Distal lobes of first pleopod conspicuously unequal in length; exopodite of second pleopod as long or almost as long as endopodite; merus of third maxilliped with single large mesiodistal spine, latter occasionally accompanied by single smaller spine distally *Astacus*
- Distal lobes of first pleopod subequal in length; exopodite of second pleopod distinctly shorter than endopodite; merus of third maxilliped usually with row of spines along mesial margin, rarely with only 1 distal spine *Austropotamobius*
- 6 (3) . Branchial formula 17 + ep; male with hooks on ischia of third, fourth, or third and fourth pereopods; first pleopod with distal portion complexly and tightly folded and sperm conduit opening on one of 2 or more terminal elements; annulus ventralis fixed or movable, if latter, seldom through arc of as much as 40 degrees 8
 Subfamily CAMBARINAE 8
- Branchial formula 16 + ep or 18 + 3r + ep; male with hooks on ischia of second and third pereopods; first pleopod with distal part bearing shallow sperm groove or complexly folded as in Cambarinae but always bearing at least 3 terminal elements; annulus ventralis present (moving through arc of at least 75 degrees) or absent (plate lacking sinus and fossa) 7
- 7 (6) . Branchial formula 16 + ep; first pleopod of male with distal portion complexly and tightly folded and sperm conduit opening on one of 3 terminal elements; annulus ventralis present *Cambarellus*
 Subfamily CAMBARELLINAE *Cambarellus*
- Branchial formula 18 + 3r + ep; first pleopod of male with shallow sperm conduit not opening on terminal element, annulus ventralis absent, plate lacking sinus and fossa *Cambaroides*
 Subfamily CAMBAROIDINAE *Cambaroides*
- 8 (6) . Third maxillipeds much enlarged; ischium without teeth on opposable margin *Troglocambarus*
- Third maxillipeds not conspicuously large; ischium with teeth on opposable margin 9
- 9 (8) . First pleopod of male terminating in 2 elements 10
- First pleopod of male terminating in more than 2 elements 15
- 10 (9) . Mesial process of first pleopod of male no more than one-half length of elongate central

- projection; central projections of paired pleopods of first form male nearly straight and overlapping *Faxonella*
- Mesial process of first pleopod of male greater than one-half length of central projection; central projections of paired pleopods overlapping only in occasional individuals of *Fallicambarus dissitus* Penn in which strongly recurved 11
- 11 (10) . Distal one-third of first pleopod of male with prominent shoulder on cephalic surface, or central projection forming distally projecting triangular plate, or central projection arising from enlarged subterminal or terminal area *Procambarus*
- Distal one-third of first pleopod of male lacking shoulder on cephalic surface; central projection never forming distally projecting triangular plate nor arising from enlarged subterminal or terminal area 12
- 12 (11) . Coxa of fourth pereopod in male lacking caudomesial boss 13
- Coxa of fourth pereopod in male with caudomesial boss 14
- 13 (12) First pleopods, of male, in resting position, deeply withdrawn between bases of pereopods and largely concealed by dense setiferous mat extending from ventrolateral margins of sternum *Hobbseus*
- First pleopods of male, in resting position, never deeply withdrawn between bases of pereopods and never concealed by dense setiferous mat extending from ventrolateral margins of sternum *Orcometes*
- 14 (12) . Opposable margin of dactyl of chela with abrupt excision in proximal one-half *Fallicambarus*
- Opposable margin of dactyl of chela without abrupt excision in proximal one-half 15
- 15 (14) . Central projection of first pleopod bladeliike, always directed caudally or caudadistally, and frequently bearing subterminal notch *Cambarus*
- Central projection of first pleopod seldom bladeliike, if so, directed laterodistally or lacking subterminal notch 16
- 16 (15) . First pleopod with both central projection and mesial process curved caudally at least 90 degrees to principal axis of shaft of appendage *Fallicambarus*
- First pleopod never with both central projection and mesial process curved caudally at angle of so much as 90 degrees to principal axis of shaft of appendage *Procambarus*
- 17 (2) . Branchiocardiac groove without conspicuous anterolateral extension; chela with dactyl moving in subhorizontal plane; branchial formula $21 + epr$ 18
- Branchiocardiac groove with anterolateral extension situated subparallel to, or converging on, cervical groove for some distance; chela with dactyl moving in subvertical or subhorizontal plane; branchial formula variable 21
- 18 (17) . Telson entirely calcified, lacking trace of transverse suture; stems of podobranchiae without winglike expansion *Astacopsis*
- Telson with posterior part membranous, with or without trace of transverse suture; stems of podobranchiae with winglike expansion 19
- 19 (18) . Distal portion of inner ramus of uropod membranous; cephalothorax rarely with small tubercles; abdominal pleura without spines or tubercles; ventral surface of third maxilliped with setae covering most of mesial half; male genitalia consisting of large papilla arising from mesial surface of coxa *Cherax*
- Distal portion of inner ramus of uropod calcified; cephalothorax with enlarged spines or tubercles; abdominal pleura with or without spines or tubercles; ventral surface of ischium of third maxilliped with median row of large setiferous punctations; male genitalia consisting of short papilla with calcified ring situated on ventral surface of coxa 20
- 20 (19) . Abdomen with spines or tubercles, sometimes limited to pleura; carpus of cheliped with enlarged submedian spine ventrodistally; ventrolateral margin of chela with one row of spines and usually with additional row or low carina *Euastacus*
- Abdomen without spines or tubercles but with many setiferous punctations on pleura; carpus of cheliped with irregularly arranged small spine or tubercles on or near median ventrodistal margin; ventrolateral margin of chela with single row of weak spines *Euastacoides*
- 21 (17) . Chela with dactyl moving in subvertical plane 22
- Chela with dactyl moving in subhorizontal plane 26
- 22 (21) . Pleural lobe of first abdominal segment not overlapped by anterior lobe of pleuron of second segment; palp of third maxilliped not reaching distal end of ischium *Engaeus*
- Pleural lobe of first abdominal segment partially overlapped by anterior lobe of pleuron

- of second segment; palp of third maxilliped overreaching distal end of ischium 23
- 23 (22) . Anterolateral lobe of branchiocardiac groove subcontiguous with cervical groove; branchial formula 20 + epr *Parastacus*
Anterolateral lobe of branchiocardiac groove widely separated from cervical groove; branchial formula 21 + epr or 18 + epr 24
- 24 (23) . Postorbital ridges well developed; eyestalks long; palm of chela depressed; carpus of cheliped produced distomesially *Geocherax*
Postorbital ridges very weak or absent; eyestalks short and bulbous; palm of chela inflated; carpus of cheliped rounded distomesially 25
- 25 (24) . Lateral rostral carina present; lateral process of sternum between fourth pereopods not separated by median longitudinal carina; branchial formula 21 + ep *Engaeus*
Lateral rostral carina absent; lateral processes of sternum between fourth pereopods separated by median longitudinal carina; branchial formula 18 + ep *Temalbranchiurus*
- 26 (21) . Ventrolateral surface of chela with 2 rows of spines, and additional rows of spines or enlarged tubercles on dorsal and ventral surfaces; branchial formula 20 + epr *Paraneohirsops*
Surface of chela never with longitudinal rows of large spines or tubercles; branchial formula other than 20 + epr 27
- 27 (26) . Carapace and pleuron of second abdominal segment with large spines or tubercles; anterolateral extension of branchiocardiac groove almost contiguous with cervical groove; telson with trace of transverse suture laterally; branchial formula 12 + epr + 5r *Astacoides*
Carapace and pleuron of second abdominal segment never with large spines or tubercles; anterolateral extension of branchiocardiac groove with wide to moderately narrow gap between it and cervical groove; telson without trace of transverse suture; branchial formula other than 12 + epr + 5r 28
- 28 (27) . Junction or approximation of branchiocardiac and cervical grooves situated no farther laterally than level of caudolateral extremity of postorbital ridge; branchial formula 17 + epr *Parastacoides*
Junction or approximation of branchiocardiac and cervical grooves situated distinctly lateral to level of caudolateral extremity of postorbital ridge; branchial formula 20 + epr or 21 + epr 29
- 29 (28) . Anterolateral part of branchiocardiac groove subparallel to cervical groove with comparatively little space between them; branchial formula 20 + epr *Samastacus*
Anterolateral part of branchiocardiac groove widely separated from, but converging throughout its length with, cervical groove; branchial formula 21 + epr 30
- 30 (29) . Male genitalia large, longer than coxa; pleuron of second abdominal segment enlarged in female *Gramastacus*
Male genitalia small, much shorter than coxa; pleuron of second abdominal segment not enlarged in female *Geocherax*

Superfamily ASTACOIDEA

ASTACOIDEA De Haan, 1841:148, 160.

ASTACINA Huxley, 1880a:254, 255.

DIAGNOSIS.—Carapace lacking dorsomedian longitudinal suture or ridge in cardiac and posterior gastric regions. Sternal plate between fifth pereopods not fused with sternal complex anteriorly. Telson almost always partially, and usually completely, divided by transverse suture. Podobranchiae of first three pereopods not differentiated into branchial and epipoditic portions but with bilobed plaited laminae. Branchial formula 16 + ep; 17 + ep; 18 + 2r + ep; or 18 + 3r + ep. Articles of lateral ramus of antennule, in region of aesthetascs,

usually bearing two clusters, only one in Cambroidinae. First pleopod present in male and possessing individual sperm groove, present or absent in female; second pleopod in male with spiral element, frequently borne on subtriangular lobe. Eggs large and hatching as miniatures of adult. All members occurring in fresh water, some migrating into salt water for part of year.

Family ASTACIDAE

astacini Latreille, 1802-1803:32.

Astakoiden Duméril, 1806:172.

Astacoidea Duméril, 1806:332.—De Haan, 1841:148, 160.

Astacia Rafinesque, 1815:98.

ASTACIDAE Samouelle, 1819:94.

Astacides Billberg, 1820:134, 135.
 ASTACINAE Latreille, 1825:279.
Astacida Vogt, 1851:459.
Astacina Gerstaecker, 1863:373.
 POTAMOBIIDAE Huxley, 1879:776, 781, 785.
 POTAMOBIIINAE Ortmann, 1891:10.
 PATAMOBIIDAE Spandl, 1926:141 [erroneous spelling].

DIAGNOSIS.—Male never exhibiting cyclic dimorphism; first pleopod with distal portion rolled to form cylinder, and distalmost part contracted to form tube or produced into 2 simple spoonlike lobes. Ischia of pereiopods of male without hooks. Female lacking annulus ventralis (sclerite present but lacking sinus and fossa). Branchial formula $18 + 2r + ep$; or $18 + 3r + ep$. Some articles of lateral ramus of antennule bearing 2 clusters of aesthescs.

Genus *Astacus*

FIGURE 1

Astacus Fabricius, 1775:413. [Type-species, by Direction 12 of the International Commission on Zoological Nomenclature, *Cancer Astacus* Linnaeus, 1758:631. Gender: masculine. Junior homonym of *Astacus* Pallas, 1772:81, latter suppressed by Commission in same direction; *Astacus* Fabricius, 1775:413, also placed on Official List of Generic Names in Zoology.]

astaca Duméril, 1806:183 [erroneous spelling].

Potamobie Leach, 1818:75 [vernacular name and nomen nudum].

Potamobius Samouelle, 1819:95. [Type-species, by monotypy, *Cancer Astacus* Linnaeus, 1758:631. Gender: masculine.]

Potamobia Desmarest, 1823:246, 424 [latinization of *Potamobie* Leach, 1818].

Patamobius Gray, 1845:410 [erroneous spelling].

Carabis Marchand, Lamy, and de Boisvillette, 1874:55. [Type-species, by monotypy, *Cancer Astacus* Linnaeus, 1758:631. Gender: masculine.]

Actacus Philippi, 1894:378 [erroneous spelling].

Astachus Ninni, 1923:13 [erroneous spelling].

Subgenus *Pontastacus* Bott, 1950:12. [Type-species, by original designation, *Astacus leptodactylus* Eschscholtz, 1823:109. Gender: masculine.]

DIAGNOSIS.—Carapace with at least rudiments of both anterior and posterior postorbital ridges; merus of third maxilliped with single large mesiodistal spine, sometimes accompanied by single smaller spine distally; epistome with spine or ridge (often bearing at least one spine) posterior to renal papilla; first pleopod of male terminating in two

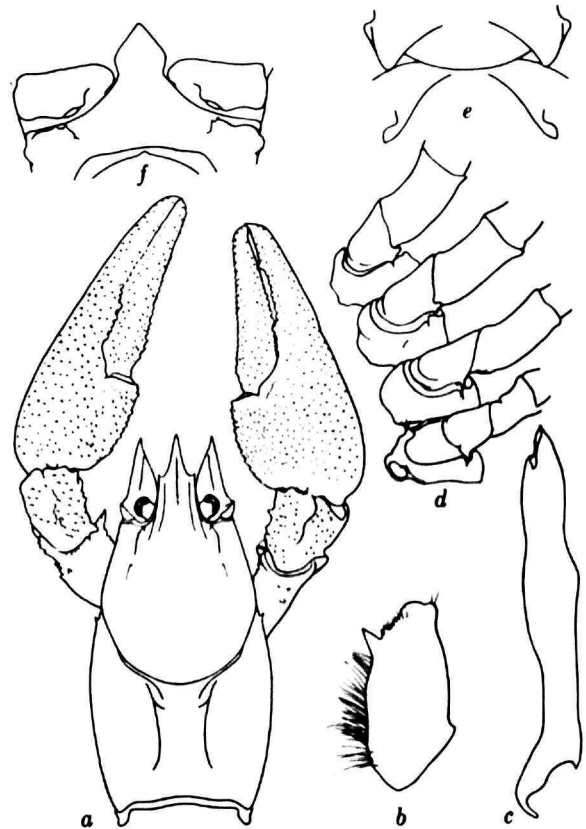


FIGURE 1.—*Astacus (A.) astacus* (Linnaeus, 1758) from Ljumgan River, Alby, Sweden: *a*, dorsal view of carapace and chelipeds of male; *b*, ventral view of merus of third maxilliped; *c*, lateral view of first pleopod of male; *d*, basal podomeres of second through fifth pereiopods; *e*, caudal thoracic sternal area of female; *f*, epistome and proximal podomere of antennae.

lobes, one reaching distinctly farther distally than other; exopodite of second pleopod extending almost or quite as far distally as endopodite.

RANGE.—Middle and eastern Europe.

NUMBER OF SPECIES.—Bott (1950) recognized four species and four subspecies assigned to two subgenera, and two additional species of uncertain relationships. Karaman (1962) treated four species and six subspecies and "natio" which were assigned to two subgenera.

REFERENCES.—Bott, 1950, 1972; Karaman, 1962; Curra, 1967.

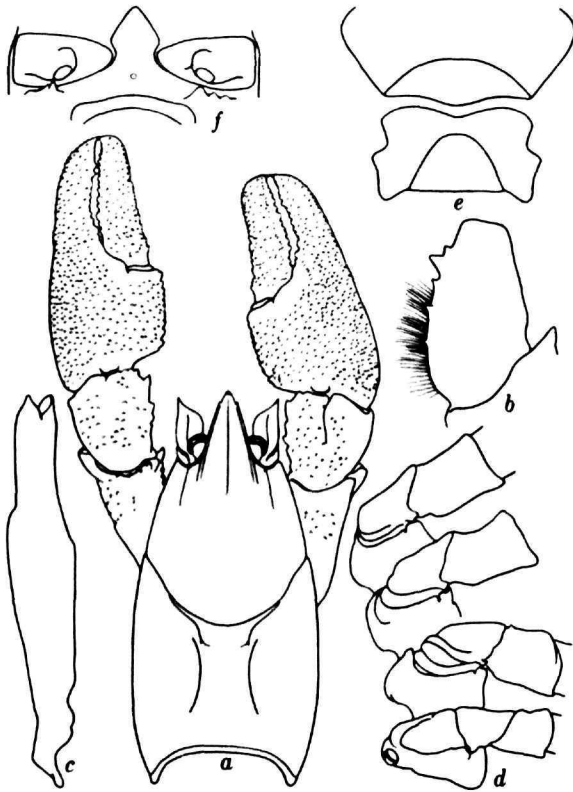


FIGURE 2.—*Austropotamobius torrentius danubicus* Karaman, 1962, from Bucharest, Rumania. (For explanation, see Figure 1.)

Genus *Austropotamobius*

FIGURE 2

Austropotamobius Skorikov, 1908:116. [Type-species, by subsequent designation (Bott, 1950:18), *Cancer torrentium* Schrank, 1803:247. Gender: masculine. Originally proposed as a subgenus of *Potamobius*; elevated to generic rank by Bott, 1950:18.]

Subgenus *Atlantoastacus* Bott, 1950:21. [Type-species, by original designation, *Astacus pallipes* Lereboullet, 1858:7. Gender: masculine.]

DIAGNOSIS.—Carapace without trace of posterior postorbital ridge; merus of third maxilliped with row of spines along mesial border; epistome with spine or ridge, latter often bearing at least one spine, posterior to renal papilla; first pleopod of male terminating in 2 lobes reaching approximately same level distally; exopodite of second pleopod never extending so far distally as endopodite.

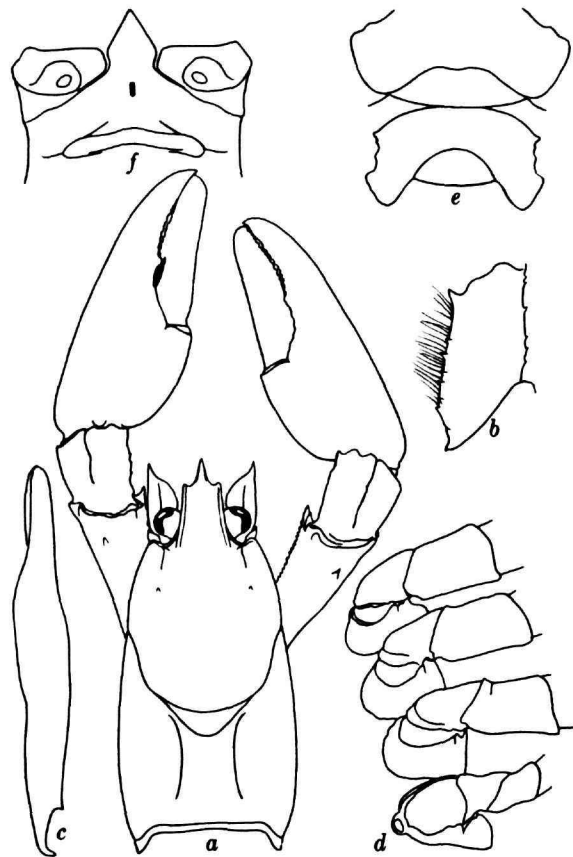


FIGURE 3.—*Pacifastacus leniusculus klamathensis* (Stimpson) from Klamath River, Klamath County, Oregon, U.S.A. (For explanation, see Figure 1).

RANGE.—West and middle Europe.

NUMBER OF SPECIES.—Bott (1950, 1972) recognized three species and five subspecies assigned to two subgenera. Karaman (1962) treated three species and eight subspecies [one of his subspecies, *A. pallipes bispinosus* Karaman, was declared a synonym of *Cambaroides schrenckii* (Kessler, 1874:361) by Holthuis, 1964b:46]; no subgenera were recognized by him.

REFERENCES.—Bott, 1950, 1972; Karaman, 1962; CUITA, 1967.

Genus *Pacifastacus*

FIGURE 3

Pacifastacus Bott, 1950:3, 24. [Type-species, by original designation, *Astacus klamathensis* Stimpson, 1857:87. Gender: masculine.]

DIAGNOSIS.—Carapace usually with at least rudiments of both anterior and posterior postorbital ridges; merus of third maxilliped with row of spines along mesial margin; epistome without spine or ridge posterior to renal papilla; first pleopod of male with distal portion contracted to form narrow tube, lacking lobes apically; exopodite of second pleopod not reaching distal end of endopodite.

RANGE.—Pacific drainage of North America and headwaters of the Missouri River in Wyoming. Introduced into Sweden and Japan.

NUMBER OF SPECIES.—Five species, one of which comprises three subspecies.

REFERENCES.—Faxon, 1885a, 1898; Bott, 1950; Hobbs, 1972b.

Family CAMBARIDAE

CAMBARINAE Hobbs, 1942a:338.

GAMBARINAE Penn, 1957:93 [erroneous spelling].

DIAGNOSIS.—Male exhibiting cyclic dimorphism (first and second form males); first pleopod either bearing shallow sperm groove mesially or distal portion tightly folded with distal end of sperm groove opening on one (central projection) of 2-4 terminal elements. Male with hooks present on ischium of one or more of second through fourth pereopods. Female with or without annulus ventralis and first pleopod. Branchial formula 18 + 3r + ep; 17 + ep; or 16 + ep. Some articles of lateral ramus of antennule bearing either 1 or 2 clusters of aesthetascs.

Subfamily CAMBARINAE

DIAGNOSIS.—First pleopod of male with distal portion tightly folded, and distal end of sperm groove opening on one (central projection) of 2-4 terminal elements; hooks present on ischia of third, fourth, or third and fourth pereopods. Female with fixed or movable annulus ventralis, if latter seldom through arc of as much as 40 degrees; with or without first pleopod. Branchial formula 17 + ep or 16 + ep. Some articles of lateral ramus of antennule bearing 2 clusters of aesthetascs.

Genus *Barbicambarus*

FIGURE 4

Barbicambarus Hobbs, 1969:95, 98. [Type-species, by original designation, *Cambarus cornutus* Faxon, 1884:120. Gender:

masculine. Proposed as subgenus of *Cambarus*; elevated to generic rank by Bouchard, 1972:56.]

DIAGNOSIS.—Antenna heavily fringed on mesial border. Third maxilliped with teeth on mesial margin of ischium. Mesial margin of palm of chela and lateral margin of fixed finger with single row of spiniform tubercles, no more than 12 tubercles in former; opposable margin of dactyl never with prominent excision. Areola broad at midlength. Ischium of third pereopod with hook. Coxa of fourth pereopod with caudomesial boss bearing deep setiferous pit. First pleopods of first form male symmetrical, widely separated at base, and with distal portion of shaft inclined caudally; terminal elements consisting of very short, distally rounded

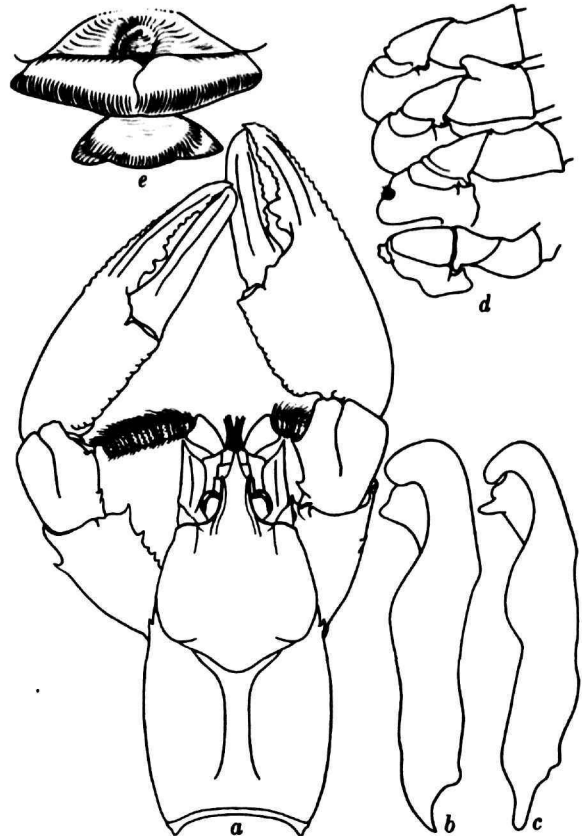


FIGURE 4.—*Barbicambarus cornutus* (Faxon, 1884) from Green River, 3.4 miles northeast of Donansburg, Green County, Kentucky, U.S.A.: a, dorsal view of carapace and chelipeds of male, form I; b, lateral view of first pleopod of male, form II; c, lateral view of first pleopod of male, form I; d, proximal podomeres of second through fifth pereopods; e, annulus ventralis of female.

central projection curved caudally at much more than right angle, and truncate, partially cornified mesial process bearing fingerlike projection reaching caudally beyond tip of central projection. Female with annulus ventralis immovable; first pleopod rudimentary. Branchial formula 17 + ep.

RANGE.—North America: Barren and Green river systems in Kentucky and Tennessee.

NUMBER OF SPECIES.—Monotypic.

REFERENCES.—Faxon, 1884, 1885a; Hobbs, 1969, 1972b.

Genus *Cambarus*

FIGURE 5

- Cambarus* Erichson, 1846:97. [Type-species, by subsequent designation (Faxon, 1898:644), *Astacus Bartonii* Fabricius, 1798:407. Gender: masculine. Proposed as subgenus of *Astacus*; elevated to generic rank by Girard, 1852:88.]
- Cambarus* Huxley, 1890b:81 [erroneous spelling].
- Cambarus* Faxon, 1885b:358 [erroneous spelling].
- Cambarus* Miller, 1895:356 [erroneous spelling].
- Bartonius* Ortmann, 1905a:97. [Type-species, by original designation, "*C. bartoni*" Fabricius, 1798:407. Gender: masculine. Proposed as subgenus of *Cambarus*, treated unintentionally as generic name by Williamson, 1907:749, and declared a synonym of *Cambarus* by Fowler, 1912:341.]
- Canbarus* Thompson, 1967:47 [erroneous spelling].
- Cambaroides* Unestam, 1969:204 [lapsus for *Cambarus*].
- cambarus* Padgett, 1970:19.
- Cambarus* Bouchard, 1973:106 [erroneous spelling].
- Subgenus *Aviticambarus* Hobbs, 1969:96, 99. [Type-species, by original designation, *Orconectes hamulatus* Cope, 1881:881. Gender: masculine.]
- Subgenus *Depressicambarus* Hobbs, 1969:96, 102. [Type-species, by original designation, *Astacus latimanus* LeConte, 1856:402. Gender: masculine.]
- Subgenus *Erebicambarus* Hobbs, 1969:95, 99. [Type-species, by original designation, *Cambarus bartoni tenebrosus* Hay, 1902:232. Gender: masculine.]
- Subgenus *Hiaticambarus* Hobbs, 1969:95, 105. [Type-species, by original designation, *Cambarus longulus* Girard, 1852:90. Gender: masculine.]
- Subgenus *Jugicambarus* Hobbs, 1969:95, 106. [Type-species, by original designation, *Cambarus bartonii asperimanus* Faxon, 1914:391. Gender: masculine.]
- Subgenus *Lacunicambarus* Hobbs, 1969:96, 110. [Type-species, by original designation, *Cambarus diogenes* Girard, 1852:88. Gender: masculine.]
- Subgenus *Puncticambarus* Hobbs, 1969:96, 101. [Type-species, by original designation, *Cambarus extraneus* Hagen, 1870:73. Gender: masculine.]
- Subgenus *Veticambarus* Hobbs, 1969:95, 96. [Type-species, by original designation, *Cambarus pristinus* Hobbs, 1965:268. Gender: masculine.]

DIAGNOSIS.—Antenna never with conspicuous fringe on mesial border. Third maxilliped with teeth on mesial margin of ischium. Mesial margin of palm of chela with row of fewer than 12 tubercles except in albinistic species in which more present; lateral margin of fixed finger never bearing spiniform tubercles; opposable margin of dactyl almost never with prominent excision. Areola broad to obliterated or linear at midlength. Ischium of third pereiopod with hook. Coxa of fourth pereiopod of male with caudomesial boss. First pleopods of first form male symmetrical, contiguous basally, with distal portion of shaft never inclined caudally, and terminating in 2 or 3 distinct parts (mesial process, central projection, and occasionally



FIGURE 5.—*Cambarus (C.) bartonii bartonii* (Fabricius, 1798) from 8.6 miles south of Waynesboro, Augusta County, Virginia, U.S.A. (For explanation, see Figure 4.)

caudal knob; cephalic process always absent), 2 prominent ones bent caudally or caudolaterally between 45 and 100 degrees or with central projection forming arc approaching 180 degrees; central projection bladelike or tapering from base, with or without subapical notch; mesial process subconical, bulbiform, or conspicuously inflated at base, seldom corneous, never appearing twisted or subspatulate distally, and lacking eminence on cephalic (morphological) border; caudal element seldom present, but occasionally represented by knoblike prominence at caudolateral base of central projection. Female with annulus ventralis immovable or with caudal half slightly movable; first pleopod present, rudimentary, or absent. Branchial formula 17 + ep.

RANGE.—North America: From the coastal region of New Brunswick, Canada, southward to the panhandle of Florida, westward to Texas, and northward to Minnesota and southern Ontario.

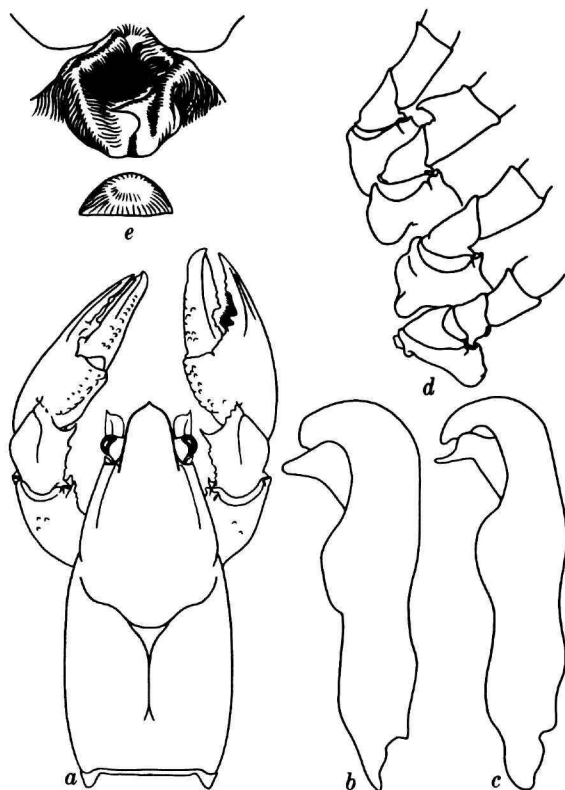


FIGURE 6.—*Fallicambarus fodiens* (Cottle, 1863) from 5 miles west of Ann Arbor, Washtenaw County, Michigan, U.S.A. (For explanation, see Figure 4.)

NUMBER OF SPECIES.—Fifty-five species and three subspecies.

REFERENCES.—Ortmann, 1931; Hobbs, 1969, 1972b.

Genus *Fallicambarus*

FIGURE 6

Fallicambarus Hobbs, 1969:111. [Type-species, by original designation, *Cambarus strawni* Reimer, 1966:11. Gender: masculine.]

DIAGNOSIS.—Antenna never with conspicuous fringe on mesial border. Third maxilliped with teeth on mesial margin of ischium. Mesial margin of palm of depressed chela with row of fewer than 12 tubercles; lateral margin of fixed finger never with row of spines or tubercles; opposable margin of dactyl usually with prominent excision. Areola linear or obliterated at midlength. Ischium of third pereiopod, and sometimes that of fourth, of male with hook. Coxa of fourth pereiopod of male with prominent caudomesial boss. First pleopods of first form male symmetrical, contiguous basally, and terminating in 2 or 3 elements (mesial process, central projection, and, occasionally, cephalic process) bent caudally or caudomesially at angle greater than 95 degrees to main shaft or forming broad arc of almost 180 degrees; central projection bladelike or tapering, and usually lacking subapical notch; mesial process never bulbiform but appearing twisted and often with eminence on cephalic (morphological) border; cephalic process at least partially corneous, situated at mesial base of mesial process, and directed caudad or caudodistad. Female with annulus ventralis only slightly movable; first pleopod present. Branchial formula 17 + ep.

RANGE.—North America: From Texas to Ontario and southward to the panhandle of Florida.

NUMBER OF SPECIES.—Nine.

REFERENCES.—Hobbs, 1969, 1972b.

Genus *Faxonella*

FIGURE 7

Faxonella Creaser, 1933:21. [Type-species, by monotypy, *Cambarus clypeatus* Hay, 1899:122. Gender: feminine. Proposed as a subgenus of *Faxonius*; elevated to generic rank by Fitzpatrick, 1963:61, and questionably by Creaser, 1962:3.]

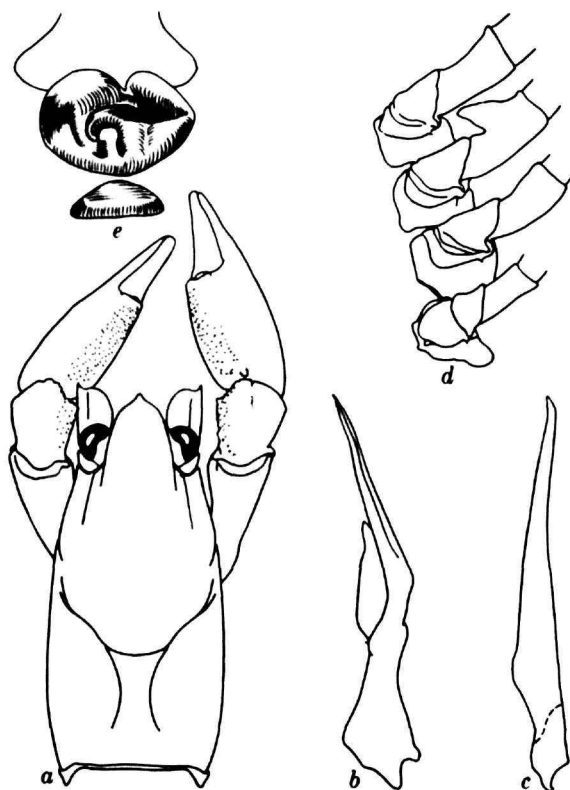


FIGURE 7.—*Faxonella clypeata* (Hay, 1899) from 6.2 miles east of Midway, Barbour County, Alabama, U.S.A. (For explanation, see Figure 4; except *b*, caudal view of first pleopod of male, form I.)

DIAGNOSIS.—Antenna never with conspicuous fringe on mesial border. Third maxilliped with teeth on mesial margin of ischium. Mesial margin of palm of chela with or without much reduced tubercles; lateral margin of fixed finger never with row of spines or tubercles; opposable margin of dactyl never with prominent excision. Areola moderately broad at midlength. Ischium of third pereiopod of male with hook. Coxa of fourth pereiopod of male without caudomesial boss. First pleopods of first form male symmetrical, contiguous basally, and terminating in one long (central projection) and one short (mesial process) element, latter no more than half length of former; central projection of paired appendages always overlapping. Female with annulus ventralis freely movable; first pleopod rudimentary to virtually absent. Branchial formula 17 + ep.

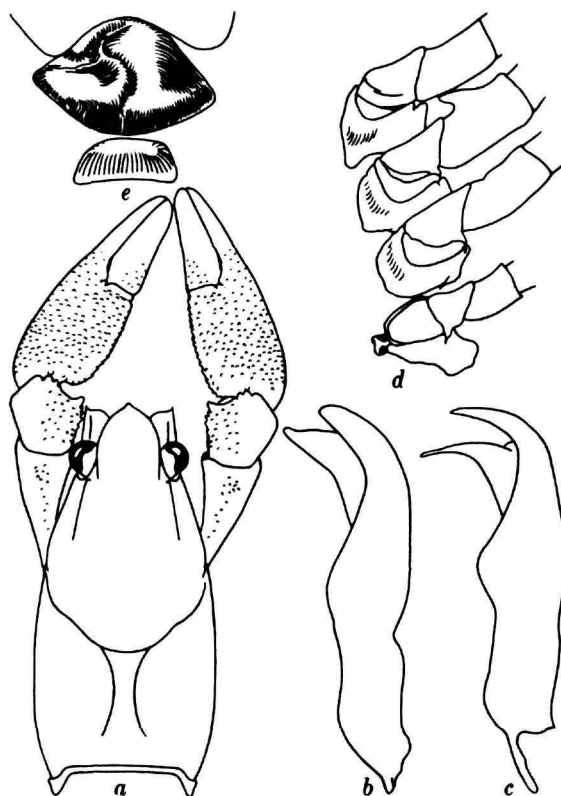


FIGURE 8.—*Hobbseus cristatus* (Hobbs, 1955) from Scooba Creek, 2 miles south of Scooba, Kemper County, Mississippi, U.S.A. (For explanation, see Figure 4.)

RANGE.—North America: Oklahoma and Texas east to Gadsden County, Florida, and Richland County, South Carolina.

NUMBER OF SPECIES.—Three.

REFERENCES.—Fitzpatrick, 1963; Hobbs, 1972b.

Genus *Hobbseus*

FIGURE 8

Hobbseus Fitzpatrick and Payne, 1968:15. [Type-species, by original designation, *Cambarus cristatus* Hobbs, 1955:95. Gender: masculine.]

DIAGNOSIS.—Antenna never with conspicuous fringe on mesial border. Third maxilliped with teeth on mesial margin of ischium. Mesial margin of palm of depressed chela with row of more than 12 tubercles; lateral margin of fixed finger never with row of spiniform tubercles; opposable margin of dactyl never with prominent excision. Areola

moderately broad at midlength. Ischium of third pereiopod with hook. Coxa of fourth pereiopod never with prominent caudomesial boss. First pleopod of first form male symmetrical or slightly asymmetrical, deeply withdrawn between bases of pereiopods and largely hidden by dense setal mat extending from ventrolateral margin of sternum, and terminating in two distinct parts (mesial process and central projection) almost straight, bent caudally as much as 159 degrees, or forming broad arc of as much as 180 degrees; central projection tapering to point distally and lacking subterminal notch; mesial process never bulbiform, with slender distal portion, and lacking eminence on cephalic (morphological) border. Female with annulus ventralis freely movable; first pleopod present. Branchial formula 17 + ep.

RANGE.—North America: Eastern Mississippi and western Alabama.

NUMBER OF SPECIES.—Five.

REFERENCES.—Fitzpatrick and Payne, 1968; Hobbs, 1969, 1972b.

Genus *Orconectes*

FIGURE 9

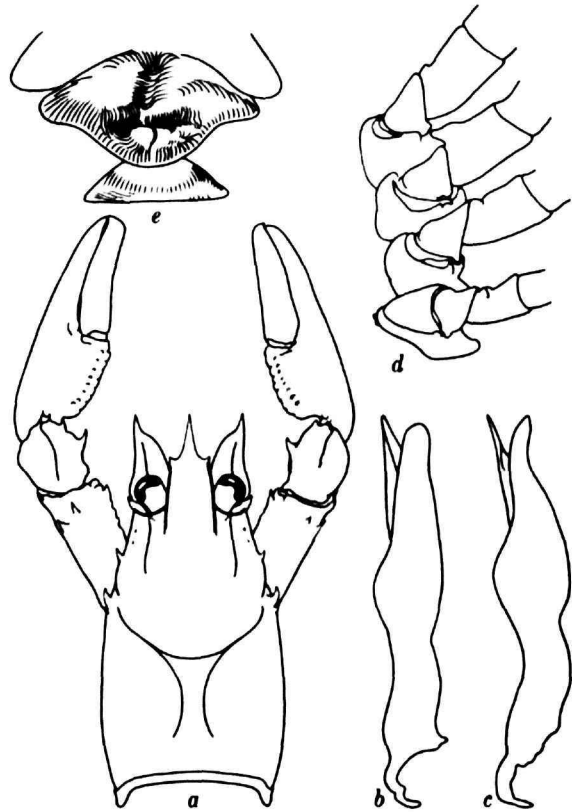


FIGURE 9.—*Orconectes limosus* (Rafinesque, 1817) from Cattail Branch at Route 97, Howard County, Maryland, U.S.A. (For explanation, see Figure 4.)

- Orconectes* Cope, 1872:419. [Type-species, by subsequent designation (Fowler, 1912:339), *Orconectes inermis* Cope, 1872:419. Gender: masculine.]
- Camtarus* Packard, 1888:156 [erroneous spelling].
- Cambrus* Price, 1900:155 [erroneous spelling].
- Orconectis* Harris, 1903:11 [erroneous spelling].
- Camborus* Clawson, 1905:103 [erroneous spelling].
- Faxonius* Ortmann, 1905a:97. [Type-species, by original designation, *Astacus limosus* Rafinesque, 1817:42. Gender: masculine. Proposed as subgenus of *Cambarus*, elevated to generic rank by Creaser, 1933:1, and declared synonym of *Orconectes* by Hobbs, 1942a:352.]
- G[ambarus]* Ortmann, 1905a:112 [incomplete spelling].
- Cityphlobius* Joleaud, 1939:14 [error for *C. typhlobius*].
- Cambarrus* Fleming, 1939:305 [erroneous spelling].
- Orconectes* Williams, 1952:330 [erroneous spelling].
- Gambarus* Croizat, 1958:908 [erroneous spelling].
- Camburus* Bacescu, 1967:218 [erroneous spelling].
- Oronectes* Bacescu, 1967:218 [erroneous spelling].
- Orchonectes* Dimond et al., 1968:760 [erroneous spelling].
- Orconectus* Ray and Stevens, 1970:58 [erroneous spelling].
- Orconectes* Molley and Prins, 1973:70 [erroneous spelling].

DIAGNOSIS.—Antenna never with conspicuous fringe on mesial border. Third maxilliped with teeth on mesial margin of ischium. Mesial margin of palm of chela usually with row of less than 12

tubercles; lateral margin of fixed finger never bearing row of spiniform tubercles; opposable margin of dactyl seldom with prominent excision. Areola broad to obliterated at midlength. Ischium of third, rarely third and fourth, pereiopod with hook. Coxa of fourth pereiopod of male lacking caudomesial boss except in troglobitic members. First pleopod of first form male almost always symmetrical, never deeply withdrawn between bases of pereiopods nor concealed by dense setal mat extending from ventrolateral margins of sternum, and contiguous basally; terminal elements (usually 2, occasionally 3 in troglobitic members) highly variable in length and disposition—divergent, straight, or curved caudo-distally or caudally; central projection never abruptly curved caudally at base nor forming arc of more than 90 degrees. Female with annulus ventralis immovable or slightly movable in troglobitic

species; first pleopod usually present. Branchial formula 17 + ep.

RANGE.—North America: Arizona and Alberta eastward to the Atlantic Ocean except eastern seaboard from South Carolina to Florida; also in Rogue River in Oregon. Introduced into western Europe.

NUMBER OF SPECIES.—Sixty-three species and seven subspecies.

REFERENCES.—Ortmann, 1931; Rhoades, 1944; Williams, 1954; Fitzpatrick, 1967; Crocker and Barr, 1968; Hobbs, 1972b.

Genus *Procambarus*

FIGURE 10

Cambarus Ortmann, 1905a:96 (not Erichson, 1846). [Type-species, by original designation, *Astacus Blandingii* Harlan, 1830:464. Gender: masculine. Proposed as typical subgenus, but type-species previously selected by Faxon, 1898:644, *Astacus Bartonii* Fabricius, 1798:407.]

Procambarus Ortmann, 1905c:455, 457. [Type-species, by subsequent designation (Fowler, 1912:340), *Cambarus Digueti* Bouvier, 1897:225. Gender: masculine. Proposed as subgenus of *Cambarus*, elevated to generic rank by Hobbs, 1942a:341.]

Paracambarus Ortmann, 1906:1. [Type-species, by monotypy, *Cambarus (Paracambarus) paradoxus* Ortmann, 1906:3. Gender: masculine. Proposed as subgenus of *Cambarus*, elevated to generic rank by Hobbs, 1942a:344, and reduced to subgenus of *Procambarus* by Hobbs, 1972a:10.]

Ortmannicus Fowler, 1912:34, 341. [Type-species, by original designation, *Astacus Blandingii* Harlan, 1830:464. Gender: masculine. Replacement name for Ortmann's subgenus *Cambarus*, utilized as generic name by Rhoades, 1944:114, and as a subgenus of *Procambarus* by Hobbs, 1972a:2-5, 9.]

Cambarellus Creaser, 1933:21 [lapsus for *Cambarus*].

procambarus Padgett, 1970:19.

Subgenus *Girardiella* Lyle, 1938:76. [Type-species, by monotypy, *Cambarus Hagenianus* Faxon, 1884:141. Gender: feminine.]

Subgenus *Acucauda* Hobbs, 1972a:3-5. [Type-species, by original designation, *Procambarus fitzpatricki* Hobbs, 1971a:461. Gender: feminine.]

Subgenus *Austrocambarus* Hobbs, 1972a:2-5. [Type-species, by original designation, *Procambarus vazquezae* Villalobos, 1954:328. Gender: masculine.]

Subgenus *Capillicambarus* Hobbs, 1972a:3-4, 6. [Type-species, by original designation, *Cambarus (Cambarus) hinei* Ortmann, 1905b:401. Gender: masculine.]

Subgenus *Hagenides* Hobbs, 1972a:2-4, 7. [Type-species, by original designation, *Astacus advena* LeConte, 1856:402. Gender: masculine.]

Subgenus *Leonticambarus* Hobbs, 1972a:2-5, 7. [Type-species, by original designation, *Cambarus barbatus* Faxon, 1890:621. Gender: masculine.]

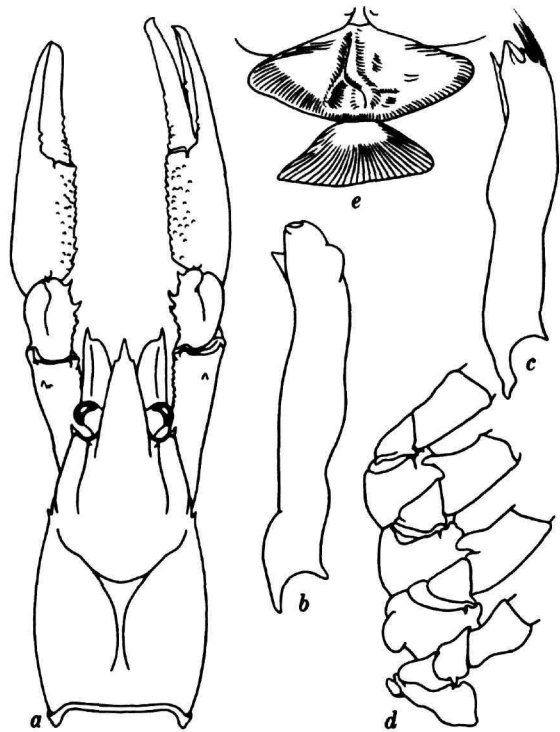


FIGURE 10.—*Procambarus (Ortmannicus) blandingii* (Harlan, 1830) from Town Creek, 3 miles south of Camden, Kershaw County, South Carolina, U.S.A. (For explanation, see Figure 4).

Subgenus *Lonnbergius* Hobbs, 1972a:2-4, 8. [Type-species, by original designation, *Cambarus acherontis* Lönnberg, 1895:6. Gender: masculine.]

Subgenus *Mexicambarus* Hobbs, 1972a:3, 4, 8. [Type-species, by original designation, *Cambarus (Cambarus) bowieri* Ortmann, 1909:159. Gender: masculine.]

Subgenus *Pennides* Hobbs, 1972a:2-4, 10. [Type-species, by original designation, *Procambarus natchitochae* Penn, 1953:5. Gender: masculine.]

Subgenus *Remoticambarus* Hobbs, 1972a:3, 4, 11. [Type-species, by original designation, *Procambarus pecki* Hobbs, 1967:2. Gender: masculine.]

Subgenus *Scapulicambarus* Hobbs, 1972a:2, 3, 5. [Type-species, by original designation, *Cambarus clarkii paeninsulanus* Faxon, 1914:369. Gender: masculine.]

Subgenus *Tenuicambarus* Hobbs, 1972a:3, 5, 12. [Type-species, by original designation, *Procambarus tenuis* Hobbs, 1950:194. Gender: masculine.]

Subgenus *Villalobosus* Hobbs, 1972a:3, 5, 12. [Type-species, by original designation, *Paracambarus riojae* Villalobos, 1944:161. Gender: masculine.]

DIAGNOSIS.—Antenna never with conspicuous fringe on mesial border. Third maxilliped with

teeth on mesial margin of ischium. Mesial margin of palm of chela with none to many tubercles; lateral margin of fixed finger never bearing spiniform tubercles; opposable margin of dactyl occasionally with prominent excision. Areola broad to obliterated at midlength. Ischia of third, fourth, or third and fourth pereiopods of male with hook. Coxa of fourth pereiopod of male with or without caudomesial boss. First pleopods of first form male symmetrical or asymmetrical, sometimes deeply withdrawn between bases of pereiopods and at least partially concealed by setae extending from ventrolateral margin of sternum; subcontiguous, contiguous, or partially overlapping basally, and terminating in 2 or more, usually 3 or 4 elements; presence of subterminal setae in many members of genus unique; terminal elements highly variable in form and disposition; if only 2 elements present (mesial process and central projection), shoulder present on distal third of cephalic surface of appendage, or central projection forming distally projecting triangular plate, or central projection arising from caudal margin of enlarged terminal region; if more than 2 elements present, central projection seldom bladeliike, if so, directed laterodistally or lacking subterminal notch, and elements never bent caudally at angle of so much as 90 degrees. Female with annulus ventralis freely movable, although sometimes partially covered ventrally by caudally projecting prominences from sternal plate immediately cephalic to it; first pleopod usually present. Branchial formula 17 + ep.

RANGE.—North America: Guatemala and Cuba to Minnesota and southern New England, except in mountains. Introduced into California, Hawaii, and Japan.

NUMBER OF SPECIES.—One hundred seventeen species and six subspecies.

REFERENCES.—Hobbs, 1942a, 1942b, 1962, 1972a, 1972b; Villalobos, 1955; Penn, 1959.

Genus *Troglocambarus*

FIGURE 11

Troglocambarus Hobbs, 1942a:334, 339, 341, 345. [Type-species, by original designation, *Troglocambarus maclanei* Hobbs, 1942a:345. Gender: masculine.]

DIAGNOSIS.—Albinistic, eyes reduced and without pigment. Antenna never with conspicuous fringe

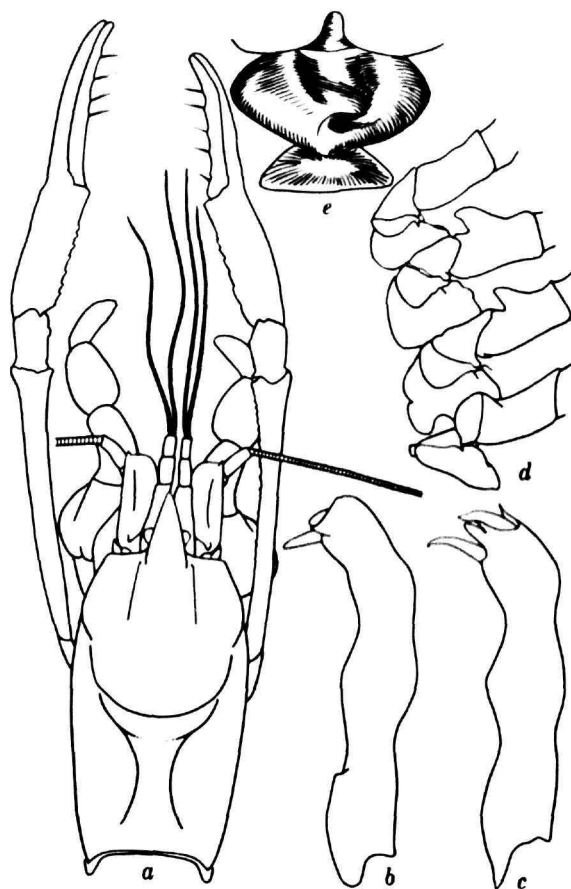


FIGURE 11.—*Troglocambarus maclanei* Hobbs, 1942, from Squirrel Chimney (Sec. 21, Twp. 9S, R. 18E), Alachua County, Florida, U.S.A. (For explanation, see Figure 4.)

on mesial border. Third maxilliped greatly enlarged and without teeth on mesial margin of ischium. Mesial margin of palm of chela weakly tuberculate or smooth; lateral margin of fixed finger lacking row of spines; opposable margin of dactyl without prominent excision. Areola broad at midlength. Ischium of third and fourth pereiopods with hooks. Coxa of fourth pereiopod of male with caudomesial boss. First pleopod of first form male asymmetrical, not conspicuously withdrawn between bases of pereiopods, partially overlapping basally, and terminating in 4 distinct elements: mesial process slender, acute, and directed caudolaterally; cephalic process acute and partially hooding cephalic base of central projection; central projection large, some-

what beaklike, with apex directed caudally; and caudal element consisting of rudimentary caudal knob and bladelike caudal process situated along caudolateral base of central projection. Female with annulus ventralis freely movable; first pleopod rudimentary. Branchial formula 16 + ep.

RANGE.—North America: Peninsular Florida.

NUMBER OF SPECIES.—Monotypic.

REFERENCES.—Hobbs, 1942a, 1972b.

Subfamily CAMBARELLINAE

CAMBARELLINAE Laguarda, 1961:69. [Originally proposed as a subfamily of the Astacidae.]

DIAGNOSIS.—Male with hooks on ischia of second and third pereopods; first pleopod with distal portion tightly folded, and distal end of sperm groove opening on one (central projection) of 3 terminal elements (mesial and caudal processes and central projection). Female with annulus ventralis freely

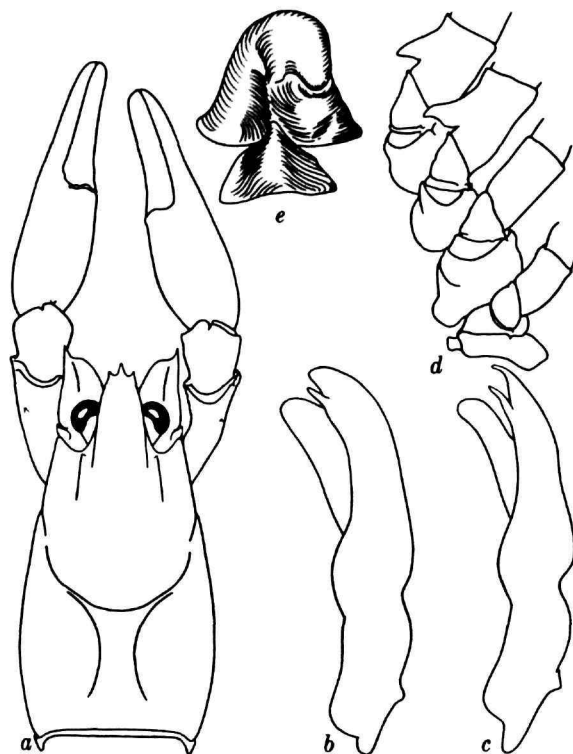


FIGURE 12.—*Cambarellus montezumae* (Saussure, 1858) from near Pachuca, Hidalgo, Mexico. (For explanation, see Figure 4).

movable through arc of at least 75 degrees; first pleopod lacking. Branchial formula 16 + ep (posterior arthrobranch absent at base of fourth pereopod). Some articles of lateral ramus of antennule bearing 2 clusters of aesthetascs.

Genus *Cambarellus*

FIGURE 12

Cambarellus Ortmann, 1905a:97, 106. [Type-species, by original designation, *Cambarus Montezumae* Saussure, 1857:102. Gender: masculine. Proposed as subgenus of *Cambarus*; elevated to generic rank by Hobbs, 1942a:350.]

Cambarella Carlisle and Knowles, 1959:50, 51 [erroneous spelling].

DIAGNOSIS.—Same as that of subfamily.

RANGE.—North America: Pacific slope and central plateau of Mexico, coastal area along the Gulf of Mexico from Texas to the Suwannee River in Florida, and northward in the Mississippi Basin to southern Illinois.

NUMBER OF SPECIES.—Twelve.

REFERENCES.—Villalobos, 1955; Penn, 1959; Hobbs, 1972b.

Subfamily CAMBAROIDINAE

CAMBAROIDINAE Villalobos, 1955:7 [originally proposed as a subfamily of the Astacidae].—Laguarda, 1961:17, 69, 70.

DIAGNOSIS.—Male with hooks on ischia of second and third pereopods; first pleopod with distal portion not complexly folded, instead bearing shallow sperm groove with distal extremity situated cephalomesially or cephalically and not on any of 3 or more terminal elements. Female lacking annulus ventralis (sclerite present but without sinus and fossa); first pleopods lacking. Branchial formula 18 + 3r + ep. Articles of lateral ramus of antennule bearing only one cluster of aesthetascs.

Genus *Cambaroides*

FIGURE 13

Astacus Pallas, 1772:81. [Type-species, by monotypy, *Astacus Dauuricus* Pallas, 1772:81. Gender: masculine. Name suppressed by International Commission on Zoological Nomenclature in Direction 12 (1955).]

Cambaroides Faxon, 1884:149, 150. [Type-species, by subsequent designation (Faxon, 1898:665), *Astacus japonicus* De



FIGURE 13.—*Cambaroides similis* (Koelbel, 1892) from near Pusan, Korea. (For explanation, see Figure 4.)

Haan, 1842:164. Gender: masculine. Originally proposed as a subgenus of *Astacus*; elevated to generic rank by Skorikov, 1908:116.]

Gambaroides Parisi, 1917:17 [erroneous spelling].

Camberoides Sowerby, 1922:58 [erroneous spelling].

DIAGNOSIS.—Same as that of subfamily.

RANGE.—Eastern Asia: Amur Basin, Korea, and Japan.

NUMBER OF SPECIES.—Four species. Birstein and Vinogradov (1934) recognized, in addition to the nominate subspecies, two subspecies of *C. dauricus* (Pallas) and one of *C. schrenckii* (Kessler, 1874: 363).

REFERENCES.—Faxon, 1884, 1885a, 1898; Skorikov, 1908; Birstein and Vinogradov, 1934.

Superfamily PARASTACOIDEA

PARASTACIDAE Huxley, 1879:771, 775.

PARASTACINAE Ortmann, 1891:5, 7.

AUSTROASTACIDAE Clark, 1936:8. [Synonymized, by implication, with Parastacidae by Riek, 1959:255.]

EUASTACIDAE Riek, 1959:255. [Synonymized with Parastacidae by Riek, 1969:861.]

DIAGNOSIS.—Carapace lacking dorsomedian, longitudinal suture or ridge in cardiac and posterior gastric regions. Sternal plate between fifth pereopods not fused with sternal complex anteriorly. Telson never completely divided by transverse suture. Podobranchiae of first three pereopods not differentiated into branchial and epipoditic portions and lacking bilobed plaited laminae; epipodite of first maxilliped usually with branchial filaments. Branchial formula ranging from $12 + epr + 5r$ to $21 + ep$. Articles of lateral ramus of antennule never with more than one cluster of aesthetascs. First pleopod absent in male and female; second pleopod similar to third. Eggs large and hatching as miniatures of adult. All members occurring in fresh water.

Family PARASTACIDAE

DIAGNOSIS.—Same as that of superfamily.

Genus *Astacoides*

FIGURE 14

Astacoides Guérin-Méneville, 1839:109. [Type-species, by monotypy, *Astacoides Goudotii* Guérin-Méneville, 1839:109, a subjective junior synonym of *Astacus madagascarensis* H. Milne Edwards and Audouin, 1839:152. Gender: masculine.]

DIAGNOSIS.—Carapace with conspicuous spines or tubercles, in addition to rostral, postorbital, branchiostegal, and cervical; anterolateral portion of branchiocardiac groove extremely narrowly separated from, and parallel to, cervical groove dorso-laterally; viewed dorsally, cervical groove broadly U-shaped and deeply impressed; postorbital ridges weak to almost obsolete. Abdomen with spines or tubercles on pleura of one or more segments; pleuron of first abdominal segment distinct and partially overlapped by that of second. Telson sometimes with spines dorsally, with or without faint transverse suture laterally, and entirely calcified. Third maxilliped with ventral surface bearing scattered setiferous punctations; distolateral portion produced in heavy spine; exopodite reduced, not reaching distolateral extremity of ischium. Chela

with ventrolateral margin tuberculate or costate but never with 2 rows of heavy spines or tubercles; when upper surface of carpus of cheliped held in horizontal plane, dactyl moving subhorizontally; carpus of cheliped with enlarged spines or tubercles mesially and ventrally. Male genitalia, situated on ventral surface of coxa, consisting of slender articulated, partially sclerotized cylinder with subapical setae. Branchial formula 12 + epr + 5r; pleurobranch on segment XIV only, and anterior arthrobranch on segment VIII and posterior arthrobranchiae on segments X through XIII rudimentary; stem of podobranchiae without winglike expansion.

RANGE.—Madagascar.

NUMBER OF SPECIES.—One species comprising four subspecies.

REFERENCES.—Monod and Petit, 1929; Holthuis, 1964a.



FIGURE 14.—*Astacoides madagascarensis betsileoensis* Petit, 1923, purchased in market place in Tananarive, Madagascar: a, dorsal view of carapace and chelipeds of male; b, lateral view of first three abdominal segments; c, dorsal view of telson; d, ventral view of ischium and exopodite of third maxilliped; e, basal podomeres of fifth pereopod illustrating male genitalia on mesial surface of coxa.

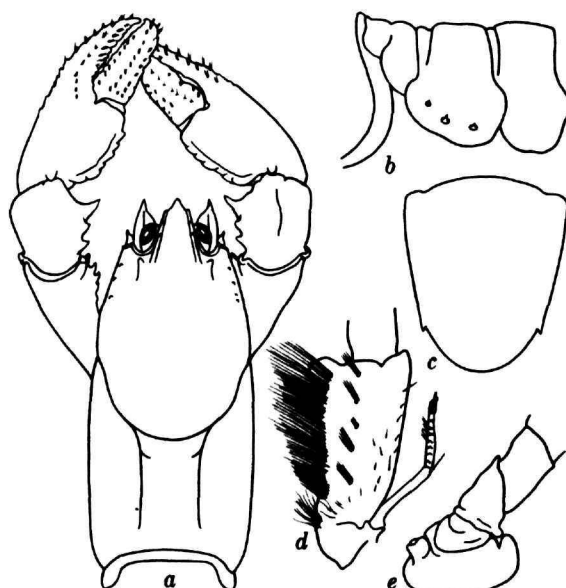


FIGURE 15.—*Astacopsis fluviatilis* Riek, 1969, from Hobart, Tasmania, Australia. (For explanation, see Figure 14.)

Genus *Astacopsis*

FIGURE 15

Astacopsis Huxley, 1879:760, 764. [Type-species, by monotypy, *Astacus franklinii* Huxley, 1879:764 (not Gray, 1845:409), (= *Astacopsis gouldi* Clark, 1936:35). Gender feminine.]

DIAGNOSIS.—Carapace with spines or tubercles, other than rostral, postorbital, branchiostegal, and cervical; anterolateral extremity of branchiocardiac groove fusing with cervical groove rather high on carapace. Abdomen with spines on pleura of only first and second abdominal segments; pleuron of first abdominal segment distinct and partially overlapped by that of second. Telson with no trace of transverse suture and entirely calcified. Third maxilliped with ventral surface of ischium provided with one row of large punctations bearing clusters of stiff setae, and often produced distolaterally in acute prominence; exopodite reduced, never reaching distal end of ischium. Chela with ventrolateral margin usually bearing 2 rows of spines, occasionally only one; when upper surface of carpus of cheliped held in horizontal plane, dactyl moving subhorizontally; carpus of cheliped with 2-4 large spines mesially and 1 or 2 on, or adjacent to, ventrodistal margin. Male genitalia consisting of short papilla

bearing calcified ring. Branchial formula 21 + epr; stem of podobranch continuous to apex of gill but without winglike expansion; 6 posterior arthrobranchiae very reduced.

RANGE.—Australia: Northwestern and central southern part of Tasmania.

NUMBER OF SPECIES.—Four.

REFERENCES.—Clark, 1936, 1939; Riek, 1969.

Genus *Cherax*

FIGURE 16

Cherax Erichson, 1846:88. [Type-species, by monotypy, *Astacus* (*Cheraps*) *Preissii* Erichson, 1846:101. Gender: masculine. Proposed as subgenus of *Astacus* with two spellings; elevated to generic rank with third spelling by Huxley, 1879:769; placed on official list of generic names by International Commission on Zoological Nomenclature, Opinion 519 (Hemming, 1958).]

Cheraps Erichson, 1846:101 [erroneous spelling].

Cherops Von Martens, 1869:516.—Bate, 1888:193 [erroneous spelling].

Chaeraps Huxley, 1879:752, 755, 764, 767-771, 775, 776, 786 [erroneous spelling].

Chaerops Huxley, 1880b:79 [erroneous spelling].

Astaconephrops Nobili, 1899:244. [Type-species, by monotypy, *Astaconephrops* *Albertisii* Nobili, 1899:244. Gender: masculine.]

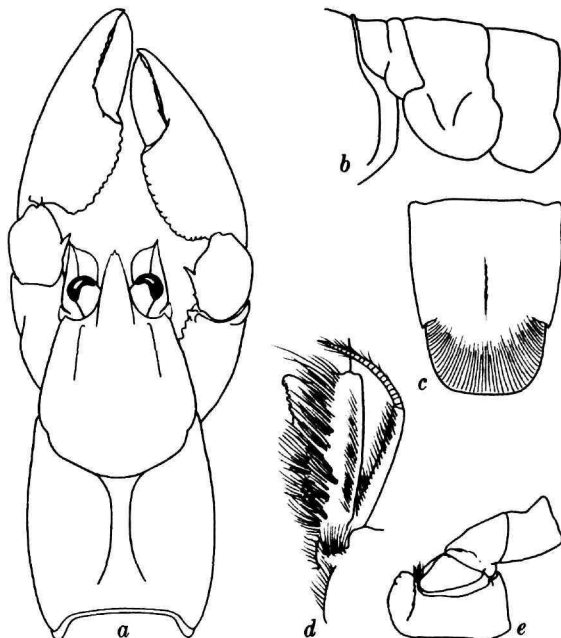


FIGURE 16.—*Cherax albidus* Clark, 1951, from Hawthorne, Victoria, Australia. (For explanation, see Figure 14.)

Parachaeraps Smith, 1912:145, 148, 150-153, 161. [Type-species, by monotypy, *Astacus* *bicarinatus* Gray, 1845:410. Gender: masculine.]

Paracheraps Baer, 1945:505, 509, 510 [erroneous spelling].

DIAGNOSIS.—Carapace smooth, punctate, or finely granulate, rarely with spines or tubercles other than rostral, postorbital, branchiostegal, and cervical; anterolateral extremity of branchiocardiac groove fused with cervical groove rather high on carapace. Abdomen rarely with spines or tubercles on pleura; pleuron of first abdominal segment distinct and partially overlapped by that of second. Telson usually without indication of transverse suture and with posterior part membranous. Third maxilliped with mesial half of ventral surface of ischium completely covered with tufts of long setae; distolateral extremity of ischium subangular, only slightly, if at all, produced; exopodite usually reaching beyond distal end of ischium. Chela with ventrolateral margin lacking spines or large tubercles, sometimes with noncalcified area; when upper surface of carpus of cheliped held in horizontal plane, dactyl moving subhorizontally; carpus of cheliped with 0-4 large spines mesially and 1 to several on or adjacent to ventrodistal margin. Male genitalia, situated on mesial surface of coxa, consisting of complex uncalcified papilla. Branchial formula 21 + epr; stem of podobranchiae produced in broad winglike expansion.

RANGE.—Australia and New Guinea: Eastern half and extreme southwestern part of Australia; New Guinea, Aru Islands, and Misool.

NUMBER OF SPECIES.—Thirty-nine species and three subspecies.

REFERENCES.—Clark, 1936; Holthuis, 1949; Riek, 1969.

Genus *Engaeus*

FIGURE 17

Engaeus Erichson, 1846:88, 89, 102. [Type-species, by subsequent designation (Clark, 1936:37), *Astacus* (*Engaeus*) *fossor* Erichson, 1846:102. Gender: masculine. Proposed as subgenus of *Astacus*; elevated to generic rank by Huxley, 1879:769.]

Eugaeus Huxley, 1880b:79 [erroneous spelling].

Pseudengaeus Clark, 1936:47. [Type-species, by original designation, *Pseudengaeus* *strictifrons* Clark, 1936:47. Gender: masculine. Synonymized with *Engaeus* by Riek, 1969:863.]

Austroastacus Clark, 1936:51. [Type-species, by original designation, *Engaeus* *hemircirratulus* Smith and Schuster, 1913:

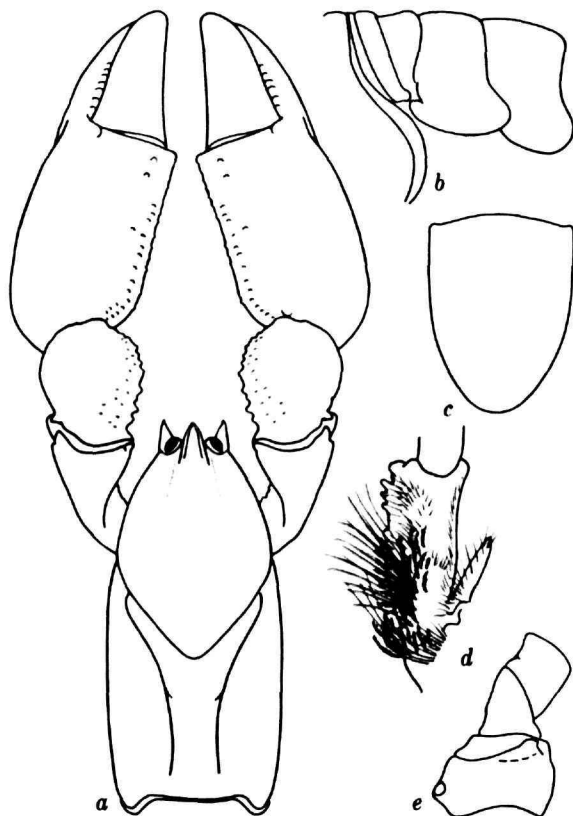


FIGURE 17.—*Engaeus orientalis* Clark, 1941, from 4 miles north of Bonong, Victoria, Australia. (For explanation, see Figure 14.)

123. Gender: masculine. Synonymized with *Engaeus* by Riek, 1969:863.]

DIAGNOSIS.—Carapace generally smooth, rarely with granules or tubercles; anterolateral portion of branchiocardiac groove widely separated from, and parallel to, cervical groove almost to midheight of carapace; viewed dorsally, cervical groove tending toward V-shape and not deeply impressed; post-orbital ridges obsolete. Abdomen smooth or punctate and conspicuously narrow; pleuron of first abdominal segment greatly reduced and not partially covered by anterior lobe of pleuron of second. Telson with no trace of transverse suture and entirely calcified. Third maxilliped with mesial half of ventral surface of ischium bearing dense tufts of stiff and plumose setae; distolateral extremity of ischium angular or rounded, only slightly produced; exop-

odite reduced, vestigial, or absent, never reaching distal end of ischium. Chela with ventrolateral margin rounded, lacking spines or large tubercles; when upper surface of carpus of cheliped held in horizontal plane, dactyl moving subvertically; carpus of cheliped without enlarged spines or tubercles mesially or ventrally, but often with row of small tubercles dorsomesially or mesiodistally. Male genitalia consisting of small simple papilla. Branchial formula $21 + epr$; stem of podobranchiae not produced in winglike expansion.

RANGE.—Australia: Victoria, New South Wales, and Tasmania.

NUMBER OF SPECIES.—Twenty-three.

REFERENCES.—Clark, 1936, 1939; Riek, 1969.

Genus *Engaewa*

FIGURE 18

Engaewa Riek, 1967a:106. [Type-species, by original designation, *Engaewa subcoerulea* Riek, 1967a:107. Gender: feminine.]

DIAGNOSIS.—Carapace smooth; anterolateral por-

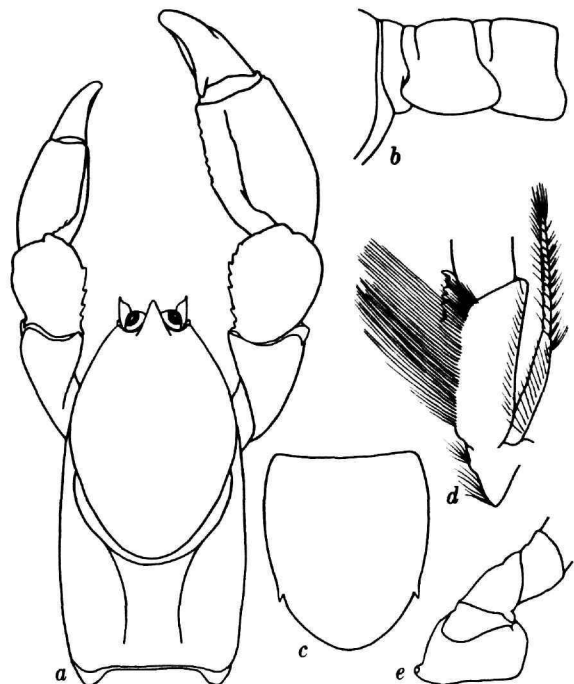


FIGURE 18.—*Engaewa subcoerulea* Riek, 1967, from Walpole, Western Australia, Australia. (For explanation, see Figure 14.)

tion of branchiocardiac groove widely separated from, and parallel to, cervical groove almost to mid-height of carapace; viewed dorsally, cervical groove broadly U-shaped and deeply impressed; postorbital ridges absent. Abdomen smooth; pleuron of first abdominal segment partially overlapped by anterior lobe of pleuron of second. Telson without transverse suture and entirely calcified. Third maxilliped with mesial portion of ventral surface of ischium bearing long stiff setae, otherwise without setae except for submarginal lateral row; exopodite well developed, extending beyond distal extremity of ischium. Chela with ventrolateral margin smooth; when upper surface of carpus of cheliped held in horizontal plane, dactyl moving subvertically; carpus of cheliped without enlarged spines or tubercles mesially or ventrally, feebly tuberculate dorsomesially. Male genitalia consisting of simple small papilla. Branchial formula 21 + ep, all four pleurobranchiae present; stem of podobranchiae with small winglike expansion.

RANGE.—Australia: Western Australia.

NUMBER OF SPECIES.—Three.

REFERENCES.—Riek, 1967a, 1969.

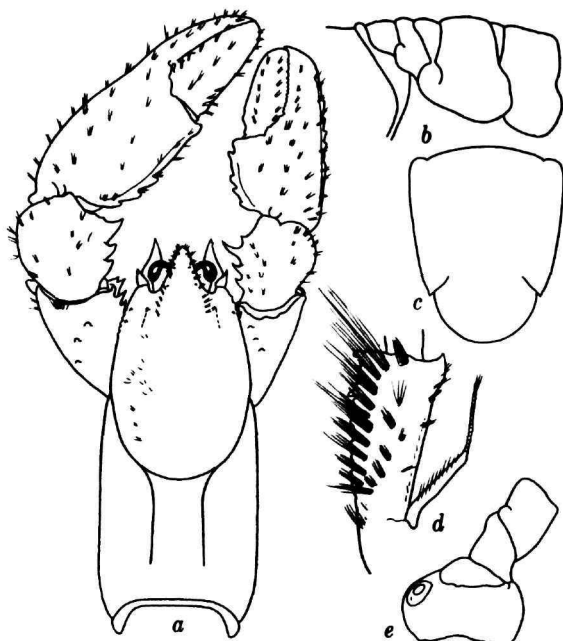


FIGURE 19.—*Euastacoides setosus* Riek, 1956, from unknown locality. (For explanation, see Figure 14.)

Genus *Euastacoides*

FIGURE 19

Euastacoides Riek, 1956:4. [Type-species, by original designation, *Euastacoides setosus* Riek, 1956:4. Gender: masculine.]

DIAGNOSIS.—Carapace with dense setiferous punctations and very small tubercles; anterolateral extremity of branchiocardiac groove fused with cervical groove rather high on carapace. Abdomen without spines but pleura provided with dense setiferous punctations; pleuron of first abdominal segment distinct and partially overlapped by that of second. Telson divided laterally by transverse suture; posterior portion membranous. Third maxilliped with ventral surface of ischium provided with one row of large punctations bearing clusters of stiff setae, and produced distolaterally in acute prominence; exopodite reduced, never reaching distal end of ischium. Chela with ventrolateral margin bearing single row of spines; when upper surface of carpus of cheliped held in horizontal plane, dactyl moving subhorizontally; carpus of cheliped with 2–4 large spines mesially and irregularly arranged small spines or tubercles on or adjacent to ventrodiscal margin. Male genitalia consisting of short papilla bearing calcified ring. Branchial formula 21 + epr; stem of podobranchiae, except on fourth pereopod, produced in winglike expansion.

RANGE.—Australia: Queensland.

NUMBER OF SPECIES.—Two.

REFERENCES.—Riek, 1956, 1969.

Genus *Euastacus*

FIGURE 20

Euastacus Clark, 1939:10. [Type-species, by original designation, *Cancer serratus* Shaw, 1794:21 (see Riek, 1969:869, 893, 894). Gender: masculine.]

Euastacus Riek, 1956:6 [erroneous spelling].

DIAGNOSIS.—Carapace with spines or tubercles other than rostral, postorbital, branchiostegal, and cervical; anterolateral extremity of branchiocardiac groove fusing with cervical groove rather high on carapace. Abdomen often with 3 or more rows of spines or tubercles, sometimes confined to margins of one or more pleura; pleuron of first abdominal segment distinct and partially overlapped by that of second. Telson, frequently with spines dorsally, divided laterally by transverse suture; posterior por-

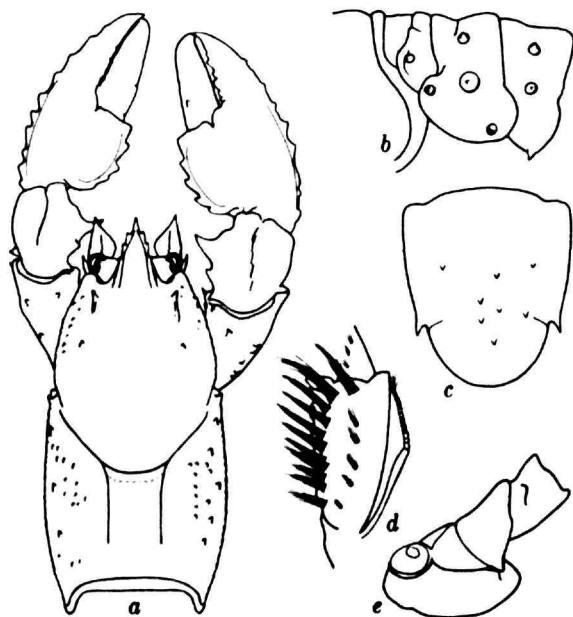


FIGURE 20.—*Euastacus bispinosus* Clark, 1941, from Otways, Beauchamp Falls, Victoria, Australia. (For explanation, see Figure 14.)

tion membranous. Third maxilliped with ventral surface of ischium provided with one row of large punctations bearing clusters of stiff setae, and produced distolaterally in acute prominence; exopodite much reduced, but flagellum often reaching distal end of ischium. Chela with ventrolateral margin bearing one row of spines and usually with additional row or subparallel low carina; when upper surface of carpus of cheliped held in horizontal plane, dactyl moving subhorizontally; carpus of cheliped with 2-4 large spines mesially and 1 or 2 on, or adjacent to, ventrodistal margin. Male genitalia, situated on ventral surface of coxa, consisting of short papilla bearing calcified ring. Branchial formula 21 + epr; stem of podobranchiae, except on fourth pereiopod, produced in winglike expansion.

RANGE.—Australia: eastern states.

NUMBER OF SPECIES.—Twenty-seven.

REFERENCES.—Clark, 1936, 1941; Riek, 1969.

Genus *Geocharax*

FIGURE 21

Geocharax Clark, 1936:31. [Type-species, by original designation, *Geocharax gracilis* Clark, 1936:31. Gender: masculine.]

DIAGNOSIS.—Carapace punctate or tuberculate; anterolateral portion of branchiocardiac groove widely separated from, and parallel to, cervical groove almost to midheight of carapace; viewed dorsally, cervical groove broadly U-shaped and deeply impressed; postorbital ridges well developed. Abdomen smooth, punctate, or setose; pleuron of first abdominal segment distinct and partially overlapped by that of second. Telson without transverse suture and entirely calcified. Third maxilliped with mesial half of ventral surface of ischium bearing setae; exopodite well developed, extending beyond distal extremity of ischium. Chela with ventrolateral margin bearing small tubercles; when upper surface of carpus of cheliped held in horizontal plane, dactyl moving subvertically but not so clearly as in *Engaeus*; carpus of cheliped without enlarged spines or tubercles, but with row of tubercles dorsomesially. Male genitalia consisting of small simple papilla. Branchial formula 21 + epr; stem of podobranchiae with small winglike expansion.

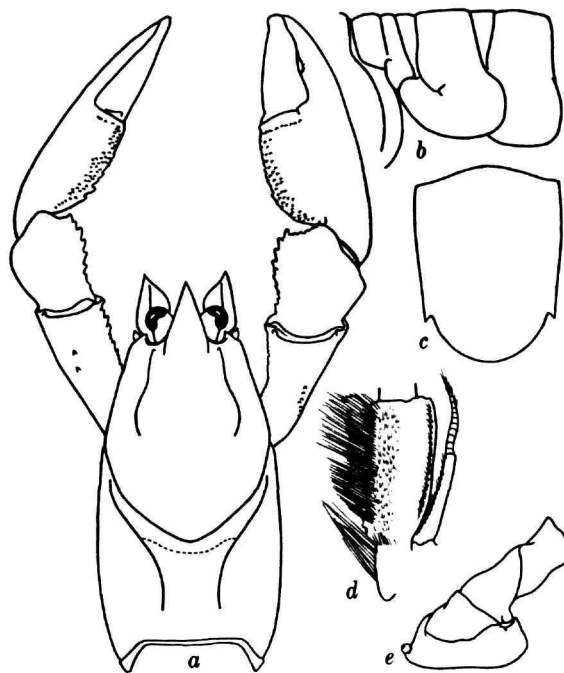


FIGURE 21.—*Geocharax falcata* Clark, 1941, from Wannan River, Western Australia, Australia. (For explanation, see Figure 14.)

RANGE.—Australia: Victoria to King Island, and northwestern Tasmania.

NUMBER OF SPECIES.—Two.

REFERENCES.—Clark, 1936; Riek, 1969.

Genus *Gramastacus*

FIGURE 22

Gramastacus Riek, 1972:385. [Type-species, by original designation, *Gramastacus insolitus* Riek, 1972:386. Gender: masculine.]

DIAGNOSIS.—Carapace punctate; anterolateral portion of branchiocardiac groove widely separated from, and parallel to, cervical groove almost to midheight of carapace; viewed dorsally, cervical groove U-shaped; postorbital ridges well developed. Abdomen without prominent tubercles; pleuron of first abdominal segment distinct and partially overlapped by that of second. Telson entirely calcified. Third maxilliped with "dense hairs over all lower surface" (Riek, 1972:385) of merus. Chela with ventrolateral margin lacking large tubercles; when upper surface of carpus of cheliped held in horizontal plane, dactyl moving subhorizontally; carpus

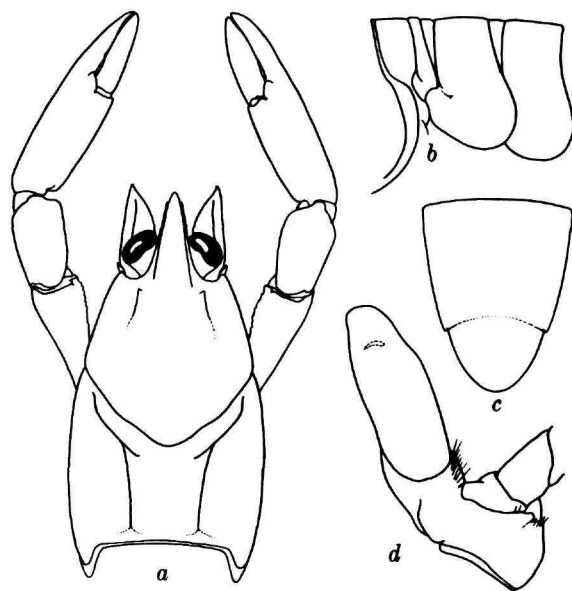


FIGURE 22.—*Gramastacus insolitus* Riek, 1972 (after Riek, 1972). (For explanation, see Figure 14; except *d*, basal podomere of fifth pereiopod illustrating male genitalia on mesial surface of coxa.)

of cheliped with "slightly enlarged tooth on mesial side towards apex." Male genitalia consisting of "very large, uncalcified (only slightly sclerotized) process, distinctly longer than wide."

RANGE.—Australia: "Grampians area of western Victoria" (Riek, 1972:385).

NUMBER OF SPECIES.—Two.

REFERENCES.—Riek, 1972.

Genus *Paranephrops*

FIGURE 23

Paranephrops White, 1842:79. [Type-species, by monotypy, *Paranephrops planifrons* White, 1842:79. Gender: masculine.]

Paranephros André, 1937:32, 34 [erroneous spelling].

Paranephrops Cunningham et al., 1953:375 [erroneous spelling].

DIAGNOSIS.—Carapace with spines or tubercles, other than rostral, postorbital, branchiostegal, and cervical; anterolateral portion of branchiocardiac groove widely separated from and parallel to cervical groove; postcervical groove prominent and fusing with anterolateral arms of branchiocardiac

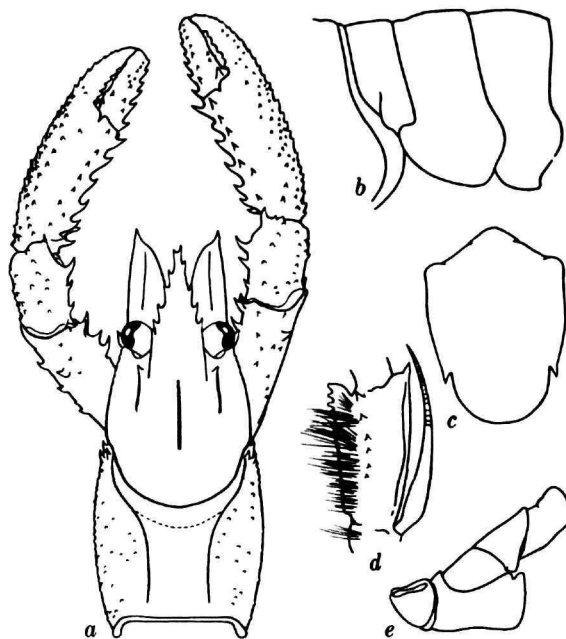


FIGURE 23.—*Paranephrops planifrons* White, 1842, from Rotorua District, North Island, New Zealand. (For explanation, see Figure 14.)

grooves; viewed dorsally, cervical groove broadly U-shaped and deeply impressed; postorbital ridges well developed. Abdomen with setiferous punctations, lacking spines on pleura; pleuron of first abdominal segment distinct and partially overlapped by that of second. Telson without transverse suture and entirely calcified. Third maxilliped usually with submedian ventral row of spiniform tubercles; mesial half of ventral surface bearing stiff setae; distolateral portion produced in spine; exopodite well developed, extending beyond distal extremity of ischium. Chela with 2 ventrolateral rows of large spines or tubercles, and additional rows both dorsally and ventrally; when upper surface of carpus of cheliped held in horizontal plane, dactyl moving more horizontally than vertically; carpus of cheliped with large spines mesially and ventrally. Male genitalia, situated on mesial surface of coxa, consisting of large, articulated, partially sclerotized lobe. Gills 20 + epr + r; pleurobranchiae on somites XI to XIV, posterior arthrobranch on XIII rudimentary; stem without winglike expansion.

RANGE.—New Zealand.

NUMBER OF SPECIES.—Two.

REFERENCES.—Hopkins, 1970.

Genus *Parastacoides*

FIGURE 24

Parastacoides Clark, 1936:10, 48. [Type-species, by original designation, *Astacus (Astacus) Tasmanicus* Erichson, 1846: 94. Gender: masculine.]

DIAGNOSIS.—Carapace setose, punctate, or granulate; anterolateral portion of branchiocardiac groove extremely narrowly separated from, and parallel to, cervical groove dorsolaterally; viewed dorsally, cervical groove broadly U-shaped and deeply impressed; postorbital ridges weakly developed. Abdomen punctate to smooth; pleuron of first abdominal segment distinct and partially overlapped by that of second. Telson without transverse suture and entirely calcified. Third maxilliped with ventral surface bearing scattered setiferous punctations; exopodite well developed, extending to or beyond distal extremity of ischium. Chela with ventrolateral margin smooth; when upper surface of carpus of cheliped held in horizontal plane, dactyl moving subhorizontally; carpus of cheliped with

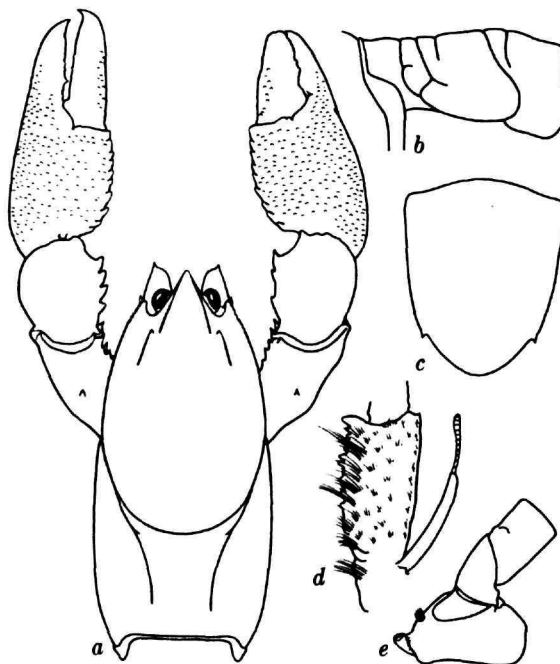


FIGURE 24.—*Parastacoides tasmanicus* (Erichson, 1846) from Derwent Bridge, Tasmania, Australia. (For explanation, see Figure 14.)

2 to several large tubercles mesially, rare on ventrodistal margin. Male genitalia consisting of large, nonlobed, fleshy, semicylindrical outgrowth on mesial side of coxa. Branchial formula 17 + epr; pleurobranchiae absent; posterior arthrobranchiae reduced; stem of podobranchiae without winglike expansion.

RANGE.—Australia: Tasmania.

NUMBER OF SPECIES.—Six.

REFERENCES.—Clark, 1939; Riek, 1967b, 1969.

Genus *Parastacus*

FIGURE 25

Parastacus Huxley, 1879:759, 771. [Type-species, by subsequent designation (Faxon, 1898:683), *Astacus pilimanus* von Martens, 1869:15. Gender: masculine.]

DIAGNOSIS.—Carapace punctate or tuberculate; anterolateral portion of branchiocardiac groove often hardly distinguishable because closely approximating deeply impressed cervical groove, two merging dorsolaterally; viewed dorsally, cervical groove somewhat V-shaped; postorbital ridges rang-

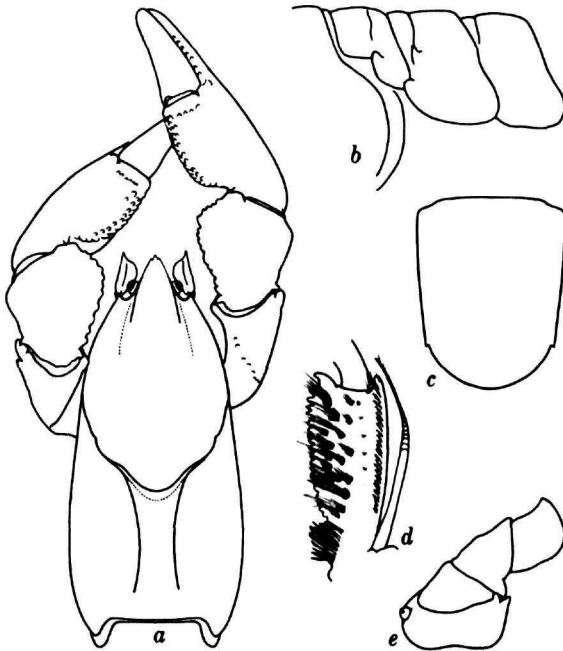


FIGURE 25.—*Parastacus pugnax* (Poëppig, 1835) from Concepción, Chile. (For explanation, see Figure 14.)

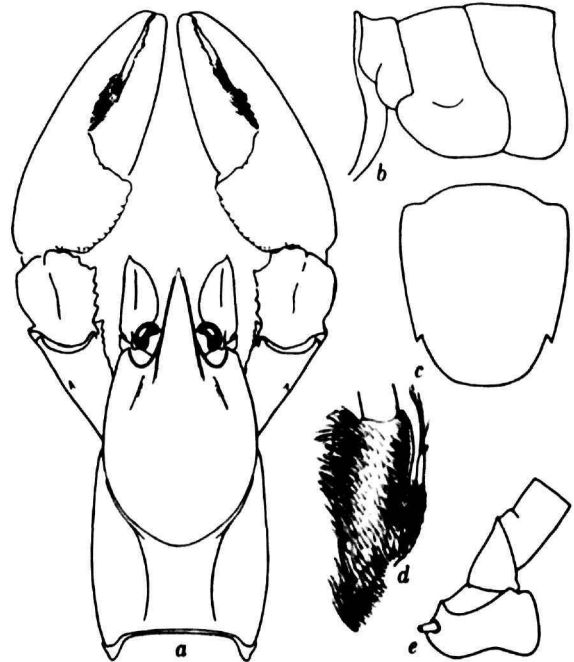


FIGURE 26.—*Samastacus spinifrons* (Philippi, 1882) from Talcahuano, Chile. (For explanation, see Figure 14.)

ing from well developed to virtually obsolete. Abdomen without tubercles or spines; pleuron of first abdominal segment distinct and partially overlapped by that of second. Telson without transverse suture and entirely, sometimes weakly, calcified. Third maxilliped with mesial half of ventral surface of ischium bearing setiferous punctations; exopodite reaching to, or slightly beyond, distal extremity of ischium. Chela with ventrolateral margin smooth or bearing small tubercles; when upper surface of carpus of cheliped held in horizontal plane, dactyl moving subvertically; carpus with or without enlarged spiniform tubercles. Male genitalia consisting of fixed, slightly elevated ventromesial ridge bearing noncalcified papilla; all members with male and female genital apertures. Branchial formula $20 + epr + r$ or $20 + ep + r$; pleurobranchiae on segments XI to XIV; posterior arthrobranch on XIII rudimentary; stem without winglike expansion.

RANGE.—South America: Chile, Argentina, Uruguay, and southern Brazil.

NUMBER OF SPECIES.—Six.

REFERENCES.—Faxon, 1885a, 1898, 1914; Riek, 1971.

Genus *Samastacus*

FIGURE 26

Samastacus Riek, 1971:134. [Type-species, by original designation, *Astacus spinifrons* Philippi, 1882:627. Gender: masculine.]

DIAGNOSIS.—Carapace punctate or smooth; anterolateral portion of branchiocardiac groove extending subparallel to cervical groove, two merging laterally; viewed dorsally, cervical groove broadly U-shaped; postorbital ridges well developed with anterior spine or tubercle. Abdomen without tubercles or spines; pleuron of first abdominal segment distinct and partially overlapped by that of second. Telson without transverse suture and entirely calcified. Third maxilliped with setiferous punctations over entire ventral surface; exopodite reaching to or slightly beyond distal extremity of ischium. Chela with ventrolateral margin smooth;

when upper surface of carpus of cheliped held in horizontal plane, dactyl moving subhorizontally; carpus without enlarged spiniform tubercles mesially or ventrally. Male genitalia consisting of articulated, slender, tubular, calcified projection; members never with both male and female apertures. Branchial formula $20 + epr + r$; stem without winglike expansion.

RANGE.—South America: Chile.

NUMBER OF SPECIES.—Two.

REFERENCES.—Riek, 1971.

Genus *Tenuibranchiurus*

FIGURE 27

Tenuibranchiurus Riek, 1951:368, 369, 381. [Type-species, by original designation, *Tenuibranchiurus glypticus* Riek, 1951:382. Gender: masculine.]

DIAGNOSIS.—Carapace punctate to finely granulate; anterolateral portion of branchiocardiac groove widely separated from, and parallel to, cervical groove almost to midheight of carapace; viewed dorsally, cervical groove broadly U-shaped and deeply impressed; postorbital ridges greatly reduced. Abdomen smooth; pleuron of first abdominal segment not rudimentary and partially covered by anterior lobe of pleuron of second. Telson without transverse suture and entirely calcified. Third maxilliped with ventral surface of ischium studded with both plumose and simple stiff setae; exopodite well developed, extending beyond distal extremity of ischium. Chela with ventrolateral margin smooth; when upper surface of carpus of cheliped held in horizontal plane, dactyl moving subvertically; carpus of cheliped without enlarged spines or

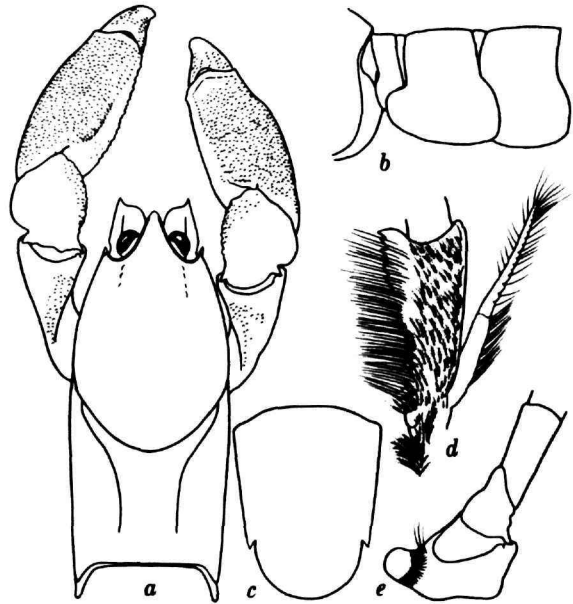


FIGURE 27.—*Tenuibranchiurus glypticus* Riek, 1951, from Caloundra, Queensland, Australia. (For explanation, see Figure 14).

tubercles mesially or ventrally, feebly tuberculate dorsomesially. Male genitalia consisting of "flattened disc-like flange" (Riek, 1969:867). Branchial formula $18 + ep$; some females, however, with 2 additional pleurobranchiae (on segments XII and XIII) = $20 + ep$; stem of podobranchiae not produced in winglike expansion.

RANGE.—Australia: Queensland.

NUMBER OF SPECIES.—Monotypic.

REFERENCES.—Riek, 1951, 1969.

Literature Cited

- André, Marc
1937. Relations entre la distribution géographique des écrevisses et celle de leurs parasites. *Compte Rendu Sommaire des Séances de la Société de Biogéographie*, 14:31-37.
- Bacescu, Mihai C.
1967. Fauna Republicii Socialiste Romania. Crustacea, Decapoda. *Academia Republicii Socialiste Romania*, 4(9):1-353, 141 figures.
- Baer, Jean G.
1945. Un temnocéphale nouveau, *Temnocéphala hand-schini* n. sp. de la Nouvelle Guinée. *Revue Suisse de Zoologie*, 52 (22-27):505-512, 8 figures.
- Bate, C. Spence
1888. *Report on the Scientific Results of the Voyage of HMS Challenger during the Years 1873-76 Zoology*. Volume 24, xc + 942 pages.
- Billberg, Gustav Johann
1820. *Enumeratio Insectorum*. 138 pages. Gadeliania.
- Birstein, J. A., and L. G. Vinogradov
1934. Die Süsswasserdecapoden der UdSSR und ihre geographische Verbreitung. Vorläufige Mitteilung. *Zoologicheskii Zhurnal (Moscow)*, 13:39-70, 26 figures. [Russian with German summary.]
- Bott, Richard
1950. Die Flusskrebse Europas (Decapoda, Astacidae).

- Abhandlungen der Senckenbergischen Naturforschenden Gesellschaft*, 483: 36 pages, 24 figures, 6 plates.
1972. *Besiedlungsgeschichte und Systematik der Astaciden West-Europas unter besonderer Berücksichtigung der Schweiz. Revue Suisse de Zoologie*, 79 (13):387-408, 8 figures, 4 plates.
- Bouchard, Raymond William
1972. A New Genus of Crayfish from Kentucky and Tennessee (Crustacea, Decapoda, Astacidae). *ASB Bulletin*, 19 (2):56.
1973. A New Crayfish of the Subgenus *Jugicambarus* from Tennessee with an Emended Definition of the Subgenus (Astacidae, Decapoda). *American Midland Naturalist*, 89 (1):103-111, 1 figure.
- Bouvier, E. L.
1897. Sur les *Cambarus* recueillis au Mexique par M. Diguët. *Bulletin du Muséum d'Histoire Naturelle*, 3 (6):224-228.
- Carlisle, David B., and Francis Knowles
1959. Endocrine Control in Crustaceans. *Cambridge Monographs in Experimental Biology*, 10: vii + 120 pages, 18 figures, 5 plates.
- Clark, Ellen
1936. The Freshwater and Land Crayfishes of Australia. *Memoirs of the National Museum* (Melbourne), 10: 1-58, 2 figures, 11 plates.
1939. Tasmanian Parastacidae. *Papers and Proceedings of the Royal Society of Tasmania*, 1938:117-127, plates 12, 13.
1941. Revision of the Genus *Euastacus* (Crayfishes, Family Parastacidae), with Notes on the Distribution of Certain Species. *Memoirs of the National Museum* (Melbourne), 12:7-30, 1 figure, 7 plates.
- Clawson, A. B.
1905. Some Results of a Study of Correlation in the Crayfish. *Report of the Michigan Academy of Science*, 7:103-108.
- Cope, E. D.
1872. On the Wyandotte Cave and Its Fauna. *American Naturalist*, 6 (7):406-422, figures 109-116.
1881. *Orconectes hamulatus*. In E. D. Cope and A. S. Packard, The Fauna of Nickajack Cave. *American Naturalist*, 15:872-882, 1 plate.
- Creaser, E. P.
1933. Descriptions of Some New and Poorly Known Species of North American Crayfishes. *Occasional Papers of the Museum of Zoology, University of Michigan*, 275:1-21, 14 figures.
1962. *Notes on Homologies and Genetic Relationships in Cambarinae Crayfishes*. 7 pages, 22 figures. Privately printed.
- Crocker, D. W., and David W. Barr
1968. *Handbook of the Crayfishes of Ontario*. ix + 158 pages, 87 figures. University of Toronto Press.
- Croizat, Leon
1958. *The New World*. Volume I of *Panbiogeography, or an Introductory Synthesis of Zoogeography, Phytogeography, and Geology; with Notes on Evolution, Systematics, Ecology, Anthropology, etc.* xxxi + 1018 pages, 119 figures. Herts, England: Distributed by Wheldon and Wesley, Ltd., Nr. Hitchin.
- Cunningham, B. T., and others
1953. A Survey of the Western Coastal Dune Lakes of the North Island, New Zealand. *Australian Journal of Marine and Freshwater Research*, 4 (2):341-386, 10 figures, 2 plates.
- Curra, R. A.
1967. A Key to Genera, Species and Subspecies of Astacinae (Nephropsidea: Astacidae). *International Revue der Gesamten Hydrobiologie*, 52:799-800, 4 figures.
- Dana, J. D.
1852. Crustacea, Part I. Volume 13 in *United States Exploring Expedition, during the Years, 1838, 1839, 1840, 1841, 1842, under the Command of Charles Wilkes, U. S. N.* viii + 685 pages.
- Desmarest, A. G.
1823. Malacostracés, Malacostraca. In *Dictionnaire des Sciences Naturelles . . .* 28:138-425. Paris: Le Normant.
- Dimond, John B., and others
1968. Persistence of DDT in Crayfish in a Natural Environment. *Ecology*, 49 (4):759-762.
- Duméril, C.
1806. *Analytische Zoologie*. vi + 344 pages. Landes-Industrie-Comptoir.
- Erichson, W. F.
1846. Uebersicht der Arten der Gattung *Astacus*. *Archiv für Naturgeschichte*, Berlin, 12(1):86-103.
- Eschscholtz, F.
1823. *Descriptio Novae Astacurum speciei Rossicae. Mémoires de la Société Impériale de Naturalistes de Moscou*, 6:109-110.
- Fabricius, J. C.
1775. *Systema Entomologiae, Sistens Insectorum. Classes, Ordines, Genera, Species, Adiectis Synonymis, Locis, Descriptionibus, Observationibus*. 832 pages. Leipzig.
1798. *Supplementum Entomologiae Systematicae*. 572 pages. Hafniae: Proft et Storch.
- Faxon, Walter
1884. Descriptions of New Species of *Cambarus*; to Which Is Added a Synonymical List of the Known Species of *Cambarus* and *Astacus*. *Proceedings of the American Academy of Arts and Science*, 20:107-158.
- 1885a. A Revision of the Astacidae, Part I: The Genera *Cambarus* and *Astacus*. *Memoirs of the Museum of Comparative Zoology at Harvard College*, 10(4): vi + 186 pages, 10 plates.
- 1885b. A List of the Astacidae in the United States National Museum. *Proceedings of the United States National Museum*, 8(23):356-361.
1890. Notes on North American Crayfishes, Family Astacidae. *Proceedings of the United States National Museum*, 12(785):619-634.
1898. Observations on the Astacidae in the United States National Museum and in the Museum of Comparative Zoology, with Descriptions of New Species. *Proceedings of the United States National Museum*, 20(1136):643-694, plates 62-70.

1914. Notes on the Crayfishes in the United States National Museum and the Museum of Comparative Zoology, with Descriptions of New Species and Subspecies. *Memoirs of the Museum of Comparative Zoology at Harvard College*, 40(8):351-427, 13 plates.
- Fitzpatrick, Joseph F., Jr.
1963. Geographic Variation in the Crawfish *Faxonella clypeata* (Hay) with the Definition and Defense of the Genus *Faxonella* Creaser (Decapoda, Astacidae). *Tulane Studies in Zoology*, 10(1):57-79, 20 figures.
1967. The Propinquus Group of the Crawfish Genus *Orconectes* (Decapoda: Astacidae). *Ohio Journal of Science*, 67(3):129-172, 27 figures.
- Fitzpatrick, J. F., Jr., and James F. Payne
1968. A New Genus and Species of Crawfish from the Southeastern United States (Decapoda, Astacidae). *Proceedings of the Biological Society of Washington*, 81(2):11-22, 12 figures.
- Fleming, Robert S.
1938-1939. The Larger Crustacea of the Nashville Region. *Journal of the Tennessee Academy of Sciences*, 13(4):296-314 (1938); 14(2):261-264 (1939); 14(3):299-324 (1939), 22 plates.
- Fowler, Henry W.
1912. The Crustacea of New Jersey. *Annual Report of the New Jersey Museum*, 1911 (Part II):29-650, 150 plates.
- Gerstaecker, A.
1863. Arthropoden. Volume 2 in Jul. Victor Carus, and C. E. A. Gerstaecker, *Handbuch de Zoologie*. 415 pages. Leipzig: Wilhelm Engelmann.
- Girard, Charles
1852. A Revision of the North American Astaci, with Observations of Their Habits and Geographical Distribution. *Proceedings of the Academy of Natural Sciences of Philadelphia*, 6:87-91.
- Gray, J. E.
1845. Descriptions of Some New Australian Animals. In Edward John Eyre, *Journals of Expeditions of Discovery into Central Australia . . .*, 1:405-411 (appendix).
- Guérin Méneville, F. E.
1839. Nouveau genre de Crustacé Macroure, établissant le passage entre deux familles, les Thalassiniens et les Astaciens. *Revue Zoologique par La Société Cuvierienne*, 1838:108-109.
- de Haan, W.
1833-1850. Crustacea. In de Siebold, *Fauna Japonica sive descriptio animalium, Quae in Itinere per Japoniam, Jussu et Auspiciis Superiorum, qui Summum in India Batava Imperium Tenent, Suscepto, Annis 1823-1830 Collegit, Notis, Observationibus Adumbrationibus Illustravit*. Pages i-xvii, i-xxxii, ix-xvi, 1-243, 71 plates.
- Hagen, Hermann A.
1870. Monograph of the North American Astacidae. *Illustrated Catalogue of the Museum of Comparative Zoology at Harvard College*, 3: 109 pages, 11 plates.
- Harlan, R.
1830. Description of a New Species of the Genus *Astacus*. *Transactions of the American Philosophical Society*, 3(15):464-465.
- Harris, J. Arthur
1903. An Ecological Catalogue of the Crayfishes Belonging to the Genus *Cambarus*. *Kansas University Science Bulletin*, 2(3):51-187, 4 plates.
- Hay, William Perry
1899. Description of Two New Species of Crayfish. *Proceedings of the United States National Museum*, 22(1187):121-123, 2 figures.
1902. Observations on the Crustacean Fauna of the Region about Mammoth Cave, Kentucky. *Proceedings of the United States National Museum*, 25(1285):223-236, 1 figure.
- Hemming, A. F.
1958. Opinion 519. In Addition to the Official List of Generic Names in Zoology of the Names of Twenty-three Genera of Macrura Reptantia (Class Crustacea) and Use of the Plenary Powers in Regard to Three Matters Connected Therewith. *Opinions and Declarations Rendered by the International Commission on Zoological Nomenclature*, 19:133-168.
- Hobbs, Horton H., Jr.
1942a. A Generic Revision of the Crayfishes of the Subfamily Cambarinae (Decapoda, Astacidae) with the Description of a New Genus and Species. *American Midland Naturalist*, 28(2):334-357, 3 plates.
- 1942b. The Crayfishes of Florida. *University of Florida Publications, Biological Science Series*, 3(2):v + 179 pages, 24 plates.
1950. A New Crayfish of the Genus *Procambarus* from Oklahoma and Arkansas (Decapoda, Astacidae). *Journal of the Washington Academy of Sciences*, 40(6):194-198, 12 figures.
1955. A New Crayfish of the Genus *Cambarus* from Mississippi. *Proceedings of the Biological Society of Washington*, 68(15):95-100, 11 figures.
1962. Notes on the Affinities of the Members of the Blandingii Section of the Crayfish Genus *Procambarus* (Decapoda, Astacidae). *Tulane Studies in Zoology*, 9(5):273-293, 72 figures.
1965. A New Crayfish of the Genus *Cambarus* from Tennessee with an Emended Definition of the Genus (Decapoda, Astacidae). *Proceedings of the Biological Society of Washington*, 78(33):265-273, 12 figures.
1967. A New Crayfish from Alabama Caves with Notes on the Origin of the Genera *Orconectes* and *Cambarus* (Decapoda: Astacidae). *Proceedings of the United States National Museum*, 123(3621):1-17, 21 figures.
1969. On the Distribution and Phylogeny of the Crayfish Genus *Cambarus*. In Perry C. Holt, Richard L. Hoffman, and C. Willard Hart, Jr., The Distributional History of the Biota of the Southern Appalachians, Part I: Invertebrates. *Virginia Polytechnic Institute, Research Division Monograph*, 1:93-178, 20 figures.
- 1971a. A New Crayfish of the Genus *Procambarus* from Mississippi (Decapoda: Astacidae). *Proceedings of*

- the *Biological Society of Washington*, 83(40):459-468, 1 figure.
- 1971b. The Entocytherid Ostracods of Mexico and Cuba. *Smithsonian Contributions to Zoology*, 81: 55 pages, 31 figures.
- 1972a. The Subgenera of the Crayfish Genus *Procambarus* (Decapoda: Astacidae). *Smithsonian Contributions to Zoology*, 117: 22 pages, 20 figures.
- 1972b. Biota of Freshwater Ecosystems, Identification Manual 9: Crayfishes (Astacidae) of North and Middle America. *Water Pollution Control Research Series*, x + 173 pages, 115 figures. United States Environmental Protection Agency.
- Holt, Perry C.
1968. The Branchiobdellida: Epizootic Annelida. *The Biologist*, 50(3-4):79-94, 2 figures.
- Holthuis, L. B.
1949. Zoological Results of the Dutch New Guinea Expedition 1939, Number 3: Decapoda Macrura with a Revision of the New Guinea Parastacidae. *Nova Guinea*, 5(new series):289-328, plates 2-9.
1964a. The Genus *Astacoides* Guérin (Decapoda Macrura). *Crustaceana*, 6(4):309-318, 1 figure, plates 9, 10.
1964b. On the Status of Two Allegedly European Crayfishes, *Cambarus typhlobius* Joseph, 1880, and *Austroptamobius pallipes bispinosus* Karaman, 1961 (Decapoda Astacidae). *Crustaceana*, 7(1):42-48, plate 3.
- Hopkins, C. L.
1970. Systematics of the New Zealand Freshwater Crayfish *Paranephrops* (Crustacea: Decapoda: Parastacidae). *New Zealand Journal of Marine and Freshwater Research*, 4(3):278-291, 7 figures.
- Huxley, Thomas H.
1879. On the Classification and the Distribution of the Crayfishes. *Proceedings of the Zoological Society of London*, 1878:751-788, 7 figures.
1880a. *The Crayfish: An Introduction to the Study of Zoology*. xiv + 371 pages, 81 figures. London: C. Kegan Paul & Co.
1880b. Classification et Distribution des Ecrevisses. *Archives de Zoologie Expérimentale et Générale*, 8:79-102, 7 figures.
- Joleaud, L.
1939. *Atlas de Paléobiogéographie*. 39 pages, 99 plates. Paris: Paul Lechevalier.
- Karaman, Mladen S.
1962. Ein Beitrag zur Systematik der Astacidae (Decapoda). *Crustaceana*, 3(3):173-191, 60 figures.
- Kessler, K.
1874. Die Russischen Flusskrebse. Vorläufige Mittheilung. *Bulletin de la Société Impériale des Naturalistes de Moscou*, 48(1):343-372.
- Laguarda, Alfredo
1961. *Contribución al Estudio Comparativo de la Formula Branquial en la Familia Astacidae (Crustacea: Decapoda)*. 74 pages, 22 plates. Facultad de Ciencias, Departamento de Biología, Universidad Nacional Autónoma de México.
- Latreille, P. A.
1802-03. *Histoire Naturelle, Général et Particulière des Crustacés et des Insectes*. 387 pages, plates 16-37. Paris: F. Dufart.
1825. *Familles Naturelles du Règne Animal, Exposées Succinctement et dans un Ordre Analytique, avec l'Indication de Leurs Genre*. 570 pages. Paris: J. B. Baillière.
- Leach, W. E.
1818. Crustacés, Crustacea. In *Dictionnaire des Sciences Naturelles* . . . , 12:69-75. Paris: Le Normant.
- Lereboullet, M.
1858. Description de Deux Nouvelles Espèces d'Ecrevisse de nos Rivières. *Mémoires Société d'Histoire Naturelle de Strasbourg*, 5:1-11, 3 plates.
- LeConte, John
1856. Descriptions of New Species of *Astacus* from Georgia. *Proceedings of the Academy of Natural Sciences of Philadelphia*, 7:400-402.
- Linnaeus, C.
1758. *Systema Naturae per Regna Tria Naturae, Secundum Classes, Ordines, Genera, Species, cum Characteribus, Differentiis, Synonymis, Locis*. Edition 10, volume 1, 824 + iii pages.
- Lönnerberg, Einar
1895. Cambarida from Florida, a New Blind Species. *Bihang till Kongliga Svenska Vetenskaps-Akademiens Handlingar*, 20(4):3-14, figures 1-5 b.
- Lyle, Clay
1938. The Crawfishes of Mississippi, with Special Reference to the Biology and Control of Destructive Species. *Iowa State College Journal of Science*, 13: 75-77.
- Marchand, A. Lamy et de Boisvillette
1874. *Statistique Scientifique d'Eure-et-Loir. Zoologie, Ichthyologie, Ornithologie*. 75 pages. Chartres: Petrot-Garnier.
- von Martens, Eduard
1869. Südbrasilische Süs- und Brackwasser-Crustaceen nach den Sammlungen des Dr. Reinh. Hensel. *Archiv für Naturgeschichte*, 35(1):1-37, 2 plates.
- Miller, W. S.
1895. The Anatomy of the Heart of *Cambarus*. *Transactions of the Wisconsin Academy of Sciences, Arts, and Letters*, 10:327-338, plates 5, 6.
- Milne Edwards, H.
1837. Histoire naturelle des crustacés, comprenant l'anatomie, la physiologie et la classification de ces animaux. *Librairie Encyclopédique de Roret*, 2:1-532.
- Milne Edwards, H., and V. Audouin
1839. [Note without title.] *L'Institut, Journal Général des Sociétés et Travaux Scientifiques de la France et de l'Etranger*, section 1, 7(280):152.
- Molloy, Michael O., and Rudolph Prins
The Effect of Temperature and Photoperiod on Molting Patterns in Seasonal Populations of the Crayfish, *Orconectes immunis*. *ASB Bulletin*, 20 (2) :70.

- Monod, Th., and G. Petit
1929. Crustacea, I: Parastacidae. *Faune des Colonies Françaises*, 3(1):3-43, 3 plates, 10 figures.
- Ninni, E.
1923. Primo contributo allo studio dei pesci e della pesca nelle acque dell'Impero Ottomano: Materiali raccolti durante la Campagna Talassografica 1921-22 a Bordo della R. Nave L. F. Marsigli. *Missione Italiani per l'Esplorazione die Mari Levante* (R. N. Marsigli), 5:187 pages, 25 figures, 16 plates. [Not seen.]
- Nobili, Di Guiseppe
1899. Contribuzioni alla conoscenza della fauna carcinologica della Papuasias, delle Molucche e dell'Australia. *Annali del Museo Civico di Genova*, serie 2, 20(40):230-282.
- Ortmann, Arnold E.
1891. Die Decapoden-Krebse des Strassburger Museums . . . Part III. Die Abtheilungen der Reptantia Boas: Homaridea, Loricata und Thalassinidea. *Zoologischen Jahrbüchern*, 6:1-58, 1 plate.
1905a. The Mutual Affinities of the Species of the Genus *Cambarus*, and Their Dispersal over the United States. *Proceedings of the American Philosophical Society*, 44(180):91-136, 1 plate.
1905b. A New Species of *Cambarus* from Louisiana. *Ohio Naturalist*, 6(2):401-403, 1 figure.
1905c. *Procamburus*, a New Subgenus of the Genus *Cambarus*. *Annals of the Carnegie Museum*, 3(3):435-442, 3 figures.
1906. Mexican, Central American, and Cuban Cambari. *Proceedings of the Washington Academy of Sciences*, 8:1-24, 4 figures.
1909. Une écrevisse nouvelle du Mexique. *Annales des Sciences Naturelles, neuvième série*, 7:159-166, 4 figures.
1931. Crayfishes of the Southern Appalachians and the Cumberland Plateau. *Annals of the Carnegie Museum*, 20(2):61-160.
- Packard, A. S., Jr.
1888. The Cave Fauna of North America with Remarks on the Anatomy of the Brain and Origin of the Blind Species. *Memoirs of the National Academy of Sciences*, 4: 156 pages, 21 figures, 27 plates.
- Padgett, Allen
1970. Georgia Cave Fauna. *Georgia Speleological Society Bulletin*, 1970:19-20.
- Pallas, A. S.
1772. *Spicilegia zoologica quibus novae imprimis et obscurae animalium species iconibus, descriptionibus atque commentariis illustrantur*. Volume 1, number 9, 86 pages, 5 plates.
- Parisi, Bruno
1917. I Decapodi giapponesi del Museo di Milano, V: Galatheidea e Reptantia. *Atti della Società Italiana di Scienze Naturali*, 56:1-24, 7 figures.
- Penn, George Henry, Jr.
1953. Two New Crayfishes of the Genus *Procamburus* from Texas, Louisiana and Arkansas (Decapoda, Astacidae). *American Museum Novitates*, 1636:1-10, 19 figures.
1957. Aberrant Secondary Sex Characters in the Crayfishes *Cambarellus shufeldtii* (Faxon) and *Procamburus dupratzi* Penn (Decapoda, Astacidae). *Transactions of the American Microscopical Society*, 76(1):93-95.
1959. An Illustrated Key to the Crayfishes of Louisiana, with a Summary of Their Distribution within the State (Decapoda, Astacidae). *Tulane Studies in Zoology*, 7(1):1-20, 86 figures.
- Philippi, R. A.
1882. Zoologia chilena: Sobre los *Astacus*. *Anales de la Universidad de Chile*, 61:624-628, 1 figure.
1894. Dos palabras sobre la sinonimia de los crustáceos, decápodos, branquiuros o jaivas de Chile. *Anales de la Universidad de Chile*, 87:369-379.
- Price, F. M.
1900. The Eyes of *Cambrus pellucidus* [title, without text, of a paper presented to the Academy]. *Proceedings of the Indiana Academy of Science*, 1899: page 155.
- Rafinesque, C. S.
1815. *Analyse de la nature; ou tableau de l'univers et des corps organisés*. 224 pages.
1817. Synopsis of Four New Genera and Ten New Species of Crustacea, Found in the United States. *American Monthly Magazine and Critical Review*, 2(1):40-43.
- Ray, Johnny, and Verl Stevens
1970. Using Baytex to Control Crayfish in Ponds. *Progressive Fish-Culturist*, 33:58-60.
- Reimer, Rollin Dewayne
1966. Two New Species of the Genus *Cambarus* from Arkansas (Decapoda, Astacidae). *Tulane Studies in Zoology*, 13(1):9-15, 18 figures.
- Rhoades, Rendell
1944. The Crayfishes of Kentucky with Notes on Variation, Distribution, and Descriptions of New Species and Subspecies. *American Midland Naturalist*, 31(1): 111-149, 10 figures.
- Riek, Edgar F.
1951. The Freshwater Crayfish (Family Parastacidae) of Queensland with an Appendix Describing Other Australian Species. *Records of The Australian Museum*, 22(4):368-388, 13 figures.
1956. Additions to the Australian Freshwater Crayfish. *Records of The Australian Museum*, 24(1):1-6, 1 plate.
1959. The Australian Freshwater Crustacea. In A. Keast, R. L. Crocker, C. S. Christian, Biogeography and Ecology in Australia. *Monographiae Biologicae*, 8: 246-258.
1967a. The Freshwater Crayfish of Western Australia (Decapoda: Parastacidae). *Australian Journal of Zoology*, 15:103-121, 5 figures, 5 plates.
1967b. The Tasmanian Freshwater Crayfish Genus *Parastacoides* (Decapoda: Parastacidae). *Australian Journal of Zoology*, 15:999-1006, 6 figures.
1969. The Australian Freshwater Crayfish (Crustacea: Decapoda: Parastacidae), with Descriptions of New

- Species. *Australian Journal of Zoology*, 17:855-918, 20 figures.
1971. The Freshwater Crayfishes of South America. *Proceedings of the Biological Society of Washington*, 84(16):129-136, 1 figure.
1972. The Phylogeny of the Parastacidae (Crustacea: Astacoidea), and Description of a New Genus of Australian Freshwater Crayfishes. *Australian Journal of Zoology*, 20:369-389, 36 figures.
- Samouelle, George
1819. *The Entomologist's Useful Compendium; or an Introduction to the Knowledge of British Insects*. . . . 496 pages. London: Thomas Boys.
- de Saussure, Henri
1857. Note Carcinologique sur la Famille des Thalassides et sur celle des Astacides. *Revue et Magasin de Zoologie Pure et Appliquée*, série 2, 9:99-102.
- Schrank, Franz von Paula
1803. *Fauna Boica*. Volume 3, part 1, viii + 272 pages. Landshut bei Philipp Krüll.
- Shaw, George
1794. *Zoology of New Holland*. Volume 1, 33 pages, 12 plates. London: J. Davis.
- Skorikov, A. S.
1908. Contributions à la classification des Potamobiidae d'Europe et d'Asie. *Annuaire du Musée Zoologique de l'Académie Impériale des Sciences de St. Pétersbourg*, 12:115-118 (1907, Russian).
- Smith, Geoffrey W.
1912. The Freshwater Crayfishes of Australia. *Proceedings of the Zoological Society of London*, 1912:144-170, plates 14-27.
- Smith, Geoffrey W., and E. H. J. Schuster
1913. The Genus *Engaeus* or the Land Crayfishes of Australia. *Proceedings of the Zoological Society of London*, 1913:112-127, plates 12-17.
- Sowerby, Carle
1922. *The Naturalist in Manchuria*. Volume 1, xiv + 347 pages, illustrated. Tientsin: Tientsin Press Limited.
- Spandl, Hermann
1926. Die Tierwelt der unterirdischen Gewässer. *Speläologische Monographien herausgegeben vom Speläologischen Institut der Bundeshöhlenkommission*, Wien, 11: xi + 235 pages, 116 figures.
- Stimpson, William
1857. Notices of New Species of Crustacea of Western North America; Being an Abstract from a Paper To Be Published in the Journal of the Society. *Proceedings of the Boston Society of Natural History*, 6(6):84-89.
- Thompson, David H.
1967. A Comparison of Visual Acuity between Cave and Epigeal Crayfish. *The Wisconsin Speleologist*, 6(3-4): 46-54.
- Unestam, Torgny
1969. Resistance to the Crayfish Plague in Some American, Japanese, and European Crayfishes. *Institute of Freshwater Research, Drottningholm*, report number 49:202-209.
- Villalobos, Alejandro
1944. Estudios de los camarinos mexicanos. II: Dos Especies Nuevas del Género *Paracambarus*. *Anales del Instituto de Biología, Universidad Nacional Autónoma de México*, 15 (1):161-174, 2 plates.
1954. Estudios de los camarinos mexicanos, XII: Revisión de las especies afines a *Procambarus mexicanus* (Erichson), con descripción de nuevas formas. *Anales del Instituto de Biología, Universidad Nacional Autónoma de México*, 25 (1 y 2):299-379, 19 plates.
1955. *Cambarinos de la Fauna Mexicana*. Pages 1-290, 62 plates. Tesis, Facultad de Ciencias, Universidad Nacional Autónoma de México.
- Vogt, Carl
1851. *Zoologische Briefe. Naturgeschichte der lebenden und untergegangenen Thiere, für Lehrer, höhere Schulen und Gebildete aller Stände*. 719 pages, 925 figures. Frankfurt: Literarische Unstalt (J. Rütten).
- White, Adam
1842. Description of an Orthopterous Insect, and Two New Species of Crustacea, from New Zealand in the Collection of the British Museum. Pages 78-79 in Gray, John Edward, *Zoological Miscellany, 1831-1844*.
- Williams, Austin B.
1952. Six New Crayfishes of the Genus *Orconectes* (Decapoda: Astacidae) from Arkansas, Missouri, and Oklahoma. *Transactions of the Kansas Academy of Science*, 55(2):330-351, 48 figures.
1954. Speciation and Distribution of the Crayfishes of the Ozark Plateaus and Ouachita Provinces. *University of Kansas Science Bulletin*, 36(12):803-918, 253 figures.
- Williamson, E. B.
1907. Notes on the Crayfish of Wells County, Indiana, with Description of a New Species. *31st Annual Report of the Department of Geology and Natural Resources of Indiana*, 1906:749-763, 1 plate.
- Word, Benjamin H., Jr., and Horton H. Hobbs, Jr.
1958. Observations on the Testis of the Crayfish *Cambarus montanus acuminatus* Faxon. *Transactions of the American Microscopical Society*, 77(4):435-450, 26 figures.

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