

MEM. NAT. MUS. VICT., X, 1936.

## THE FRESHWATER AND LAND CRAYFISHES OF AUSTRALIA.

*By Ellen Clark.*

(Plates I-XI.)

Freshwater and land crayfishes of the families Parastacidae and Austroastacidae are found throughout Australia and Tasmania. Eight genera, comprising thirty-two species, are now recorded, and there can be little doubt that many others will be found. Previous to this investigation the only systematic collecting was that of Messrs. S. W. Fulton, W. Kershaw and J. A. Kershaw, between 1870 and 1910. During the past two years collecting in Victoria and Tasmania has resulted in the discovery of seven new species.

With six exceptions, all the mainland species have been found in Victoria, the smallest of the States, where most attention has been paid to collecting, while only three species of one genus (*Cherax*) are known from the vast territory of Western Australia, probably due to lack of field work. Even in the arid districts of Central Australia Parastacidae are abundant, if one may judge from the material collected by the late Sir Baldwin Spencer during his expeditions in those regions. Parastacidae are known to exist in the Kimberley district, Western Australia, but so far no specimens have been received for examination.

Between fifteen hundred and sixteen hundred specimens have been examined. The majority are from Victoria and the eastern portion of South Australia; a large collection from the latter State was received on loan from the authorities of the South Australian Museum. Most species are represented by a series ranging from between twenty and sixty specimens, and in some instances hundreds of examples of the one species have been examined. In only one case two specimens have been available, and with the exception of seven species the types or paratypes of each species have been examined.

Until systematic collecting extends over the whole continent the distribution of the family will remain unknown, but distribution as far as at present known, is indicated by giving, after each specific description, a list of localities from which that species has been collected or recorded.

Australian species of Parastacidae are either aquatic or

terrestrial in habit, but a few species are equally at home in water and in burrows in dry or moist soil. Both aquatic and terrestrial forms crawl on land, especially in wet weather, and this habit probably accounts for their presence in artificial dams and ponds distant from natural lakes, swamps or water-courses.

In each genus there are both aquatic and terrestrial species. For example, in *Cherax* there are aquatic species (*bicarinatus*, *tenuimanus*); semi-aquatic, i.e. living in ponds and water-holes which often dry up during the summer months (*destructor*, *albidus*, *quinquecarinatus*); and terrestrial (*punctatus*). *Engaeus*, although usually a terrestrial genus, has species which live in creeks as well as on land in such localities as Skipton, Ferntree Gully and Marysville, Victoria.

Both aquatic and terrestrial species are burrowing animals; the former burrow in submerged, the latter in moist or dry soil. Aquatic species do much damage to retaining walls of channels and dams, and to banks of rivers and streams. Terrestrial species are sometimes serious pests in orchards where they burrow under roots of trees, and in some pastoral districts where large community burrows are numerous and collapse under the weight of cattle and horses. At Whitegate, a few miles from Benalla (Victoria), some areas riddled by yabbies are practically useless and are known as "crab-hole country."

Burrows of the various species of *Engaeus* are similar to those of the North American genus *Cambarus*, which have been described and figured by Ortmann, Abbott, Harris and Tarr, and the habits of both genera agree closely. Some species have burrows for only one occupant; others have community burrows for numerous occupants. The two genera also agree in including species which live in creeks as well as in burrows in soil. Ortmann's method of collecting specimens (1906, p. 345), by digging them out with a bayonet, is not much use when dealing with the Victorian species of *Engaeus*; a pick and shovel are the best collecting implements as many of the burrows descend six or seven feet.

Little has been published on the life history and habits of the Parastacidae. From observations made in Victoria and Tasmania during the past two years the breeding season is in spring, following the period of moulting, when numerous egg-bearing females were taken. During December and January females with newly-hatched young attached to the swimmerets were collected. While carrying eggs or young the females are particularly vicious, brandish their large chelae threaten-

ingly when approached, and attack any object placed near them. Except in the size of the abdomen and the position of the genital openings there are no external differences between the sexes, though the abdomen of the female is generally broader and longer than that of the male, especially in some terrestrial species.

Species of *Euastacus*, *Cherax* and *Engaeus* kept alive in observation tanks were fed on earthworms, raw meat, fish and tadpoles, all of which were torn to pieces by the chelate pereopods before being eaten. Examination of stomach contents shows that they also swallow mud and debris of the rivers, etc., in which they live.

Fully-grown specimens range in length from about 2 inches (*Pseudengaeus*) to 16 inches (*Euastacus* and *Astacopsis*). The largest of all known freshwater crayfishes belong to the two last-named genera. Specimens of *E. nobilis* (Dana) from the Thomson River, Victoria, weighed 5 lb. and measured 16 inches from the tip of the rostrum to the end of the telson; Smith records from Tasmania a specimen of *Astacopsis* that measured 16 inches and weighed 8 lb. Except in the large spiny or tuberculate species, there is little difference between immature and mature specimens of one species. Immature specimens of spiny species are comparatively free from spines and they gradually acquire the adult armature with each successive moult. Immature specimens of known species have been described as new species on several occasions.

My thanks are due to Dr. Isabella Gordon, Dr. W. T. Calman and W. E. Barnett, of the British Museum, for comparing specimens with the type material of Gray, and for the loan of specimens; to the various museums and institutions in Australia that loaned or donated material; to Mr. R. M. Murray, of Mt. Lyell, Tasmania, who collected specimens of *Astacus tasmanicus* Erichson; to Miss H. Alexander, Mr. A. Blain and Mr. E. Nelson for collections of Western Australian species; to numerous other collectors for material; and to Mr. K. A. Lodewyckx, of the Public Library of Victoria, who translated papers by Erichson, von Martens and Hess.

### Tribe ASTACURA.

Definition of the tribe (after Huxley, "The Crayfish," 1880, p. 254):

"Multicellular animals provided with an alimentary canal and with a chitinous cuticular exoskeleton; with a ganglionated central nervous

system traversed by the œsophagus; possessing a heart and branchial respiratory organs.

"The body is bilaterally symmetrical, and consists of twenty metameres (or somites and their appendages), of which six are associated into a head, eight into a thorax, and six into an abdomen. A telson is attached to the last abdominal somite.

"The somites of the abdominal region are all free, those of the head and thorax, except the hindermost, which is partially free, are united into a cephalothorax, the tergal wall of which has the form of a continuous carapace. The carapace is produced in front into a rostrum, at the sides into branchiostegites.

"The eyes are placed at the ends of movable stalks. The antennules are terminated by two filaments. The exopodite of the antenna has the form of a mobile scale. The mandible has a palp. The first and second maxillae are foliaceous; the second being provided with a large scaphognathite. There are three pairs of maxillipedes, and the endopodites of the third pair are narrow and elongated. The next pair of thoracic appendages is much larger than the rest, and is chelate, as are the two following pairs, which are slender ambulatory limbs. The hindmost pairs of thoracic appendages are ambulatory limbs, like the foregoing, but not chelate. The abdominal appendages are small swimmerets, except the sixth pair, which are very large, and have the exopodite divided by a transverse joint.

"All the crayfishes have a complex gastric armature. The seven anterior thoracic limbs are provided with podobranchiae, but the first of these is always more or less completely reduced to an epipodite. More or fewer arthrobranchiae always exist. Pleurobranchiae may be present or absent."

### *Key to Families of ASTACURA.*

First abdominal somite of male, and usually of female, provided with appendages.

First antennae each with two well-developed flagella. Outer rami of uropods with transverse sutures . . . . . ASTACIDAE

First abdominal somite devoid of appendages in either sex.

First antennae each with two well-developed flagella. Outer rami of uropods with transverse sutures. Carapace not vaulted posteriorly

PARASTACIDAE Huxley

First antennae with the secondary flagellum reduced or absent. Outer rami of uropods without transverse sutures. Carapace strongly vaulted posteriorly . . . . . AUSTROASTACIDAE fam. nov.

### Family PARASTACIDAE Huxley.

Proc. Zool. Soc., Lond., p. 775, 1878.

*Astacidae* (*Astacinae*) Dana, U.S. Explor. Exped., xiii, Crust., pt. i, p. 520, 1852.

*Astacidae*, Miers, Cat. N.Z. Crust., p. 71, 1876; McCoy, Prodr. Zool. Victoria, i, Dec. 2, p. 17, 1878; l.c., Dec. 3, p. 45, 1879; Spence-Bate, Report Voy. H.M.S. *Challenger*, Crust. Macr., xxiv, 1888, p. 192.



*Astacidae* (*Parastacinae*) Haswell, Cat. Austrl. Mus., Crust., p. 174, 1882; McCoy, Prod. Zool. Victoria, ii, Dec. 16, p. 225, 1888; Faxon, Proc. U.S. Nat. Mus., xx, p. 668, 1898.

*Parastacidae* Huxley, Proc. Zool. Soc., Lond., 1878, p. 775; The Crayfish, International Scientific Series, xxvii, 1880, p. 306; Ortmann, Proc. Amer. Phil. Soc., xli, p. 291, 1902; Smith, Cambridge Nat. Hist. iv, p. 157, 1909; Smith, Proc. Zool. Soc. Lond., 1912, pp. 144-170; Smith and Schuster, Proc. Zool. Soc. Lond., 1913, pp. 112-127; Faxon, Mem. Mus. Comp. Zool., xl, No. 8, p. 402, 1914; Hale, Handbook Crust. Sth. Austrl., 1927, p. 74.

First abdominal somite devoid of appendages in either sex.

Podobranchs without a bilobed plaited lamina, although the stem may be expanded into a wing. Epipod of first maxilliped generally furnished with branchial filaments.

Telson usually without transverse suture; in some cases, however, more or less completely divided by a transverse suture.

In "The Crayfish," p. 307, fig. 76, Huxley figured an Australian Crayfish (to which he assigns no name) showing a very distinct transverse suture on the telson; but the family character given on p. 256 is "The telson is never divided by a transverse suture." As three species of Australian crayfishes have the telson more or less completely divided by a transverse suture, and except in this feature and in having the abdomen heavily armed with spines and tubercles they do not differ sufficiently from others of the group to justify the erection of a new family, the diagnosis of the family as set out above has been enlarged to include them.

### *Key to genera of PARASTACIDAE Huxley.*

Telson more or less completely divided by a transverse suture, membranous posteriorly.

Stems of podobranchs each laterally produced into a broad wing-like expansion, covered by numerous hooked setae.

Second antennae inserted at the side of first.

Abdomen usually furnished laterally with three rows of large spines or tubercles; lateral margins rounded. Lateral lobes on first somite large and rounded . . . . . EUASTACUS gen. nov.

Telson without transverse suture; posterior half of telson and uropods membranous.

Stems of podobranchs each laterally produced into a broad wing-like expansion, bearing numerous hooked filaments.

Second antennae inserted at the side of first.

Abdomen without spines or tubercles, lateral margins rounded. Lateral lobes on first somite large and rounded . . . . . CHERAX Erichson

Telson without transverse sutures, entirely calcareous.

Stems of podobranchs each laterally produced into a small wing-like expansion, bearing a few hooked filaments.

Second antennae inserted at the side of the first.

Abdomen without spines or tubercles, lateral margins rounded. Lateral lobes on first abdominal somite small and rounded. Sternal keel narrow, continued across the obsolete posterior pair of lateral processes . . . . . GEOCHARAX gen. nov.

Stems of podobranchs without lateral wing-like expansion.

Second antennae inserted at the side of the first.

Abdomen without spines or tubercles, except on pleura of second somite; lateral margins round or pointed. Lateral lobes on first somite large and rounded . . . . . ASTACOPSIS Huxley

Second antennae inserted under the first.

Abdomen without spines or tubercles, lateral margins rounded.

Pleurobranchs present, gill formula  $2I + epr$ .

Sternal keel narrow, posterior pair of lateral processes single, large and grooved. First abdominal somite without lateral lobes

ENGAEUS Erichson

Sternal keel broad and swollen, posterior pair of lateral processes appearing double. First abdominal somite without lateral lobes

PSEUDENGAEUS gen. nov.

No pleurobranchs present, branchial formula  $12 + 5r + epr$ . First abdominal somite with lateral lobes large and rounded

PARASTACOIDES gen. nov.

### Genus EUASTACUS gen. nov.

*Cancer* Shaw, Zool. of New Holland, i, p. 21, pl. 8, 1794.

*Astacoides* Dana, U.S. Explor. Exped., Crust., pt. i, p. 526, 1852; Heller, Reise Novara, Crust., p. 102, 1865; von Martens, Ann. Mag. Nat. Hist., ser. 3, xvii, p. 359, 1866; McCoy, Prodromus Zool. Victoria, i, 1879, p. 17.

*Astacus* McCoy, Ann. Mag. Nat. Hist., ser. 3, xx, 1867, p. 189; Heller, Reise Novara, Zool., ii, pt. 3, Crust., 1865, p. 100; von Martens, Monats. Akad. Wiss. Berlin, 1868, p. 615.

*Astacopsis* Haswell, Cat. Austrl. Mus., Crust., p. 175, 1882; Spence-Bate, "Challenger" Reports, xxiv, 1888, p. 195; Smith, Proc. Zool. Soc. Lond., p. 154, 1912; Faxon, Mem. Mus. Comp. Zool., xl, 8, p. 402, 1914; Faxon, Proc. U.S. Nat. Mus., xx, 1898, p. 669; McCulloch, Rec. Austrl. Mus., No. 11, 1917, p. 237; Hale, Handbook Crust. Sth. Austrl., 1927, p. 75.

Carapace furnished with large spines or tubercles; rostral carinae tuberculate or spinous. Cervical groove deeply impressed, rounded.

Abdomen usually with three or more rows of spines or tubercles laterally, lateral margins rounded. First somite with lateral lobes large and rounded. Telson more or less completely divided by a transverse suture, membranous posteriorly.

Second antennae set at the side of the first; squames large. Upper lip long and narrow, straight or somewhat concave medianly.

Vas deferens on simple short papillae on coxae of fourth pereopods.

Stems of podobranchs each produced into a broad wing-like expansion (Plate I, fig. 1), covered by numerous long setae, terminated by sharply recurved hooks. Last posterior arthrobranch small. Gill formula  $2I + epr$ .

Genotype *Cancer serratus* Shaw.

Previous authors have referred the various species of this genus to *Astacopsis* Huxley, which is based on the Tasmanian Crayfish, *A. gouldi* sp. nov. (= *A. franklinii* Huxley, non Gray). *Euastacus* is separated from *Astacopsis*, as now restricted, by three important characters:

1. The form of the gills. In *Astacopsis* (Plate I, fig. 2) the podobranchs have no broad wing-like expansion, and the stem is continued to the apex of the gill. In *Euastacus* (Plate I, fig. 1) the stems of the podobranchs are each laterally produced into a broad wing-like expansion, and the stem is not continued to the apex.

2. The telson of *Astacopsis* is entirely calcareous, without trace of transverse sutures. The telson of *Euastacus* is membranous posteriorly, and more or less completely divided by a transverse suture.

3. The abdomen of *Astacopsis* is smooth, except for four or five small spines on the pleura of the second abdominal somite. The abdomen of *Euastacus*, especially in adult examples, usually has three or more rows of large spines or tubercles laterally on each somite.

*Key to species of EUASTACUS gen. nov.*

Rostrum twice as long as broad at base.

Abdomen shorter than carapace, furnished with three, sometimes four, rows of large sharp spines laterally on each somite.

Second antennae reaching beyond end of telson

SERRATUS (Shaw)

Carapace and abdomen densely covered by short downy setae

s.sp. HIRSUTUS (McCulloch)

Abdomen as long as carapace, furnished with two, sometimes three, rows of large spines laterally on each somite.

Second antennae reaching to third abdominal somite

YARRAENSIS (McCoy)

Rostrum one-fourth longer than broad at base.

Abdomen longer than carapace, furnished with three sharp spines laterally on each somite; dorsum of first four segments raised to a large tumid ridge.

Carapace studded with numerous small tubercles; six or seven large tubercles in an irregular row on dorsum of branchiostegites

NOBILIS (Dana)

Carapace sparsely studded with small tubercles on branchiostegites

s.sp. KERSHAWI (Smith)

Abdomen longer than carapace, without spines or tubercles, except on lateral margins . . . . . FLECKERI (Watson)

*Euastacus serratus* (Shaw).

(Pl. I, fig. 1; Pl. II, fig. 12.)

*Cancer serratus* Shaw, Zool. of New Holland, i, 1794, p. 21, pl. 8.*Astacus serratus* Gray, Eyre's Journ. Exped. Disc. Cent. Austrl., i (Appendix), p. 409, 1845; McCoy, Ann. Mag. Nat. Hist., ser. 3, xx, p. 189, 1867; von Martens, Monats. Akad. Wiss. Berlin, p. 615, 1868.*Potamobius serratus* White, Proc. Zool. Soc. Lond., 1850, xviii, p. 95, pl. 15.*Astacoides serratus* McCoy, Prodromus Zool. Victoria, i, 1879, p. 17, pl. 15.*Astacopsis serratus* Haswell, Cat. Austrl. Mus., Crust., 1882, p. 174; Ortmann, Proc. Amer. Philos. Soc., xli, p. 292, 1902; Smith, Proc. Zool. Soc. Lond., p. 157, pl. 16, 1912; McCulloch, Rec. Austrl. Mus., No. 11, p. 237, 1917; Hale, Handbook Crust. Sth. Austrl., 1927, p. 75.*Astacoides spinifer* Heller, Reise Novara, Zool., ii, pt. 3, Crust., 1865, p. 102.*Astacopsis spinifer* Spence-Bate, "Challenger" Reports, xxiv, 1888, p. 195, pl. 28; Faxon, Proc. U.S. Nat. Mus., xx, 1898, p. 670; Faxon, Mem. Mus. Comp. Zool., xl, 1914, p. 402.*Astacus armatus* von Martens, Ann. Mag. Nat. Hist., ser. 3, xvii, 1866, p. 359.*Astacopsis sydneyensis* Spence-Bate, "Challenger" Reports, xxiv, 1888, p. 204, pl. 23.*Astacus australasiensis* Milne-Edwards, Hist. Nat. Crust., ii, p. 332, pl. 24, figs. 1-5, 1837; Audouin and Milne-Edwards, Arch. du Mus. d'Hist. Nat., ii, 1841, p. 36; Erichson, Arch. f. Naturg., xii, 1846, p. 94; Heller, Reise Novara, Crust., 1865, p. 100; von Martens, Monats. Akad. Wiss. Berlin, 1868, p. 618; Faxon, Proc. U.S. Nat. Mus., xx, 1898, p. 675.*Astacopsis australasiensis* Haswell, Cat. Austrl. Mus., Crust., 1882, p. 178; Faxon, Mem. Mus. Comp. Zool., xl, 1914, 8, p. 351.

Length of average adult specimen, 300 mm.

Rostrum twice as long as broad at base, apex long and sharp; carinae sharp, with four or five sharp spines; a sharp spine at base of each carina, with another posterior-laterally to it.

Second antennae reaching beyond end of telson; squame smooth, inner lobe broad, terminal spine long and stout. Interantennal spine triangular, ending in a blunt point, lateral margins smooth or feebly serrated.

Carapace twice as long as broad, broader than high, longer than abdomen. Branchiostegites studded with numerous small tubercles, and eight to twelve sharp spines in an irregular row on upper margin.

First abdominal somite with two sharp spines on each lateral lobe; second with two spines on lateral margin, remaining somites each with a long sharp spine on lateral margin; four long sharp spines on dorsum of each somite, spines very small on sixth somite.

Telson broad, slightly longer than broad, almost completely divided by a transverse suture, with a spine on each lateral margin at suture and five small spines on surface; inner rami of uropods each with a spine on lateral margins,



median carina feeble, ending in a sharp spine near posterior margin; outer rami of uropods each with numerous spines along transverse suture, some examples having two or three small spines on outer lateral margin. Lobes at base of uropods without spines.

Sternal keel rounded below first and second pereopods, sharp below great chelae; first pair of lateral processes very small and sharp, second pair larger, and third pair four times as large as first, rounded; posterior pair large, blunt, and deeply grooved; processes between fourth pereopods long and stout.

Great chelae stout, propodus two and one-half times as long as broad, upper margin with four sharp spines, lower margin with a double row of sharp spines, cutting edge with two large and several small tubercles; dactylus with several small tubercles on cutting edge, upper margin usually smooth, sometimes with one or two small sharp spines. Carpus with two long sharp spines on upper margin, upper surface deeply grooved; merus with three large and five small sharp spines on upper margin.

*Colour.*—The colour, chiefly in shades of blue and bluish-green, is subject to considerable variation at all stages of growth. McCulloch (1917) records bright pink examples from the Blue Mountains, New South Wales. In specimens received alive from Dr. W. J. Harris, of Echuca, Victoria, the carapace, abdomen and pereopods varied from light blue to very dark blue, but some were a light greenish-blue; the dorsum of the carapace, spines on carapace, abdomen and pereopods, and the whole of the great chelae, white.

Great variation is shown in the number and position of the spines in individuals of all sizes, particularly those on the rostrum and telson. In the series from Echuca no two examples are identical; some have numerous small spines on the upper surface of the telson, others only two or three spines, others again spines on the lateral margins only. In some specimens the rostrum has five spines on each side; one has three spines on one side and two on the other; another has one spine at each side of the apex and two very small tubercles behind the spines. The spines on the branchiostegites and abdomen also vary in number and size.

*Habitat.*—Murray River and its tributaries in *Victoria, New South Wales* and *South Australia*; Brisbane Waters (White, 1850).

Described from a series of 60 specimens ranging in length from 50 mm. to 300 mm., from various localities in Victoria, New South Wales and South Australia. It is popularly known as the Murray Lobster, or Murray Crayfish.

*Local Varieties.*—A series of seven specimens from the Jamieson River (A. Hordern, 1935) and a series of nine from the Goulburn and Howqua Rivers (E. Clark, 1935), although fairly close to *serratus* in general characters, differ in having the spines on the carapace very small and less numerous; and the second antennae barely reach the base of the telson. The largest examples (212 mm.) were cress green on the carapace, abdomen and pereopods, with the great chelae and all the spines white; a few examples were entirely green. Many of the smallest (90 mm.) were entirely dark reddish-brown, with the spines more reddish.

Specimens from Buffalo River, Victoria (E. Clark, 1935), agree in general characters with *serratus* but the great chelae are very short and stout as in *yarraensis*, and the spines on the branchiostegites are smaller and less numerous than in *serratus*. Colour as in *serratus*.

*Euastacus serratus* s.sp. *hirsutus* (McCulloch).  
(Pl. II, fig. 14.)

*Astacopsis serratus* var. *hirsutus* McCulloch, Records, Australian Museum, No. 11, 1917, p. 238, pl. 43.

*Male*.—Length, 82 mm.

General characters as in *serratus*. Carapace and abdomen devoid of spines and tubercles, but densely covered by short setae. Carpus of great chelae with three spines on upper margin where *serratus* has two.

*Habitat*.—*New South Wales*: Belmore Falls Creek, Kangaroo River (type locality).

Types in the Australian Museum, Sydney.

Described from two paratypes received on loan from the Australian Museum, Sydney.

*Euastacus yarraensis* (McCoy).  
(Pl. II, fig. 13.)

*Astacopsis serratus* Shaw var. *yarraensis* McCoy, Prodromus Zool. Victoria, ii, Dec. 16, 1888, p. 225, pl. 16.

Length of average adult specimen, 300 mm.

Rostrum twice as long as broad at base, apex long and sharp; carinae sharp, each with three or four small sharp spines; two blunt spines on carapace posterior-laterally to carinae.

Second antennae stout, reaching to third abdominal somite; squame smooth, inner lobe broad, terminal spine long and stout. Interantennal spine triangular, long, sharply pointed, lateral margins serrated.

Carapace twice as long as broad, broader than high, as long as abdomen; branchiostegites with numerous small tubercles and an irregular row of six to nine large tubercles on upper margin.

First abdominal somite with a small sharp spine on lateral lobes, second somite with three sharp spines along lateral margins, three following somites with a sharp spine on lateral margins and a smaller one immediately above it, and a large sharp spine nearer dorsum of somite; most examples have a row of small blunt tubercles on dorsum.

Telson longer than broad, almost completely divided by a transverse suture, posterior half membranous; ten to fifteen sharp spines present on surface, and a spine on each lateral margin at suture; inner rami of uropods each with two sharp spines marking the obsolete median carina, one spine on outer lateral margin near posterior margin; outer rami each with an obsolete longitudinal median carina, numerous sharp spines along transverse suture, and three spines on outer lateral margins. Lobes at base of uropods without spines.

Great chelae stout, propodus almost twice as long as broad, upper margin with four blunt spines, lower margin with a double row of short blunt spines, cutting edge with two large tubercles; upper margin of dactylus smooth, cutting edge with six or seven large tubercles; two sharp spines on under surface at base of dactylus. Carpus with one large and one small spine on upper margin; merus with four or five large and three small spines on upper margin.

*Habitat*.—*Victoria*: Yarra River (type locality); Yea River (Yea State

School, 1935); Plenty River (S. A. Keartland, 1896); Barwon River (W. Kershaw, 1879); Watts River (S. W. Fulton, 1898); Kennedy's Creek (W. A. Hall, 1897); Badger Creek (F. J. Williams, 1905).

Type in National Museum, Melbourne.

Described from a series of 40 specimens ranging in length from 90 mm. to 300 mm. The type of the species is a half-grown specimen 110 mm. long. Specimens equalling in size the largest *E. serratus* have been received by the National Museum since the species was described by McCoy.

Readily separated from *E. serratus* by the very broad, highly-arched abdomen; the longer telson and uropods, and the reduction in size and number of spines on the carapace and abdomen; also by the great chelae being shorter and stouter, and the second antennae much shorter than in *serratus*.

*Euastacus nobilis* (Dana).

(Pl. III, fig. 15.)

*Astacoides nobilis* Dana, U.S. Explor. Exped., Crust., pt. 1, 1852, p. 526, pl. 33.

*Astacoides nobilis* Hess, Archiv. f. Naturg., xxxi, 1865, p. 164; Heller, Reise Novara, Zool., ii, pt. 3, Crust., 1865, p. 101; von Martens, Ann. Mag. Nat. Hist., ser. 3, xvii, p. 360, 1866.

*Astacus nobilis* von Martens, Monatsber. Akad. Wiss. Berlin, p. 616, 1868.

*Astacopsis nobilis* Haswell, Cat. Austrl. Mus., Crust., 1882, p. 175; Faxon, Proc. U.S. Nat. Mus., xx, p. 675, 1898; Faxon, Mem. Mus. Comp. Zool., x1, 8, 1914, p. 402.

*Astacopsis serratus* Smith, Proc. Zool. Soc. Lond. 1912, p. 157.

*Astacopsis paramattaensis* Spence-Bate, "Challenger" Reports, xxiv, p. 202, 1888; Faxon, Proc. U.S. Nat. Mus., xx, 1898, p. 675.

Length of average adult specimen, 320 mm.

Rostrum one-fourth longer than broad at base, apex short and blunt; lateral carinae sharp with three or four blunt spines; a blunt spine at base of carinae, and a large rounded boss posterior-laterally to it.

Second antennae reaching fourth abdominal somite, squame smooth, inner lobe short and broad, sloping to a long sharp terminal spine. Interantennal spine rather long and narrow, bluntly pointed.

Carapace twice as long as broad, broader than high, somewhat shorter than abdomen; branchiostegites studded with numerous small tubercles, and six or seven large round tubercles in an irregular row on upper margin; two or three sharp spines on anterior margin.

First abdominal somite with a long sharp spine on lateral lobes; second with three long sharp spines on lateral margins, and a long spine above third; remaining somites each with three sharp lateral spines; dorsum of first four somites raised to large tumid ridges, occupying half the width of the somite.

Telson almost completely divided at middle by a transverse suture, posterior half membranous; rather short, with a spine on each lateral margin at suture,

and eight or nine spines on surface; some examples with three spines on lateral margins, and four spines on surface. Inner rami of uropods each with three sharp spines marking the obsolete median carina, three large and several small spines on outer lateral margin; outer rami each with numerous sharp spines along transverse suture. Lobes at base of uropods with a spine on upper lobe.

Sternal keel moderately sharp; first pair of lateral processes small and round, increasing in size and sharpness to posterior, the latter large and deeply grooved.

Great chelae stout, propodus twice as long as broad, upper margin with four small blunt spines, lower margin with a double row of numerous small sharp spines, cutting edge of propodus with two large and a few small tubercles; dactylus with several small tubercles on cutting edge, and six or seven blunt spines on upper margin. Carpus with three long sharp spines on upper margin, upper surface deeply grooved; merus with four large sharp spines and a few small spines on upper margin.

*Habitat*.—*New South Wales*: Sydney (W. Kershaw, 1890); Wollongong; Parramatta River; Mt. Kosciusko; Blue Mountains. *Queensland*: Stanthorpe; Moreton Bay. *Victoria*: Bruthen (J. Barling, 1918); Narracan River (W. Kershaw, 1890); Thomson River (R. James, 1936).

*Euastacus nobilis* s.sp. *kershawi* (Smith).

(Pl. III, fig. 16.)

*Astacopsis kershawi* Smith, Proc. Zool. Soc. Lond., 1912, p. 160.

Rostrum, antennae, squame, interantennal spine and sternal keel as in *E. nobilis*.

Carapace twice as long as broad, somewhat shorter than abdomen; branchiostegites sparsely studded with small tubercles.

Abdomen as in *E. nobilis*, but telson and uropods longer.

Great chelae as in *nobilis* but less spinose. Carpus with two sharp spines on upper margin, in some examples.

*Colour*.—The colour varies from deep olive-green to mid bluish-green on carapace, abdomen, pereopods and great chelae, tinged with red on the tips of the spines and tubercles, and on the basal portions of the pereopods, the bases of the antennae, and on the posterior portion of the branchiostegites, and the membranous portion of telson and uropods. A few examples in the series are brownish-green, with the spines on body and the whole of the great chelae bright blue, pereopods dull reddish-brown.

*Habitat*.—*Victoria*: Moe River (type locality) (W. Kershaw, 1886); Thorpdale (W. Kershaw, 1888); Bunyip River (W. Kershaw, 1888); Fern-tree Gully (S. W. Fulton, 1906); Warburton (F. J. Williams, 1905); Vereker Range, Wilson's Promontory (J. A. Kershaw, 1913); Glenelg River, near junction with Limestone Creek (H. Pritchard, 1935); Crawford River (J. H. McEachern, 1936).

Types in National Museum, Melbourne.

Dana (1852) described and figured *Astacoides nobilis*, which he queried inhabited New South Wales. Huxley (1880) considered *nobilis* identical with *armatus* (*serratus*). Haswell (1882) quoted Dana's description, adding that it was probably identical with *A. franklinii* (Gray). Faxon (1898) listed



the name and considered the species valid, possibly the Australian representative of *A. franklinii*. Smith (1912) placed *nobilis* in the synonymy of *serratus* (Shaw) from the Parramatta River, and described a new species, *A. kershawi*, from Victoria. For reasons given below I consider *A. nobilis* to be a valid species and *A. kershawi* to be a subspecies of it.

In the material examined *E. nobilis* and *E. nobilis* s.sp. *kershawi* are represented by eighty individuals ranging in length from one and one-half inches to eleven inches from tip of rostrum to end of telson. The series includes the three large specimens on which Smith founded *A. kershawi*, and eleven small which he called the Local Variety or Small Gippsland Crayfish.

The smallest in the series have the body smooth or with very minute scattered tubercles on the branchiostegites; on examples three inches long the tubercles are more pronounced. Specimens five inches long have the tubercles larger, but not prominent, agreeing in all details with Dana's description. Examples seven inches long have the tubercles on the carapace similar to those of the adults, the row of large tubercles on the dorsum of the branchiostegites being prominent; and the large tubercle-like ridges on the first four abdominal somites are noticeable. The largest specimens have very large tubercles on the dorsum of the branchiostegites, thus differing from those described by Smith as *A. kershawi*.

Specimens of *nobilis* and *kershawi* are separated at all stages by the size of the telson and uropods, which are larger in *kershawi*, and by the large tubercles on the carapace of *nobilis* which are absent in *kershawi*, although two specimens of *kershawi* have two or three fairly large tubercles on one side only. As the differences are constant, although so slight, *kershawi* is retained as a subspecies of *nobilis*.

*Euastacus fleckeri* (Watson).

(Pl. III, fig. 17.)

*Astacopsis fleckeri* Watson, Mem. Queensland Mus., x, pt. v, 1935, p. 232, pl. xxxiv; l.c., xi, pt. 1, 1936, p. 52. Flecker, Nth. Queensland Nat., iv, 41, 1936, pp. 18-20.

Length of largest specimen examined, 210 mm.

Rostrum slightly longer than broad at base, apex rounded; lateral carinae blunt, each with three or four small tubercles; a small tubercle at base of each carina.

Second antennae reaching to base of telson; squame smooth, inner lobe broad, terminal spine short and sharp. Interantennal spine long and narrow, sharply pointed, margins serrated.

Carapace twice as long as broad, broader than high, somewhat shorter than abdomen. Branchiostegites studded with numerous small tubercles.

First abdominal somite with a long sharp spine on lateral lobes; second with four or five sharp spines on lateral margins; remaining somites each with one spine on lateral margin. No other spines or prominences on abdomen.

Telson longer than broad, almost completely divided at posterior third by a transverse suture, posterior third membranous; a small spine on each lateral margin at suture, without other median or lateral spines. Inner rami of uropods with obsolete median carina ending in a small blunt spine almost on posterior margin, a small blunt spine at posterior third of outer margin. Outer rami each with numerous small spines along transverse suture. Lobes at base of uropods smooth.

Sternal keel moderately sharp; first pair of lateral processes small and round, increasing in size and sharpness to posterior pair, these large and deeply grooved.

Great chelae stout, propodus more than twice as long as broad, upper margin with four small blunt spines, cutting edge of propodus with one large and three or four small tubercles on cutting edge, upper margin smooth or with one or two small tubercles. Carpus with four or five sharp spines along upper margin, upper surface flat; merus with four or five small spines on upper margin.

*Habitat*.—North Queensland: Root's Creek (type locality); Mossman River and its tributaries.

Type in the Queensland Museum, Brisbane.

Readily separated from *E. nobilis*, which it somewhat resembles, by the absence of spines or tubercles from the dorsum of the abdominal somites, the absence of spines on the telson and uropods, and by the form of the carpus. Redescribed from three specimens, two females and one male, received from the authorities of the Queensland Museum.

The species was described from a single specimen stated to be a male. An examination, however, shows the specimen to be a female. Flecker (1936), dealing with the habits and haunt of the species, also alludes to the type as a male.

### Genus CHERAX Erichson.\*

*Astacus* (*Cherax*) Erichson, Arch. f. Naturg., xii, pp. 88-89, 1846.

*Astacus* (*Cheraps*) Erichson, l.c., p. 101.

*Astacus* Gray, Eyre's Journ. Exped. Disc. Cent. Austrl., i (Appendix), 1845, p. 410; von Martens, Monats. Akad. Wiss. Berlin, 1868, p. 164.

*Astacoides* Hess, Arch. f. Naturg., xxxi, 1865, p. 164; McCoy, Prod. Zool. Victoria, i, Dec. 3, 1879, p. 45.

*Astacopsis* Haswell, Cat. Austrl. Mus., Crust., p. 177, 1882; Spencer and Hall, Rep. Horn Exped. Centr. Austrl., pt. ii, Zool., p. 244, 1896.

*Cheraps* Huxley, Proc. Zool. Soc. Lond., 1878, p. 769; Smith, Proc. Zool. Soc. Lond., 1912, p. 165.

\*For notes on the generic definition of *Cherax* see page 50.

*Cheraps* Faxon, Proc. U.S. Nat. Mus., xx, 1898, p. 671; Ortmann, Proc. Amer. Philos. Soc., xli, 1902, p. 291; Faxon, Mem. Mus. Comp. Zool., xl, 8, p. 403, 1914; McCulloch, Rec. West. Austrl. Mus., i, pt. 3, p. 229, 1914.

*Parachaeraps* Smith, Proc. Zool. Soc. Lond., 1912, p. 165; McCulloch, Rec. West. Austrl. Mus., i, pt. 3, p. 234, 1914; Hale, Austrl. Mus. Mag., ii, No. 8, p. 271, 1925; Hale, Handbook Crust. Sth. Austrl., 1927, p. 73.

Carapace punctate, sometimes tuberculate; lateral carinae of rostrum feeble or conspicuously sharp. Cervical suture deeply impressed, rounded.

Abdomen longer than carapace, either punctate or tuberculate; lateral margins rounded. First somite with lateral lobes large and rounded. Telson and uropods each half calcareous and half membranous. Telson without a transverse suture.

Second antennae set at the side of first; squame large. Upper lip long and narrow, straight or slightly concave medianly.

Vas deferens on long projecting papillae on coxae of fourth pereopods.

Stems of podobranchs (Pl. i, fig. 3) each produced into a broad wing-like expansion bearing numerous hooked filaments. Last posterior arthrobranch very small. Gill formula 21 + epr.

Erichson (1846) divided the genus *Astacus* into five subgenera to which he gave a key (p. 88). In this key the name of the fourth subgenus is *Cherax*, and in the next two pages it is referred to repeatedly as *Cherax*. In the description of the subgenus and the new species (p. 94) the name is spelt *Cheraps*, and on p. 376 he again refers to it as *Cheraps*. All subsequent authors have used the name *Cheraps*, or misspelt it *Chaeraps*. Since *Cherax* is the name first given to the subgenus, it must stand.

My friends who are Greek scholars consider that, since there are no such Greek words as *Cherax* or *Cheraps*, the generic name *Cherax* is evidently a misspelling of the word *Charax* (Χάραξ), a pointed stake (i.e., a thing that scratches), derived from the verb χαράσσειν, to furrow, engrave or scratch a mark.

### *Key to species of CHERAX Erichson.*

Rostrum four times as long as broad at base.

Five carinae on carapace.

Squame of second antennae reaching beyond the third segment of second antennae.

Great chelae long and slender, propodus two and one-half times longer than broad, dactylus long and slender

TENUIMANUS (Smith)

Squame of second antennae reaching almost to end of third segment of second antennae.

Great chelae long and stout, propodus two and one-half times longer than broad, dactylus short and stout

QUINQUECARINATUS (Gray)

Four carinae on carapace.

Squame of second antennae long and slender.

Great chelae long and slender, propodus three times as long as broad,  
dactylus long and slender

QUADRICARINATUS (von Martens)

Rostrum twice as long as broad at base, apex sharp.

Two carinae on carapace.

Squame of second antennae not broad anteriorly.

Sternal keel very sharp.

Great chelae long and stout, propodus two and one-half times as  
long as broad, dactylus short and stout, with a tubercle in  
centre of cutting edge . . . . . BICARINATUS (Gray)

Great chelae slender, propodus two and one-half times as long as  
broad, dactylus long and slender

s.sp. ANGUSTUS (McCulloch)

Rostrum twice as long as broad at base, apex sharp.

Two carinae on carapace.

Squame of second antennae very broad anteriorly.

Sternal keel moderately sharp, without conspicuous opening on  
lateral processes . . . . . DESTRUCTOR sp.nov.

Sternal keel blunt, with conspicuous openings on lateral processes

ALBIDUS sp.nov.

Rostrum slightly longer than broad at base, apex rounded.

Two carinae on carapace.

Sternal keel very sharp; lateral processes below second and third pereopods produced into conspicuous openings . PUNCTATUS sp.nov.

### *Cherax tenuimanus* (Smith).

(Pl. IV, fig. 18.)

*Chaeraps tenuimanus* Smith, Proc. Zool. Soc. Lond., 1912, p. 166, pl. 22; 27, fig. 30.

*Cheraps tenuimanus* McCulloch, Rec. West. Austrl. Mus., i, pt. 3, 1914, p. 233, pls. 34, 35.

Length of average adult specimen, 375 mm.

Rostrum long and slender, four times as long as broad at base, reaching to, or beyond, end of third segment of second antennae, carinae sharp, each with from three to six spines; two carinae on carapace at outer side of rostral carinae, and one median carina.

Squame of second antennae long and slender, reaching well beyond the end of third segment of second antennae, terminal spine short and sharp. Interantennal spine short and broad, bluntly pointed.

Carapace shorter than abdomen, cervical suture deeply impressed, areola broad; branchiostegites covered with numerous small obtuse spines and tubercles, a row of sharp spines behind cervical suture. Anterior of carapace with numerous small tubercles, a row of obtuse spines reaching from interantennal spine to cervical suture. Entire carapace densely hirsute.

Sternal keel highly raised, broad and blunt, serrated into four large blunt tubercles, a sharp backwardly directed spine below great chelae. First three pairs of lateral processes obsolete, fourth pair large and flattened, shelf below



wide and sharp; processes between fourth pereopods short and stout, with a large blunt spine in centre of processes.

Abdomen densely punctate, lateral margins of first somite covered with numerous small blunt spines or tubercles, following somites each with a few small tubercles on lateral margins; entire abdomen more or less densely hirsute.

Telson with a spine on each lateral margin, and two or more median spines, at junction of membranous portion; inner rami of uropods each with a median spine and an outer lateral spine at junction of membranous portion; outer rami each with several sharp spines along transverse suture. Lobes at base of uropods with upper lobe produced into a long sharp spine.

Great chelae: these vary in size and stoutness in individuals of all sizes, length varying from two and one-half times to three and three-fourths times as long as broad; upper margin feebly serrated, without the setose margin usually found in species of *Cherax*, lower margin smooth, cutting edge of propodus and dactylus each with two or three small tubercles, smooth in some examples; apex of both sharply recurved. Carpus with one or two sharp spines on upper margin, upper surface deeply grooved. Merus with one or two small blunt tubercles on upper margin.

*Habitat.*—*Western Australia*: Margaret River (Miss H. Alexander, 1936); Harvey River; Koriijekup; Kojonup; Balingup Brook; Warren River; Blackwood River; Katanning.

Popularly known as the Marron, fully-grown specimens equal in size the large Murray River Crayfish. The difference in the size of the great chelae in the sexes is striking in the 12 specimens examined, but in a large series it may not be a constant feature. Great variation is shown in the armature of the carapace and abdomen of immature and adult specimens.

### *Cherax quinquecarinatus* (Gray).

(Pl. V, fig. 20.)

*Astacus quinque-carinatus* Gray, Eyre's Journ. Exped. Disc. Cent. Austrl., i (Appendix), 1845, p. 410, pl. 3, fig. 3.

*Astacus quinquecarinatus* Erichson, Arch. f. Naturg., xii, 1846, p. 376; White, List Crust. Brit. Mus., 1847, p. 72; von Martens, Monats. Akad. Wiss. Berlin, 1868, p. 616.

*Astacopsis quinque-carinatus* Haswell, Cat. Austrl. Mus., Crust., p. 176, 1882.

*Cheraps quinquecarinatus* Faxon, Proc. U.S. Nat. Mus., xx, 1898, p. 677; Ortmann, Proc. Amer. Philos. Soc., xli, 1902, p. 291; Faxon, Mem. Mus. Comp. Zool., xl, 1914, p. 403; McCulloch, Rec. West. Austrl. Mus., i, pt. 3, 1914, p. 232, pl. 33.

*Chaeraps quinquecarinatus* Smith, Proc. Zool. Soc. Lond., 1912, p. 165.

Length of average adult specimen, 130 mm.

Rostrum long and slender, three times as long as broad at base, reaching to end of third segment of first antennae, apex sharp, with one or two spines at each side; carinae sharp, carried well back on to carapace; two carinae on carapace at outer side of rostral carinae, and one median carina.

Squame of each second antenna long and slender, reaching the end of

the third segment of second antennae, terminal spine short and sharp. Inter-antennal spine short and broad, sharply pointed.

Carapace shorter than abdomen, as high as broad, twice as long as broad; cervical groove deeply impressed, areola fairly broad; branchiostegites punctate, minutely tuberculate on some examples, a row of large tubercles behind cervical suture.

Sternal keel very sharp; first three pairs of lateral processes very small, posterior pair small and slightly grooved; processes between fourth pereopods short and stout.

Telson with a spine on each lateral margin at junction of membranous portion; inner rami of uropods each with a median spine and an outer lateral spine at junction of membranous portion; outer rami each with several sharp spines along transverse suture. Lobes at base of uropods with upper lobe produced into a long sharp spine.

Great chelae long and stout; propodus two and one-half times longer than broad, upper margin serrated, lower margin smooth; cutting edge of propodus and dactylus each with one or two small tubercles. Carpus with a small sharp spine on upper margin. Merus with one or two small blunt tubercles on upper margin.

*Habitat.*—*Western Australia*: Swan River (type locality); Perth (A. Blain, 1936); Northam, Avon River (E. Nelson, 1936); Chidlow's Wells; Cannington; Koriyekup; Harvey, Harvey River; Vasse River; Mundaring Weir; Toodyay.

Type in British Museum.

Popularly known as the Gilgy. Described from a series of 60 specimens received from Mr. A. Blain and Mr. E. Nelson.

Amongst the material from Perth is a fine example of a gynandromorph (Pl. IV, fig. 20c), a description of which is included here. Of the many hundreds of specimens examined during the progress of this paper it is the only such example, and is apparently the first to be definitely recorded from Australia.

Length, 110 mm.

Rostrum short and broad, reaching almost to end of first segment of first antennae, apex sharply upturned; carinae sharp, carried well back on to carapace, without spines; lateral carinae sharp, median carinae blunt.

Squame of the second antenna on the left side curved inwards instead of continuing straight to apex.

The carapace is broader in proportion to size than in the normal specimens, and the sternal keel much more raised and sharp. The external sexual organs of the male appear on the coxae of the fourth pereopod on the right side, and of the female on the second pereopod on the left side.

The great chela on the left side is large and stout, and that on the right small and slender.

### *Cherax quadricarinatus* (von Martens).

(Pl. IV, fig. 19.)

*Astacus quadricarinatus* von Martens, Monats. Akad. Wiss. Berlin, 1868, p. 617.

*Astacopsis quadricarinatus* Haswell, Cat. Austrl. Mus. Crust., 1882, 177.

*Cheraps quadricarinatus* Faxon, Proc. U.S. Nat. Mus., xx, 1898, p. 677; Ortmann, Proc. Amer. Philos. Soc., 1902, xli, p. 291; Calman, Ann. Mag. Nat. Hist., viii, 1911, p. 366; Faxon, Mem. Mus. Comp. Zool., xl, 1914, p. 403.

*Chaeraps quadricarinatus* Smith, Proc. Zool. Soc. Lond., 1912, p. 167.

*Astaconephrops albertsii* Nobili, Ann. Mus. Civ. Genova, xl, p. 244, 1899; Nobili, Boll. Mus. Zool. Torina, 1903, xviii, p. 1; Faxon, Mem. Mus. Comp. Zool., xl, 1914, p. 404.

*Cheraps lorentzi* Roux, Notes Leyden Mus., xxxiii, 1911, p. 97, figs. 4-5.

*Cheraps aruanus* Roux, Notes Leyden Mus., xxxiii, 1911, p. 88, figs. 2-3.

*Astacopsis australasiensis* Nobili, Ann. Mus. Civ. St. Nat., xl, 1899, p. 246; Boll. Mus. Zool. Torino, xviii, No. 445, 1903, p. 2.

Rostrum long and slender, three and one-half times as long as broad at base, apex long and sharp, with three spines at each side; carinae sharp, not reaching to apex, carried well back on to carapace, lateral carinae sharp.

Squame of each second antenna very long and slender. Interantennal spine short and broad, sharply pointed.

Carapace shorter than abdomen, as broad as high, areola very broad.

Sternal keel raised, moderately sharp; lateral processes obsolete, fourth pair flattened; a sharp backwardly directed spine in centre of obsolete lateral processes of fourth pereopods.

Membranous portion of telson short in comparison with upper calcareous portion, a spine on each lateral margin at posterior third. Uropods as long as telson, each divided by a longitudinal median carina ending in a spine at junction of membranous portion, a spine on outer lateral margin at membranous border; outer rami each divided by a feeble longitudinal median carina, numerous small sharp spines along transverse suture. Lobes at base of uropods with upper lobe produced to a small sharp spine.

Great chelae long and slender, propodus three times as long as broad, dactylus long and slender. Carpus with one to four small sharp spines on upper margin; upper margin of merus with two sharp spines.

*Habitat*.—*Queensland*: Cape York (type locality). *Northern Territory*: Adelaide River; Roper River (Sir B. Spencer). *New Guinea*: Katau; Mainikion; Sabang; Baie Etna; Mimika River. *Aru Islands*.

### *Cherax bicarinatus* (Gray).

(Pl. V, figs. 21, 22.)

*Astacus bicarinatus* Gray, Eyre's Journ. Exped. Disc. Cent. Austrl., i (Appendix), p. 410, 1845.

*Astacus bicarinatus* Erichson, Arch. f. Naturg., xii, 1846, p. 376.

*Astacopsis bicarinatus* Haswell, Cat. Austrl. Mus., Crust., p. 177, 1882.

*Chaeraps intermedius* Smith, Proc. Zool. Soc. Lond., 1912, p. 168.

*Cheraps preissii* Er., McCulloch, Rec. West. Austrl. Mus., i, pt. 3, 1914, p. 229.

Length of average adult specimen, 140 mm.

Rostrum short and broad, reaching to base of third segment of first antennae, almost twice as long as broad at base, apex sharp with two blunt spines on each side; carinae smooth and blunt; lateral carinae blunt, ending in a rounded boss.

Squame of each second antenna fairly broad, sharply pointed, reaching to end of third segment of second antennae. Interantennal spine short and broad, sharply pointed.

Carapace shorter than abdomen, higher than broad, twice as long as broad; cervical groove deeply impressed, areola fairly broad; branchiostegites punctate, minutely tuberculate on some examples.

Sternal keel very sharp; a long sharp backwardly-directed spine below great chelae; first two pairs of lateral processes obsolete, third pair small and blunt, posterior pair larger, deeply grooved; processes between fourth pereopods long and stout.

Telson with a spine on each lateral margin at junction of membranous portion; inner rami of uropods each with a median spine and an outer lateral spine at junction of membranous portion; outer rami each with several sharp spines along transverse suture. Lobes at base of uropods with upper lobe produced into a long sharp spine.

Great chelae long and stout, propodus twice as long as broad, lower margin smooth, upper margin serrated; cutting edge smooth or with a few small tubercles; dactylus with one large tubercle in centre of cutting edge. Carpus with a large forwardly directed spine on upper margin. Merus with one or two small blunt tubercles on upper margin.

*Habitat*.—*Northern Territory*: Port Essington (type locality). *Western Australia*: Kojonup; Harvey, Harvey River; Guildford; streams outside Mammoth Cave, and inside the Calgardup Cave, Cave district (McCulloch); Hillman; Darkan; Korejikup; Toll's Pass, Stirling Range.

Types in British Museum.

Described from two specimens from Gray's type material, on loan from British Museum; compared with the two types of *C. intermedius* Smith in the National Museum; and seven specimens from Western Australia. Specimens from both Gray's and Smith's material are figured for comparison (Plate V).

*Cherax bicarinatus* s.sp. *angustus* (McCulloch).

*Chaeraps preissi* var. *angustus* McC., Rec. West. Austrl. Mus., i, pt. 3, p. 231.

"This variety differs from the typical form only in having more slender chelipeds and legs, and a slightly narrower carapace. The chelae are particularly narrow in my smallest specimens, and in this respect differ greatly from others of the typical form of about the same size in which they are almost similar to those of the adults. The colour, after long preservation, is a dark violet with light bluish areas on the sides and under parts.

"The plate illustrates the only three specimens I have seen, which were collected for the Australian Museum by Mr. A. Abjornssen, near Albany. They are 141, 102 and 78 mm. long from the tip of the rostrum to the end of the telson, and the largest and smallest are females" (McCulloch, op. cit.).



Smith (1912) erected a new genus *Parachaeraps* for a single species, *Astacus bicarinatus* Gray, which previously was included in the genus *Cheraps*. The reasons for erecting the genus are rather vague, as he states that *bicarinatus* does not differ very strikingly from species retained in *Cheraps*. The main reason, apparently, was to demonstrate his theory of the evolution of the Australian crayfishes, but in the paper with E. H. J. Schuster (1913) he refutes his original theory, introducing another in which this species is not important, making the genus no longer necessary from this point of view. Apart from that, the generic characters given do not apply to the specimens, now in the National Museum, upon which he founded the genus.

The chief generic character given is as follows:

"The distance between the tip of the rostrum and the cervical suture is *shorter* than between the cervical suture and the posterior border of the carapace."

While in *Chaeraps*:

"The distance between the tip of the rostrum and the cervical suture is distinctly *longer* than that between the cervical suture and the posterior border of the carapace."

Over four hundred specimens, including Smith's types, have been examined, and in all the distance between the tip of the rostrum and the cervical suture is at least one and one-third times as great as the distance between the cervical suture and the posterior border of the carapace.

Furthermore, the specimens on which *Parachaeraps* is based are not, as stated, *Astacus bicarinatus* Gray.

Gray (1845) described and figured *Astacus bicarinatus* from material collected at Port Essington, Northern Territory. Two pages preceding the description he gave an account of a drawing, received from Mr. Eyre, of a crayfish called by the natives eu-kod-ko or koon-go-la; he applied no name to this species, which he considered to be nearest his *quinquecarinatus*. Subsequent authors, however, have treated the drawing as synonymous with *A. bicarinatus*, although Faxon (1898, p. 673) noted that the description and figure do not apply very closely to the species commonly known by this name.

The types of *A. bicarinatus* received on loan from the British Museum show that Gray's species is identical with that described by Smith as *Chaeraps intermedius*. The common yabby (apparently the original of the drawing of the eu-kod-ko) on which Smith founded *Parachaeraps*, is distinct from *bicarinatus* and has not otherwise been named.

McCulloch (1914) placed *intermedius* as a synonym of *preissii* Erichson. Erichson (1846, p. 376) dealing with Gray's paper, states that the description of the telson would place *A. bicarinatus* in his subgenus *Cheraps*, but that the description of the head made it nearer *A. tasmanicus*. Therefore *bicarinatus* (or *intermedius*) apparently is not synonymous with *preissii*. Erichson's description of *preissii* is given for comparison.

*Cherax preissii* (Erichson).

*Astacus* (*Cheraps*) *preissii* Erichson, Archiv. f. Naturg., xii, 1846, p. 101.

*Astacus preissii* von Martens, Monats. Akad. Wiss. Berlin, 1868, p. 617.

*Astacopsis preissii* Haswell, Cat. Austrl. Mus., Crust., 1882, p. 177.

*Cheraps preissi* Ortmann, Proc. Amer. Philos. Soc., xli, 1902, p. 291; Faxon, Proc. U.S. Nat. Mus., xx, 1898, p. 672.

*Chacraps preissii* Smith, Proc. Zool. Soc. Lond., p. 163, 1912.

"Etwas zusammengedrückt. Panzerschild punktirt, an den Seiten sehr fein gekörnt. Schnabel allmählich zugespitzt, glatt-randig, bis an das Ende des zweiten Gliedes der äusseren Fühler reichend. Die Fühlerblätter gross, eiförmig zugespitzt, fast bis zur Spitze des dritten Gliedes der äusseren Fühler reichend. Die Scheeren kräftig, nach innen und auf der Mitte einzeln, an der Aussenseite dichter und gröber punktirt, der Innenrand zu einer sägeförmig gezähnten Leiste erhoben; die Scheerenfinger stark mit hakiger Spitze. Das Glied vor der Scheere an der Innenseite mit einem Dorn. Die überstehenden Ecken der Schwanzschilder mit stumpfen etwas abgerundeten Winkeln.

"Länge von der Schnabelspitze bis zum Ende der Schwanzflosse 3" 5"', des Schnabels 3"', des Scheerenbeines 2" 3"', der Scheere 1", Breite der letzteren 5"', grösste Breite des Panzerschildes 9"', grösste Höhe desselben 10"."

"In dem südwestlichen Neuholland. Von Herrn Preiss eingesandt."

*Cherax destructor* sp. nov.

(Pl. I, figs. 3, 5; Pl. V, fig. 23.)

*Astacoides bicarinatus* McCoy, Prod. Zool. Vic., i, Dec. 3, p. 45, pl. 29, 1879.

*Astacopsis bicarinatus* Spencer and Hall, Rep. Horn Exped. Cent. Austrl., pt. ii, Zool., p. 244, 1896.

*Cheraps bicarinatus* Ortmann, Zoolog. Jahrb., Abth. f. Syst., vi, p. 7, pl. 1, fig. 2; Ortmann, Semon's Zoolog. Forsch. in Austrl., v, p. 21; Faxon, Proc. U.S. Nat. Mus., xx, p. 676, 1898; Ortmann, Proc. Amer. Philos. Soc., xli, p. 291, 1902.

*Parachacraps bicarinatus* Smith, Proc. Zool. Soc. Lond., 1912, p. 163; McCulloch, Rec. West. Austrl. Mus., i, pt. 3, 1914, p. 234; Raff, Proc. Roy. Soc. Vic., xxxi, p. 325, pl. 15, 1919; Hale, Austrl. Mus. Mag., ii, No. 8, 1925, p. 271; Hale, Handbook Crust. Sth. Austrl., p. 73, 1927.

Length of average adult specimen, 160 mm.

Rostrum twice as long as broad at base, reaching to base of third segment of first antennae, apex sharp, with a spine on each side; carinae blunt; lateral carinae blunt, ending in a rounded boss.

Squame of each second antenna very broad anteriorly, terminal spine short and sharp, reaching almost to end of third segment of second antennae. Interantennal spine short and broad, bluntly pointed; on some examples short, broad and rounded.

Carapace shorter than abdomen, broader than high, twice as long as broad; cervical groove deeply impressed, areola narrow; carapace punctate, branchiostegites minutely tuberculate.

Sternal keel moderately sharp, produced to a long, sharp, backwardly-directed spine below great chelae; first two pairs of lateral processes obsolete, third pair small and sharp, posterior pair small and very deeply grooved; processes between fourth pereopods short and stout.

Telson with a spine on each lateral margin at junction of membranous portion; inner rami of uropods each with a median spine and an outer lateral spine at junction of membranous portion; outer rami each with several sharp spines along transverse suture. Lobes at base of uropods with upper lobe produced to a small blunt spine.

Great chelae long and stout, propodus two and one-half times as long as broad, with numerous large punctures; upper margin formed by a row of large blunt tubercles, lower margin smooth, cutting edge of propodus and dactylus feebly serrated. Carpus with a small, blunt forwardly-directed spine on upper margin; merus with upper margin feebly serrated.

*Colour*.—The Hawthorn series shows the great variety of colours found in this species, the following being the colours of various examples: Light and dark green; dark green with blue pereopods and chelae; dark chocolate-brown; brown mottled with red; dark cream-buff mottled with red; pale pinkish on carapace and abdomen, with orange pereopods and chelae; light and dark slate-grey. These colours appear to be fairly general for all localities. Hale (1925-27) records almost black examples from Broken Hill, New South Wales.

*Habitat*.—*Victoria*: Melbourne (type locality); Fernshaw (W. Kershaw, 1879); Thorpdale (W. Kershaw, 1890); Muckleford Creek (F. L. Billingham, 1894); Pyramid Hill (E. H. Hennell, 1890); Warburton; Mortlake (S. W. Fulton, 1905); Castlemaine (T. S. Hall); Goulburn River; Chiltern (J. A. Kershaw, 1905); Lake Hattah (J. E. Dixon, 1917); Murchison (N. Lyons, 1935); Yea (J. and R. Drysdale, 1935); Somerville (B. Durrant, V. McConachy, 1936); Hawthorn (L. and R. Jones, T. Quigley, 1936); Dunolly (A. J. Williamson, 1930); Skipton (E. G. Austin, 1936). *South Australia*: Blanchetown No. 1 Lock (G. Brooks, 1935); Kapunda (H. L. Haines, 1935); Lucindale (A. M. Lea, 1914); Lower Light, via Two Wells (H. T. Donnelly, 1935); Happy Valley (P. H. Dodd, 1936); Myponga; Mosquito Creek, 8 miles south of Naracoorte (A. S. Dolan, 1935); Onkaparinga (F. R. Ball, 1936); Renmark No. 6 Lock (Kennewell, 1935); River Torrens (M. McAuna, 1936); Straun Creek, 9 miles south of Naracoorte (H. A. Lindsay, 1936); Yacka (C. Laube, 1935). *Central Australia*: Macumba River; Finke River; Stevenson River; Charlotte Waters; Running Waters; Hermannsburg (Sir Baldwin Spencer). *New South Wales*: Broken Hill (F. W. Shepherd, 1925); Manning River (Haswell, 1882); Mooki River (L. Weatherly, 1936). *Queensland*: Cape York; Rockhampton; Burnett River; Barron Falls (A. Tubb, 1935); Dunk Is. (D. A. Casey, 1936).

Types in the National Museum, Melbourne.



Over 400 specimens from all the above-mentioned localities were examined.

This species is extremely variable, particularly in the great chelae, interantennal spine and rostrum. In a series of two hundred specimens from a quarry hole at Hawthorn, Victoria, the great chelae vary in length and breadth at all stages of growth. Several examples, two inches long, have very short stout chelae with the dactylus less than half as long as the propodus; other examples of the same size have long, slender chelae, with the dactylus one-half as long as the propodus. Adult specimens, five and six inches long, show similar variations. The interantennal spine in some is short and broad, with a blunt point; in others short, broad and rounded; the outer margin may be serrated, or smooth. The rostrum varies greatly in breadth in examples of all sizes, the spines at the apex are obsolete in several specimens, and three have a spine on one side only of the apex.

Specimens from Barron Falls, Queensland, have the long, slender chelae and broad rostrum, identical with the Hawthorn examples. Specimens from Charlotte Waters, Central Australia, have no spines at the apex of the rostrum, but are otherwise identical with the type specimens.

*Cherax albidus* sp. nov.

(Pl. I, fig. 4; Pl. VI, fig. 24.)

Length of average adult specimen, 137 mm.

Rostrum twice as long as broad at base, reaching almost to base of third segment of first antennae; apex blunt, carinae blunt reaching almost to apex; lateral carinae blunt, ending in a rounded boss.

Squame of each second antenna broad anteriorly, terminal spine short and sharp, reaching to base of third segment of first antenna. Interantennal spine short and broad, sharply pointed.

Carapace shorter than abdomen, broader than high; areola fairly broad. Anterior of carapace smooth, posterior densely, minutely, punctate.

Sternal keel blunt, slightly rounded, produced to a sharp, backwardly-directed spine below great chelae; first two pairs of lateral processes obsolete, third pair small and flat, each with a conspicuous opening; posterior pair larger, slightly grooved, each with a conspicuous round opening on upper margin; processes between fourth pereopods flattened.

Telson with a spine on each lateral margin at junction of membranous portion; inner rami of uropods each with a median spine and an outer lateral spine at junction of membranous portion; outer rami each with several sharp spines along transverse suture. Lobes at base of uropods with upper lobe rounded.

Great chelae very long and stout; propodus three times as long as broad, with a few scattered punctures, upper margin with three feeble tubercles posteriorly, lower margin smooth, cutting edge with one small tubercle;



dactylus short and stout, upper margin smooth, cutting edge with two or three small tubercles. Carpus with a small, blunt, forwardly-directed spine on upper margin; upper margin of merus smooth. Upper margin of propodus and carpus, and cutting edge of propodus and dactylus densely covered with long setae.

*Colour*.—Carapace very pale olive-grey; abdomen light buff; underside and pereopods translucent white; joints of pereopods and great chelae vermilion; great chelae: ground colour light buff, suffused with light bluish-green.

*Habitat*.—*Victoria*: Nurrabiel, about 25 miles SW. of Horsham (type locality) (F. E. Hutchinson, 1935); Skipton (E. C. Austin, 1936). *New South Wales*: Berrigan (A. Hordern, 1935). *South Australia*: Angaston; Birdwood; Blackwood; Bordertown (L. Larwood, 1936); Gawler; Hamley Bridge; Koppio, near Todd River Reservoir (P. A. McDonald, 1936).

Types in the National Museum, Melbourne.

A series of 147 specimens from Victoria, 85 from South Australia, and 15 from New South Wales, was examined. Near *C. destructor*, but readily separated by the extremely large great chelae, and the sternal keel. This species is commonly known at Nurrabiel and Skipton as the White Yabby, to distinguish it from the common yabby, *C. destructor*, which is abundant in the same localities.

As in *C. destructor* there are numerous variations in the size and shape of the interantennal spine, rostrum and great chelae.

*Cherax punctatus* sp. nov.

(Pl. I, fig. 6; Pl. VI, fig. 25.)

Length of largest specimen examined, 121 mm.

Rostrum broadly cone-shaped, slightly longer than broad at base, apex rounded; carinae blunt, with two rows of punctures along each carina; lateral carinae each ending in a rounded boss, a row of deep punctures along each carina.

Squame of each second antenna rather short, reaching to base of second segment of first antenna, inner lobe moderately broad, terminal spine short and sharp. Interantennal spine slender, bell-shaped, surface concave.

Carapace shorter than abdomen, broader than high. Cervical groove deeply impressed, branchio-cardiac grooves obsolete, areola narrow. Entire carapace densely punctate; branchiostegites and anterior of carapace minutely tuberculate.

Abdomen densely punctate. Telson longer than broad, anterior calcareous, posterior from apical third membranous, a spine on each lateral margin at junction of membranous portion. Uropods half calcareous and half membranous, inner rami each with a longitudinal median carina ending in a short spine on membranous portion, a long sharp spine on outer lateral margin; numerous small blunt spines along transverse sutures of outer rami. Lobes at base of uropods without spines.

Sternal keel (Pl. I, fig. 6) narrow, raised and very sharp; first two pairs of lateral processes very small, third pair larger, with a conspicuous

round opening; posterior pair erect, each with a large round opening; processes between fourth pereopods obsolete.

Great chelae densely punctate; propodus stout, twice as long as broad, upper margin serrated, lower margin smooth, a narrow fringe of short hair on upper surface along upper margin, cutting edge smooth, apex curved; dactylus long and stout, apex curved, upper and lower margins smooth; a thick fringe of setae on underside of cutting edge of propodus and dactylus. Carpus with a longitudinal groove in middle of upper surface, upper margin with a double, forwardly-curved spine formed by a large and a small tubercle united at base; upper margin of merus serrated.

*Habitat*.—*Queensland*: Coorari (type locality) (Sir Baldwin Spencer, 1891); Eumundi (J. A. Kershaw).

Types in National Museum, Melbourne.

Described from 9 specimens, all of which were taken from burrows. This is the first species of burrowing crayfish to be described from Queensland. The habits are very similar to the various species of *Engaeus*, common in Victoria. They burrow down several feet to water level and build large cones at the entrances to the burrows. Two of the specimens collected by Mr. Kershaw were found under a rotten log. This is the first terrestrial species of *Cherax* to be described, although three species are taken in dams, quarry holes, etc.

### *Incertae Sedis.*

#### *Astacoides plebejus* Hess.

*Astacoides plebejus* Hess, Arch. f. Naturg., xxxi, 1865, p. 164, pl. 7, fig. 17.

*Astacus plebejus* von Martens, Monats. Akad. Wiss. Berlin, 1868, p. 617.

*Astacopsis plebejus* Haswell, Cat. Austrl. Mus., Crust., 1882, p. 177.

*Cheraps preissi* Faxon, Proc. U.S. Nat. Mus., xx, 1898, p. 676.

*Astacopsis serratus* Smith, Proc. Zool. Soc. Lond., 1912, p. 157.

"Der Cephalothorax ist fast glatt mit eingedrückten Punkten, das dreieckige Rostrum ist geneigt und läuft in eine Spitze aus. An der Basis desselben befindet sich beiderseits eine Erhöhung. Das erste Beinpaar ist lang und stark, der Arm lang dreieckig, der Carpus kurz, an der inneren Seite mit einem nach vorn gekrümmten Zahne. Die Hand ist verhältnissmässig gross, am unteren Seitenrande gezähnt. Der innere Rand des Zeigefingers trägt in der Mitte einen Tuberkel und ist am Ende abgestumpft. Der Daumen ist spitz und etwas gebogen und trägt ebenfalls in der Mitte des innenrandes einen Tuberkel. Die mittlere Schwanzflosse trägt in der Mitte beiderseits einen Zahn und ist am Ende bewimpert. Die seitlichen Schwanzflossen sind etwas kürzer ebenso bewimpert; die letzte ist nur an der äusseren Seite, die erste auch in der Mitte mit einem Zahne versehen.

"Länge 9, 4 Cm.

"Farbe gelblich, die Hände dunkel.

"Sydney (M. G.)."

The above description will not fit any of the hundreds of specimens examined. It is apparently a species of *Cherax*, judging by the figure. No mention is made in the text as to whether the telson and uropods are membranous. The figure shows the telson entirely calcareous, the inner rami of the uropods are divided by transverse sutures which may indicate the junction of membranous and calcareous portions, but the outer rami are apparently entirely calcareous, without transverse sutures. The great chelae also differ in the figure and the text.

### Genus *GEOCHARAX* gen. nov.

Carapace higher than broad, punctate or tuberculate. Cervical groove deeply impressed, rounded.

Abdomen smooth, punctate, or setose; lateral margins rounded. First somite with lateral lobes small and rounded. Telson without transverse sutures, entirely calcareous.

Second antennae set at the side of the first, squame large. Upper lip short and broad, with a concave arch medianly.

Lateral processes of sternal keel obsolete, keel continued across posterior pair. Vas deferens on simple short papillae on coxae of fourth pereopods.

Stem of each podobranch laterally produced into a small wing-like expansion, bearing few hooked filaments. Gill formula 21 + epr.

Genotype *Geocharax gracilis* sp. nov.

### *Key to Species of GEOCHARAX gen. nov.*

Rostrum slender and sharp . . . . . GRACILIS sp. nov.  
Rostrum broad and blunt . . . . . LYELLI sp. nov.

### *Geocharax gracilis* sp. nov.

(Pl. I, fig. 8; Pl. VI, fig. 26.)

Length of average adult specimen, 55 mm.

Rostrum slender, reaching to end of third segment of first antennae, apex sharp and upturned; carinae very sharp, straight, carried well back on to carapace; lateral carinae very sharp, each ending in a rounded boss.

Second antennae slender, reaching to telson; squames large, reaching beyond the end of the third segment of first antennae, terminal spines short and sharp. Interantennal spine short and broad, pyriform, apex sharp. Eyes very large. Median arch of upper lip produced into two sharp, erect protuberances.

Carapace higher than broad, more than twice as long as broad, shorter than abdomen. Cervical suture deeply impressed, rounded; branchio-cardiac grooves obsolete, areola very broad. Entire carapace densely studded with minute tubercles.

Sternal keel narrow, sharp, continuous from great chelae across lateral processes of third pereopods; lateral processes obsolete, fourth pair small and flattened downwards; processes between fourth pereopods very short and stout.

Telson entirely calcareous, with a spine on each lateral margin at apical third; inner rami of uropods each divided by a longitudinal median carina reaching almost to posterior margin; outer rami each divided by two longitudinal median carinae, transverse suture placed at apical third, several small sharp spines along suture. Lobes at base of uropods with lower lobe produced to a small spine.

Pereopods very slender, especially fourth pair. Great chelae short and slender; propodus more than twice as long as broad, punctate, upper margin serrated, lower margin smooth; apex sharp and incurved, cutting edge with one large tubercle; dactylus one-half as long as propodus, stout, upper margin smooth, sharply curved on cutting edge, apex sharp and incurved. Carpus densely punctate, upper margin serrated; upper margin of merus serrated.

*Habitat*.—*Victoria*: Gellibrand River, south of Colac (type locality) (W. H. F. Hill); Portland (L. R. Kurtze, 1935). *Kangaroo Island* (Sth. Aust. Museum, 1936).

Types in National Museum, Melbourne.

A well-graduated series of 68 specimens examined.

*Geocharax lyelli* sp. nov.

(Text fig. 1.)

Length of largest specimen, 62 mm.

Rostrum broad, reaching to base of second segment of first antennae, apex blunt; carinae sharp, straight, carried well back on to carapace; lateral carinae obsolete.

Second antennae slender, reaching to base of telson; squame large, very broad anteriorly, terminal spine short and sharp. Interantennal spine short and broad, apex sharp. Eyes small. Median arch of upper lip smooth.

Carapace higher than broad, more than twice as long as broad, shorter than abdomen. Cervical suture deeply impressed, rounded; branchio-cardiac grooves obsolete, areola broad. Entire carapace studded with minute tubercles.

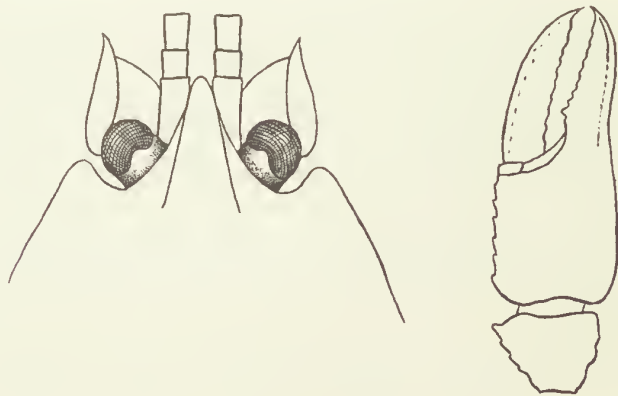


FIG. 1. *GEOCHARAX LYELLI* sp. nov.



Sternal keel of male blunt, high and swollen between second and third pereopods, first three pairs of lateral processes obsolete, fourth pair each with a large opening on lateral surface; processes between fourth pereopods very short and stout. Sternal keel of female slender and sharp between second and third pereopods and the openings on the fourth pair of lateral processes much larger than in male.

Telson entirely calcareous, with a spine on lateral margins at apical third; inner rami of uropods each divided by a longitudinal median carina reaching almost to posterior margin; outer rami each divided by two longitudinal median carinae, transverse suture placed at apical third, several small sharp spines along suture. Lobes at base of uropods rounded.

Pereopods slender. Great chelae short and slender, propodus twice as long as broad, upper margin serrated, lower margin smooth; apex sharp and incurved, cutting edge usually formed by a row of small tubercles, with one larger tubercle about posterior third; dactylus one-half as long as propodus, stout, upper margin smooth, lower margin with a few small tubercles, apex sharp and incurved. Upper margins of both carpus and merus serrated.

*Habitat*.—*Victoria*: Gisborne (G. Lyell, 1936).

Described from 2 males and 1 female. Readily separated from *G. gracilis* by the rostrum and the sternal keel.

### Genus *ASTACOPSIS* Huxley.

Proc. Zool. Soc. Lond., 1878, p. 764.

*Astacus* Gray, Eyre's Journ. Exped. Disc. Centrl. Austrl., i (Appendix), p. 409, 1845; von Martens, Monatsber. Akad. Wiss. Berlin, 1868, p. 615.

*Astacopsis* Smith, Trans. Linn. Soc. Lond., ser. 3, xi, 1908, Zool., p. 70; Haswell, Cat. Austrl. Mus., Crust., 1882, p. 175; Smith, Proc. Zool. Soc. Lond., 1912, p. 154; Faxon, Proc. U.S. Nat. Mus., xx, 1898, p. 669; Faxon, Mem. Mus. Comp. Zool., xl, 8, p. 402, 1914.

Carapace with numerous small tubercles and punctures. Rostrum broad, carinae blunt, tuberculated. Cervical groove deeply impressed, rounded.

Abdomen smooth or punctate, lateral margins pointed, usually with spines on lateral margins only of first and second somites. First somite with lateral lobes large and rounded. Telson and uropods calcareous, except at posterior margin; telson without a transverse suture.

Second antennae set at the side of the first, squames large. Upper lip long and narrow, straight or somewhat concave medianly.

Sternal keel raised, blunt or moderately sharp.

Vas deferens on simple short papillae on coxae of fourth pereopods.

Stems of podobranchs (Pl. I, fig. 2) without broad wing-like expansions.

Gill formula 21 + epr.

### *Key to Species of ASTACOPSIS Huxley.*

Squame serrated . . . . . FRANKLINII (Gray)  
Squame smooth.

Rostrum divided by a longitudinal median carina . . . GOULDI sp. nov.

Rostral carinae produced to sharp points . . . TRICORNIS sp. nov.

*Astacopsis franklinii* (Gray).

(Pl. VII, fig. 27.)

*Astacus franklinii* Gray, Eyre's Journ. Exped. Disc. Cent. Austrl., i (Appendix), p. 409, t. 3, f. 1.

*Astacus franklinii* Erichson, Arch. f. Naturg., xii, 1846, p. 375; White, List Crust., Brit. Mus., p. 72; von Martens, Monats. Akad. Wiss. Berlin, 1868, p. 616.

*Astacopsis franklinii* Haswell, Cat. Austrl. Mus., Crust., p. 176, 1882; Thomson, Papers and Proc. Roy. Soc. Tas., 1892, p. 50; Faxon, Proc. U.S. Nat. Mus., xx, p. 669, 1898; Ortmann, Proc. Amer. Philos. Soc., xli, p. 292, 1902; Faxon, Mem. Mus. Comp. Zool., xl, 8, p. 402.

Length of largest specimen examined, 100 mm.

Rostrum broadly cone-shaped, almost as long as broad at base, apex blunt; carinae blunt, with six or seven small round tubercles; surface of rostrum with numerous large, deep punctures; a small tubercle at base of lateral carinae.

Eyes large. Outer antennae slender, reaching to third abdominal segment, squame with three to five small sharp spines on outer margin, terminal spine stout and blunt, inner lobe broad. Interantennal spine long and broad, sharply pointed, lateral margins serrated.

Carapace shorter than abdomen, as high as broad, slightly more than twice as long as broad; cervical groove deeply impressed, branchio-cardiac grooves obsolete; branchiostegites and anterior of carapace minutely tuberculate.

Sternal keel blunt; first two pairs of lateral processes small and sharp, third pair larger, blunt and slightly grooved, posterior pair large, blunt and deeply grooved; processes between fourth pereopods short and stout.

First segment of abdomen with a small sharp spine on each lateral lobe; second segment with four small sharp spines along lateral margins; lateral margins of second to sixth abdominal segments each produced to a small spine; no other spines or prominences on abdomen. Telson slightly longer than broad, without trace of transverse suture, a small spine on each lateral margin near posterior margin; uropods as long as telson, each divided by a feeble longitudinal median carina, ending in a spine almost on posterior margin; inner rami with a small spine on lateral margin near posterior margin; transverse suture of outer rami fringed by several small sharp spines; semi-membranous below transverse suture. Lobes at base of uropods without spines.

Great chelae short and stout; propodus twice as long as broad, with numerous small tubercles and deep punctures, upper margin with a single row of blunt tubercles, lower margin with a double row of small blunt tubercles, cutting edge with five small tubercles, margined on the outer side by a row of seven or eight small blunt tubercles; dactylus stout, cutting edge with three large and four small tubercles, margined on the outer side by a row of seven or eight small blunt tubercles; upper margin with two longitudinal carinae, each with five or six small round tubercles; carpus with one large and four or five small sharp spines on upper margin; merus with a row of very small sharp spines on upper margin.

*Habitat*.—*Tasmania*: Saundridge (A. Bartholomew); Hobart (V. Hickman).

Types in the British Museum.

Described from six specimens, all of which were dug out of burrows in swampy ground. The serrated squame readily distinguishes this species from others of the genus.

Drawings of specimens examined were compared with the types in the British Museum (see notes on *A. gouldi* sp. nov.).

*Astacopsis gouldi* sp. nov.

(Pl. VII, fig. 28.)

*Astacus* sp. Gould, Papers and Proc. Roy. Soc. Tas., p. 42, 1870.

*Astacopsis franklinii* Huxley, Proc. Zool. Soc. Lond., 1878, p. 764; Smith, Trans. Linn. Soc. Lond., sec. ser., xi, Zool., p. 70, 1908; Smith, *A Naturalist in Tasmania*, p. 110, fig. 30, 1909; Smith, Proc. Zool. Soc. Lond., p. 154, 1912.

Length of average adult specimen, 375 mm.

Rostrum broad, apex sharp, almost as broad as long at base; carinae rounded, with three blunt spines on each side; a sharp longitudinal carina in centre of rostrum continued backward from apex about half-way to base; a blunt spine at base of rostral carinae, with a large rounded boss posterior-laterally to it.

Eyes large. Squame of each second antenna smooth, as broad as long, inner lobe rounding gradually to a short blunt spine. Interantennal spine rather long and narrow, sharply pointed, lateral margins either smooth or serrated.

Carapace longer than abdomen; twice as long as broad, broader than high; branchiostegites with a few small scattered tubercles and punctures.

Sternal keel moderately sharp, with a long, sharp, backwardly-directed spine below first pereopods; lateral processes large and sharp, largest below great chelae, posterior pair deeply grooved.

First segment of abdomen with a spine on each lateral lobe; second segment with five spines on each lateral margin, remaining segments with lateral margins each produced to a small spine. Telson as long as broad at base, without trace of transverse suture, with a spine on each posterior-lateral margin; inner rami of uropods each with a median posterior spine and a lateral spine; outer rami each with eight or nine spines along transverse suture; lobes at base of uropods with a spine on each upper lobe.

Great chelae very stout; propodus two and one-half times as long as broad, upper margin with three large tubercles, lower margin with one or two rows of spines or tubercles, one large and several small tubercles on cutting edge; dactylus with one large and several smaller tubercles on cutting edge, upper margin with three or four small tubercles; apex densely tuberculate; carpus with a long sharp spine and a short blunt spine on upper margin; merus with five or six small spines on upper margin.

*Habitat*.—*Tasmania*: Circular Head (type locality) (J. Leadbeater); Zeehan; Mt. Wellington; Gordon River; Brid and Muddy Creeks, Bridport; Macquarie Harbour;

Types in the National Museum, Melbourne.

Generally identified by previous workers as *A. franklinii* Gray, this species differs considerably, particularly in the armature of the squame of the second antennae and the carpus

of the great chelae. *A. franklinii* is represented in the National Museum collections by six specimens, the largest measuring 100 mm. from tip of rostrum to end of telson. Gray does not give the size of his types. Drawings of *A. franklinii* and *A. gouldi* were sent to Dr. Isabella Gordon at the British Museum for comparison with Gray's types, and in her notes on *franklinii*, accompanied by sketches, Dr. Gordon writes that the larger of the two type specimens is complete and measures just under five inches from tip of chela to end of telson. The smaller specimen is damaged.

Gould (1870) gave an account of the habits and distribution of this species, and remarked on the fact that, in spite of its great size and the ease with which it is captured, it did not appear to be named.

*Astacopsis tricornis* sp. nov.

(Pl. I, fig. 7; Pl. VII, fig. 29.)

Length of largest specimen examined, 105 mm.

Rostrum narrow, one and one-half times as long as broad at base; carinae blunt, with three or four tubercles; apex of rostrum and carinae each produced into a long bluntly-pointed spine; a small tubercle present at base of carinae, with a large rounded boss posterior-laterally.

Eyes large. Squame of each second antenna smooth, reaching to end of third segment of first antennae, broad and sharply pointed. Interantennal spine short and broad, apex long and sharp, surface concave, lateral margins serrated.

Carapace shorter than abdomen, as high as broad, slightly more than twice as long as broad; cervical groove deeply impressed, branchio-cardiac grooves feeble, areola broad. Branchiostegites and anterior of carapace with several, scattered small tubercles; otherwise smooth.

Sternal keel (Pl. I, fig. 7) blunt; lateral processes erect, slender and sharp, posterior pair deeply grooved; a large deep opening under lateral processes, largest on third and fourth pairs; process between fourth pereopods long and stout.

First abdominal segment with a small spine on each lateral lobe; second segment with four small spines along each lateral margin; lateral margins of all following segments each produced to points. A row of small blunt tubercles on dorso-lateral margins of each segment; abdomen otherwise smooth. Telson slightly longer than broad, without trace of transverse suture, with a spine on each lateral margin near posterior margin. Uropods rounded, as long as telson, inner rami each divided by a feeble longitudinal median carina ending in a blunt spine near posterior margin; outer rami each with transverse suture at apical third, one large and several small spines along suture; lobes at base of uropods rounded, without spines.

Great chelae: propodus two and one-half times as long as broad, upper and lower surface with a few scattered punctures; upper margin with six sharp spines, lower margin with a double row of small sharp spines, cutting edge with three small tubercles; dactylus with a double row of small blunt spines on upper margin, and two small tubercles on cutting edge; one large



sharp spine and a small blunt spine on upper margin of carpus; merus with one large and four small sharp spines on upper margin.

*Habitat.*—*Tasmania*: Lake St. Clair (type locality) (Spencer, 1893); Cradle Mountain.

Types in the National Museum, Melbourne.

This species was identified by Smith as *A. franklinii* var. *tasmanicus* Er., and is mentioned in his notes on that species. As shown elsewhere in this paper *tasmanicus* Erichson is not an *Astacopsis*. *A. tricornis* differs from other species of the genus in having the rostral carinae produced into long blunt spines, giving the impression of a pair of horns; also by the openings under the lateral processes of the sternal keel.

Five specimens examined.

### Genus ENGAEUS Erichson.

*Astacus (Engaeus)* Erichson, Arch. f. Naturg., xii, 1846, p. 102.

*Astacus* von Martens, Monats. Akad. Wiss. Berlin, p. 618, 1868.

*Engaeus* Huxley, Proc. Zool. Soc. Lond., p. 769, 1878; Haswell, Cat. Austrl. Mus., Crust., p. 178, 1882; Faxon, Proc. U.S. Nat. Mus., xx, p. 670, 1898; Faxon, Mem. Mus. Comp. Zool., xl, 8, p. 403, 1914; Smith and Schuster, Proc. Zool. Soc. Lond., 1913, p. 118.

Carapace higher than broad, punctate or feebly tuberculate, cervical groove either feeble or moderately well impressed, somewhat "V" shaped. Rostral carinae smooth or feebly tuberculate.

Abdomen smooth, punctate, or setose; lateral margins rounded. First somite without lateral lobes. Telson without transverse sutures, entirely calcareous.

Second antennae set under the first; squames small. Upper lip short and broad, and more or less highly arched medianly.

Sternal keel narrow, posterior pair of lateral processes large and deeply grooved. Vas deferens on simple short papillae on coxae of fourth pereopods.

Stems of podobranchs without wing-like expansions. Posterior pleurobranchs usually well developed, sometimes rudimentary. Gill formula 21 + epr.

Genotype *Astacus (Engaeus) fossor* Erichson.

### Key to Species of ENGAEUS Erichson.

Abdomen longer than carapace. Sternal keel without openings on lateral processes.

Cervical groove moderately impressed, areola broad.

Uropods rounded.

Great chelae slender, a row of feeble tubercles on upper margin, lower margin smooth . . . . . CUNICULARIUS Erich.

Abdomen as long as carapace. Sternal keel with openings on lateral processes.

Cervical groove deeply impressed; areola fairly broad. Uropods pointed.

Great chelae with a row of tubercles on upper, lower and posterior margins . . . . . PHYLLOCERCUS Sm. and Sch.

- Cervical groove feebly impressed, areola fairly broad. Uropods rounded.  
Great chelae slender, a row of feeble tubercles on upper margin, lower margin smooth; under surface with a covering of downy hair  
SERICATUS sp. nov.
- Great chelae stout, a single row of tubercles on upper margin, lower margin with a smooth ridge . . . . . QUADRIMANUS sp. nov.
- Great chelae stout, a double row of tubercles on upper margin, and a single row on lower margin . . . . . FOSSOR Erich.
- Abdomen shorter than carapace. Sternal keel without openings on lateral processes.  
Cervical groove deeply impressed.  
Areola broad; inner rami of uropods rectangular, transverse sutures strong . . . . . TUBERCULATUS sp. nov.
- Areola narrow; uropods rounded, transverse sutures strong  
VICTORIENSIS Sm. and Sch.
- Cervical groove obsolete, branchio-cardiac grooves deeply impressed, areola fairly broad.  
Carapace, abdomen and chelae densely hirsute . . . VILLOSUS sp. nov.
- Cervical groove and branchio-cardiac grooves obsolete, areola fairly broad.  
Uropods rounded, transverse sutures feeble AFFINIS Sm. and Sch.

*Engaeus cunicularius* Erichson.

(Pl. VIII, fig. 35.)

*Astacus (Engaeus) cunicularius* Erichson, Arch. f. Naturg., xii, 1846, p. 102.

*Astacus cunicularius* von Martens, Monats. Akad. Wiss. Berlin, p. 169, 1868.

*Engaeus cunicularius* Haswell, Cat. Austrl. Mus., Crust., 1882, p. 179, Thomson, Papers and Proc. Roy. Soc. Tas., p. 50, pl. 1, figs. 1-2, 1892; Faxon, Proc. U.S. Nat. Mus., xx, p. 676, 1898; Ortmann, Proc. Amer. Phil. Soc., xli, p. 292, 1902; Smith and Schuster, Proc. Zool. Soc. Lond., p. 124, 1913; Faxon, Mem. Mus. Comp. Zool., xl, 8, p. 403, 1914.

Length of average adult specimen, 60 mm.

Rostrum broad, reaching to base of third segment of first antennae, apex blunt, slightly upturned; carinae sharp, carried well back on to carapace.

Eyes large. First antennae with inner flagella slender, seven-eighths as long as outer. Squame of each second antenna with a sharp terminal spine, inner lobe broad posteriorly. Interantennal spine elongated, triangular, bluntly pointed. Exopods of third maxillipedes long and slender.

Carapace punctate, shorter than abdomen, cervical groove and branchio-cardiac grooves deeply impressed, areola broad. Branchiostegites minutely tuberculate.

Sternal keel narrow, very sharp; first three pairs of lateral processes rudimentary; posterior pair large, slightly grooved; processes between fourth pereopods small and stout.

Telson rounded, a spine on lateral margins near posterior margin; uropods rounded, longer than telson, each with a longitudinal median carina ending in a spine almost on posterior margin; inner rami each with a spine on outer

lateral margins; outer rami each with four or five sharp spines along transverse suture.

Great chelae slender, propodus twice as long as broad, feebly tuberculate on upper margin, lower margin smooth; dactylus straight, inner margin smooth or feebly tuberculate; cutting edge of propodus feebly tuberculate, or with a large compound tubercle; upper margin of carpus and merus smooth or feebly serrated.

Posterior pleurobranch long and well developed.

*Habitat*.—*Tasmania*: Glenore, near Hageley (A. Bartholomew, 1889); Launceston (A. Bartholomew, 1889); Mundan Farm, Longford (A. Bartholomew, 1889).

Types in the Berlin Museum.

Nineteen specimens from various localities were examined.

### *Engaeus phyllocercus* Smith and Schuster.

(Pl. VIII, fig. 33.)

*Engaeus phyllocercus* Sm. and Sch., Proc. Zool. Soc. Lond., 1913, p. 122.

Length of average adult specimen, 60 mm.

Rostrum broad, reaching to base of third segment of first antennae, apex sharp and upturned; carinae sharp, carried well back on to carapace, anteriorly reaching apex.

Eyes small. First antennae with inner flagella two-thirds as long as outer, slender. Squame of each second antenna very slender, ending in a short sharp spine. Interantennal spine broad, rounded or bluntly pointed. Exopods of third maxillipedes rudimentary or in the form of a short papilla, in some examples exopods absent.

Carapace punctate, as long as abdomen, cervical groove and branchio-cardiac grooves deeply impressed, arcola fairly broad. Branchiostegites minutely tuberculate.

Sternal keel moderately sharp; first three pairs of lateral processes small and sharp, posterior pair rounded, deeply grooved; processes between fourth pereopods slender, not joined above, on some examples stout and joined above.

Telson cone-shaped, with a spine on each posterior lateral margin; inner rami of uropods slender, longer than telson, each divided by a longitudinal median carina ending in a long sharp point beyond posterior margin, a sharp spine on outer lateral margin; outer rami each with a longitudinal median carina ending in a blunt point on posterior margin, transverse suture placed at apical third, five or six small sharp spines along suture.

Great chelae punctate; propodus stout, twice as long as broad, margined by a row of large tubercles on upper surface, dactylus and anterior of propodus long and slender, each with one tooth on cutting edge; carpus and merus each with a row of tubercles on upper margin.

Posterior pleurobranch rudimentary; in some examples well developed.

*Colour*.—General colouring orange-scarlet; telson, lateral margins of carapace and abdomen light yellowish-brown. Great chelae: upper surface deep orange-scarlet, yellowish-brown on under surface, carpus and merus shading to brown.

*Habitat*.—*Victoria*: Narracan (W. Kershaw, 1889); Thorpdale (W.

Kershaw, 1890); Trafalgar (J. A. Kershaw, 1888); Warragul (W. Kershaw, 1887); Mt. Eccles (C. E. Summers, 1929); Wilson's Promontory (A. Clavarine, 1906); Warburton (F. J. Williams, 1871).

Types in the National Museum, Melbourne.

Smith and Schuster state that "All pleurobranchs are of approximately equal size, the last one not being reduced." Over 30 specimens, including the types, have been examined, and only six specimens have the posterior pleurobranch well developed, all the others having only a rudimentary pleurobranch. The species is very variable, particularly in the length of the exopod of the third maxilliped and the sharpness of the sternal keel.

*Engaeus sericatus* sp. nov.

(Pl. VIII, fig. 34.)

Length of average adult specimen, 60 mm.

Rostrum broad, reaching base of third segment of first antennae, apex blunt and straight; in some examples apex sharp and upturned; carinae sharp, not reaching apex.

Eyes small. First antennae with inner flagella three-fourths as long as outer. Outer antennae reaching third segment of abdomen, squame short and broad, terminal spine long and sharp. Interantennal spine triangular, sharply pointed, surface convex. Exopods of third maxillipedes long and slender; maxillipedes, exopods, and all the mouth-parts with a thick covering of soft downy setae.

Carapace as long as abdomen, cervical groove and branchio-cardiac grooves obsolete, areola fairly broad; branchiostegites and anterior of carapace with numerous minute tubercles.

Sternal keel raised and sharp; first two pairs of lateral processes small, third pair larger and sharp, posterior pair blunt, slightly grooved; processes between fourth pereopods short and stout, not joined above; a conspicuous round opening present on each lateral process.

Telson broadly cone-shaped with a spine on each posterior-lateral margin; uropods rounded, same length as telson, inner rami each with a longitudinal median carina ending in a spine almost on posterior margin, outer lateral margin with a spine at posterior margin; outer rami each with a longitudinal median carina, transverse suture fringed by several small spines, suture placed at apical third.

Great chelae: propodus slender, two and one-half times as long as broad, upper surface smooth, under surface with a covering of soft downy setae; upper margin feebly serrated, lower margin smooth, cutting edge with one large and a few small tubercles; cutting edge of dactylus with a large compound tubercle; some examples with two or three simple tubercles near compound one; upper margin of carpus and merus feebly serrated.

*Habitat*.—*Victoria*: Croydon (type locality) (S. W. Fulton); Mortlake; Warragul; Warburton; Matlock.

Types in the National Museum, Melbourne.

This species is characterized by the thick covering of downy



setae on the under surface of the great chelae, on the third maxillipedes, and on all the mouth parts.

Thirty specimens from the above localities examined.

*Engaeus quadrimanus* sp. nov.

(Pl. VIII, fig. 32.)

Length of average adult specimen, 80 mm.

Rostrum reaching almost to base of third segment of first antennae, apex blunt and straight; carinae blunt, reaching to apex.

Eyes large. First antennae with inner flagella seven-eighths as long as outer. Squame of each second antenna broad, terminal spine long and sharp. Interantennal spine long, broadly triangular, sharply pointed. Exopods of third maxillipedes long, fully developed.

Carapace as long as abdomen, cervical groove feebly impressed laterally, deeply impressed posteriorly, branchio-cardiac grooves feeble, areola narrow. Branchiostegites and anterior of carapace tuberculate.

Sternal keel raised and sharp; first two pairs of lateral processes small and blunt, third pair sharp, posterior pair fairly large, blunt and deeply grooved; each of the lateral processes with a small but conspicuous round opening, largest on third pair; processes between fourth pereopods long and stout, not joined above.

Telson broadly cone-shaped with a spine on posterior-lateral margins; uropods large and rounded, as long as telson, inner rami each with a longitudinal median carina ending in a spine almost on posterior margin, outer lateral margin with a spine near posterior margin; outer rami each with a longitudinal median carina, transverse suture placed at apical third, several small sharp spines along suture.

Great chelae minutely tuberculate; propodus stout, twice as long as broad, upper margin with a single row of large tubercles, lower margin with a smooth carina, cutting edge with two or three large and several small tubercles; dactylus with a large compound tubercle and a few small simple tubercles on cutting edge, upper margin with a smooth carina; carpus and merus each with a row of small tubercles on upper margin.

Posterior pleurobranch long, well developed.

*Colour*.—In general appearance dark olive-green shading into light green on telson and lateral margins of carapace and abdomen. Dactylus and anterior of propodus, upper and posterior margins of propodus, carpus and merus dark olive-green; remainder of chelae shading from light green to cream-buff.

*Habitat*.—*Victoria*: Warragul (type locality) (W. Kershaw, 1888); Lakes Entrance (W. Kershaw, 1887); Derby River, Wilson's Promontory (J. A. Kershaw, 1905); Ferntree Gully (S. W. Fulton, 1906); Croydon (S. W. Fulton, 1907); Mt. Dandenong (S. W. Fulton, 1910); Warburton (F. J. Williams, 1871); Skipton (C. E. Austin, 1935); King Island (G. Mack, 1935).

Types in the National Museum, Melbourne.

Widely distributed throughout Victoria, south of the Main Divide. This species was described and figured by Smith and Schuster (1913) as *E. cunicularius* Er., but is readily distin-

guished by the form of the great chelae and the sternal keel; *E. cunicularius* appears to be confined to Tasmania. Specimens from King Island differ from the mainland form in having the great chelae and pereopods covered by long, stout setae, but there are no other characters to separate the two forms.

Forty-two specimens examined.

*Engaeus fossor* Erichson.

(Pl. I, fig. 9; Pl. VIII, fig. 31.)

*Astacus (Engaeus) fossor* Erichson, Arch. f. Naturg, xii, 1846, p. 102.

*Astacus fossor* von Martens, Monats. Akad. Wiss. Berlin, 1868, p. 618.

*Engaeus fossor* Haswell, Cat. Austrl. Mus., Crust., p. 178, 1882; Faxon, Proc. U.S. Nat. Mus., xx, p. 676, 1898; Ortmann, Proc. Amer. Phil. Soc., xli, p. 292, 1902; Smith and Schuster, Proc. Zool. Soc. Lond., 1913, p. 119; Faxon, Mem. Mus. Comp. Zool., xl, 8, p. 403, 1914; Clark, Vict. Nat., liii, 1936, p. 66, fig. 2.

*Engaeus fultoni* Smith and Schuster, Proc. Zool. Soc. Lond., 1913, p. 126.

Length of average adult specimen, 55 mm.

Rostrum narrow, apex blunt; carinae sharp, carried well back on to carapace.

Eyes large. Inner flagella of first antennae seven-eighths as long as outer. Squame of each second antenna small, bluntly pointed, inner lobe narrow. Interantennal spine short and narrow, bluntly pointed. Exopod of each third maxilliped usually long and slender, on some examples indicated by a small papilla.

Carapace punctate, as long as abdomen; cervical groove and branchio-cardiac grooves feebly impressed, areola broad.

Sternal keel (Pl. I, fig. 9) raised and very sharp; first two pairs of lateral processes small, third pair larger and sharp, posterior pair small and blunt, slightly grooved; a conspicuous opening present on each lateral process; processes between fourth pereopods long and stout, not joined above.

Telson narrowly cone-shaped, with a spine on lateral margins; uropods rounded, with a longitudinal median carina ending in a sharp spine almost on posterior margin, inner rami each with a spine on outer lateral margin; outer rami each with several small spines along transverse suture.

Great chelae punctate; propodus one and one-half times longer than broad; two rows of large tubercles on upper margin, lower margin with a single row of tubercles; dactylus curved, with one tubercle on cutting edge, upper margin with three longitudinal grooves reaching from apex to base; cutting edge of propodus with three tubercles, margined by a smooth carina, lower margin with a distinct carina; carpus and merus each with a row of tubercles on upper margin.

Posterior pleurobranch well developed.

*Habitat.*—*Tasmania*: Smithton (R. H. Champion, 1935); Clayton Rivulet (E. Scott, 1934); Pioneer Mine, Derby; Muddy Creek, Bridport. *Victoria*: Otway Ranges (W. Groves, 1934); Ferntree Gully.

Types in Berlin Museum.

A series of 24 specimens from the Otway Ranges and the type specimens of *fultoni* have been examined and compared with specimens from various localities in Tasmania. There is no character on which to separate them.

*Engaeus tuberculatus* sp. nov.

(Pl. IX, fig. 39.)

Length of average adult specimen, 70 mm.

Rostrum long and slender, apex upturned, long and sharp; carinae sharp, half as long as rostrum, with three small tubercles at anterior end.

Eyes large. First antennae with inner flagella very short and slender, about one-fifth as long as outer. Squame of each second antenna slender, ending in a long sharp spine. Interantennal spine short and broad, bluntly pointed, laterally produced at base. No exopod on third maxillipedes.

Carapace longer than abdomen; cervical groove and branchio-cardiac grooves well defined, areola fairly broad. Branchiostegites and anterior of carapace minutely tuberculate.

Abdomen with small tubercle-like swellings, rather low and flattened, with a puncture on summit; two rows on each segment. Telson broadly cone-shaped, without median or lateral spines; inner rami of uropods rectangular, inner corners sharp and outer rounded, each divided by a longitudinal median carina reaching to posterior margin, without median or lateral spines; outer rami each divided by a longitudinal median carina ending in a sharp spine on transverse suture, two or three spines along suture, suture placed at apical third of uropods.

Sternal keel raised and fairly sharp; first two pairs of lateral processes rudimentary, small but sharp below second pereopods, larger and rounded below third pereopods, deeply grooved; processes between fourth pereopods short and stout.

Great chelae long and stout; propodus stout, twice as long as broad, bordered on upper, lower and posterior margins by a double row of small tubercles, cutting edge with one compound and three or four simple large tubercles, a smooth carina reaches from apex to base of upper surface of dactylus; dactylus with two large tubercles on cutting edge, upper margin divided by a smooth carina, several small tubercles and punctures on upper margin; carpus with upper surface covered by six or seven rows of small tubercles; merus with a row of small tubercles on upper margin.

Posterior pleurobranch rudimentary.

*Habitat*.—*Victoria*: Sherbrook Falls (N. J. Favalora); Dandenong (S. W. Fulton); Warburton (S. W. Fulton).

Types in the National Museum, Melbourne.

Forty-three specimens examined.

*Engaeus victoriensis* Smith and Schuster.

(Pl. IX, fig. 38.)

*Engaeus victoriensis* Sm. and Sch., Proc. Zool. Soc. Lond., 1913, p. 121;

Clark, Vict. Nat., liii, 1936, p. 66, fig. 1.

Length of average adult specimen, 60 mm.

Rostrum slender, reaching to base of third segment of first antennae, apex

upturned; carinae blunt, reaching almost to apex; in some examples rostrum fairly broad, reaching to end of third segment of first antennae, carinae blunt, reaching almost to apex.

Eyes small. First antennae with inner flagella one-half as long as outer, slender. Squame of each second antenna long and slender, sharply pointed. Interantennal spine triangular, bluntly pointed, surface either flat or concave. Exopods of third maxillipedes absent.

Carapace punctate, longer than abdomen; cervical groove and branchio-cardiac grooves deeply impressed, areola narrow.

Sternal keel sharp; lateral processes small and rounded, posterior pair deeply grooved; processes between fourth pereopods short and stout, joined together above.

Great chelae: propodus twice as long as broad, upper margin with a double row of small tubercles, lower margin smooth, or with an obsolete row of small tubercles, cutting edge with five large tubercles, two smooth carinae on upper and under surface reaching from apex to base of dactylus; dactylus long and stout, with three large tubercles on cutting edge, upper margin smooth, upper and under surface each with a smooth carinae reaching from apex to base; carpus with a row of tubercles on upper margin, and two or three rows of small tubercles on surface; merus with a row of tubercles on upper margin.

Posterior pleurobranch rudimentary.

*Colour*.—Abdomen and carapace olive-green or reddish-brown; chelae dark olive green above, cream below; tips of chelae, carpus and merus, and the pereopods reddish-brown. Whole animal with a translucent waxy appearance.

*Habitat*.—*Victoria*: Dandenong Ranges (W. Kershaw, 1872); Box Hill (S. W. Fulton); Croydon (F. P. Spry, 1904); Ringwood (E. H. Hennell, 1890); Ferntree Gully; Belgrave (F. Spry); Emerald (E. Jarvis, 1904); Gembrook (S. W. Fulton, 1906); Launching Place (J. Coghill, 1907); Woori Yallock (F. P. Spry, 1912); Warburton; Matlock (S. W. Fulton); Jumbunna (A. E. Kitson, 1901); Foster (J. Clark); Beaconsfield; Loch.

Types in the National Museum, Melbourne.

Fifty-eight specimens examined.

### *Engaeus villosus* sp. nov.

(Pl. I, fig. 10; Pl. IX, fig. 36.)

*Male*.—Length of average adult specimen, 67 mm.

Rostrum broad, reaching almost to base of third segment of first antennae, apex sharp, straight; carinae tuberculate, half as long as rostrum, continued to apex by three rows of long stout setae.

Eyes large. First antennae each with inner flagellum one-half as long as outer. Squame of each second antenna very slender, inner lobe narrow, sharply pointed. Interantennal spine short, broad and rounded. Exopod of third maxilliped indicated by a small tubercle.

Carapace slightly longer than abdomen; cervical groove obsolete, branchio-cardiac grooves well defined, areola fairly broad. Branchiostegites and anterior of carapace densely, minutely, hirsute; long stout setae scattered over remainder of carapace.

Abdomen broad, smooth, with numerous tufts of long setae. Telson broadly cone-shaped, without median or lateral spines; uropods large,



longer than telson, inner rami rounded, each divided by a longitudinal median carina reaching to posterior margin, without spines; outer rami rounded, each divided by a longitudinal median carina, transverse suture placed at posterior third, three sharp spines on suture. Telson and uropods with numerous tufts of long stout setae.

Sternal keel raised and blunt; first two pairs of lateral processes rudimentary, small but sharp below second pereopods; small and blunt below third pereopods, deeply grooved; processes between fourth pereopods long and slender.

Great chelae short and stout; propodus smooth, twice as long as broad, upper margin formed by two rows of small tubercles; lower margin almost smooth, two or three very small tubercles posteriorly; four tubercles on cutting edge. Dactylus stout, with three tubercles on cutting edge, upper margin smooth; a few tufts of short setae scattered over propodus and dactylus. Carpus with three rows of large tubercles on upper surface, centre of upper surface deeply hollowed; merus with a row of small tubercles on upper margin.

Posterior pleurobranch long and well developed. Posterior arthrobranchs small, last thread-like. No gill-filaments on epipod of first maxilliped.

*Female*.—Length of average adult specimen, 73 mm.

Similar to male but differs in the form of the outer rami of the uropods, and the great chelae. The outer rami of the uropods are larger than in the male, and the posterior margin of each ramus is broadly crenulate.

Great chelae long and slender, propodus two and one-half times as long as broad, upper margin formed by two rows of small tubercles, lower margin with a single row of very small tubercles, three tubercles on cutting edge; dactylus long and slender, three tubercles on cutting edge, upper margin smooth; propodus and dactylus covered by numerous tufts of long, stout setae. Carpus with two rows of tubercles on upper surface, not grooved as in male; upper margin of merus with a row of small tubercles. All the pereopods densely hirsute.

*Colour*.—General colouring bright orange. Great chelae, carpus and merus orange; propodus and dactylus bright translucent blue, apex of both and tubercles orange.

*Habitat*.—*Victoria*: Acheron River flats, near Marysville (E. Clark, Dec., 1935).

Types in the National Museum, Melbourne.

This species somewhat resembles *E. tuberculatus* sp. nov. but is readily separated by the form of the abdomen and great chelae. The differences in the form of the chelae in the sexes of this species is very striking, being constant in all examples.

A series of 135 specimens varying in size from 12 mm. to 73 mm. long examined. Many of the small specimens (25 mm.) are a dull dark blue colour all over, others have the same colouring as the adults. The smallest specimens are salmon pink.

This species burrows both in swampy ground near the river, and higher up the hill in dry, heavily-timbered ground. The burrows in the swamp have a large cone with the opening on the side, near the top of the cone; burrows from eighteen

inches to three feet deep. The burrows on the hillside have no cone, the only indication being a small round hole; hundreds of these holes were found in a few square yards of ground. In an area of four or five square feet, containing numerous holes, all the burrows converge to one central pool of water where whole communities are found. These burrows are from five to seven feet deep. These yabbies are difficult to capture, as there are so many burrows leading into each underground pool; the yabbies escape along other passages when each burrow is dug out. Several square yards of ground have sometimes to be dug before a capture is made.

*Engaeus affinis* Smith and Schuster.

(Pl. IX, fig. 37.)

*Engaeus affinis* Sm. and Sch., Proc. Zool. Soc. Lond., 1913, p. 120.

Length of average adult specimen, 60 mm.

Rostrum slender, reaching to base of third segment of first antennae, apex upturned; carinae half as long as rostrum, with four blunt tubercles, continued to apex by two rows long stout setae. In some examples rostrum not reaching base of third segment, apex straight, carinae with three tubercles; carinae sometimes smooth.

Eyes large. First antennae with inner flagella one-half as long as outer, slender. Squame of each second antenna long and slender, sharply pointed. Interantennal spine round, or bluntly pointed. No exopods on third maxillipedes.

Carapace punctate, longer than abdomen; cervical groove and branchio-cardiac grooves obsolete, areola fairly broad.

Sternal keel blunt; lateral processes small and rounded, posterior pair deeply grooved; processes between fourth pereopods long and slender, not joined above.

Telson broadly cone-shaped; inner rami of uropods broad, longer than telson; outer rami each with transverse suture represented by a feeble broken carina, the transverse continuation of the longitudinal carina, lower portion of uropods not flexible, without spines; a few examples have from one to four small spines on the transverse suture.

Great chelae: propodus stout, one and one-half times as long as broad, upper margin with a double row of small tubercles, lower margin with an irregular row of feeble tubercles, cutting edge with four or five large tubercles; dactylus short and stout, with one large tubercle on cutting edge, upper margin smooth, usually divided by a longitudinal carina; carpus with a row of tubercles on upper margin, and one or sometimes two, rows of tubercles on surface; merus with a row of small tubercles on upper margin.

Posterior pleurobranch well developed.

*Habitat*.—*Victoria*: Warburton (F. J. Williams, 1869); Healesville; Fernshaw (J. A. Kershaw, 1880); Matlock (S. W. Fulton).

Types in the National Museum, Melbourne.

A series of 26 specimens examined.

## Genus PSEUDENGAEUS gen. nov.

Carapace higher than broad; smooth or setose. Cervical groove feeble, somewhat "V" shaped.

Rostrum short and broad. Second antennae inserted under the first. First abdominal somite without lateral lobes.

Telson without transverse sutures, entirely calcareous. Sternal keel very broad posteriorly; posterior pair of lateral processes appearing double. Vas deferens on simple short papillae on coxae of fourth pereopods.

Stem of podobranchs without a lateral wing-like expansion. Gill formula 21 + epr.

Genotype *Pseudengaeus strictifrons* sp. nov.

*Pseudengaeus strictifrons* sp. nov.

(Pl. IX, fig. 40.)

Length of adult specimens, 60 mm.

Rostrum broad, almost as broad at apex as at base, reaching nearly to base of second segment of first antennae; carinae blunt, reaching to apex.

Eyes small. First antennae with inner flagella three-fourths as long as outer; second antennae slender, reaching to second abdominal segment, squames extremely small, not reaching to base of second segment of first antennae, broad and rounded, each with a small blunt terminal spine. Inter-antennal spine small and slender, semi-pyramidal. Exopod of each third maxilliped as a short papilla, one-fourth as long as ischius of maxillipedes.

Carapace shorter than abdomen, two and one-half times longer than broad, one and one-half times higher than broad, branchiostegites with numerous minute scattered hairs. Cervical groove and branchio-cardiac grooves obsolete, areola fairly broad.

Sternal keel blunt; first three pairs of lateral processes small and rounded, posterior pair appearing double, upper portion very small and slightly grooved, sternum swollen below, partly overhanging fourth pereopods.

Great chelae: propodus twice as long as broad, entirely smooth, lower margin smooth posteriorly and with three smooth carinae anteriorly (one on centre of margin and one on each side), cutting edge with eight or nine small tubercles, bordered on each side by smooth carina; dactylus with two smooth carinae on upper margin, cutting edge with five small tubercles, bordered on each side by a smooth carina. Carpus and merus smooth.

Telson entirely calcareous, narrowly cone-shaped, without median or lateral spines, posterior half divided by a longitudinal median groove; uropods entirely calcareous, as long as telson, inner rami each divided by a longitudinal median carina reaching to posterior margin, without posterior or lateral spines; outer rami each divided by a longitudinal median carina reaching transverse suture, four or five small spines on suture.

*Habitat*.—*Victoria*: Portland (H. W. Davey).

Types in the National Museum, Melbourne.

The size of the squame of each second antenna and the shape of the rostrum readily distinguish this species.

*Pseudengacus sternalis* sp. nov.

(Pl. IX, fig. 41.)

Length of adult specimens, 47 mm.

Rostrum broad, almost as broad at apex as at base, reaching nearly to base of second segment of first antennae; carinae blunt, reaching to apex.

Eyes very large. Squame of each second antenna rudimentary, represented by a very small blunt spine. Interantennal spine small and slenderly pyriform. Exopod of each third maxilliped indicated by a small papilla.

Carapace as long as abdomen. Cervical groove and branchio-cardiac grooves obsolete, areola fairly broad. Anterior of carapace covered with short, soft down, very dense about rostrum.

Sternal keel narrow from great chelae to third pereopods, very broad and swollen between third and fourth pereopods; posterior pair of lateral processes small, low and flattened, crenulate on posterior margin; sternum below large and swollen, overhanging fourth pereopods.

Great chelae: propodus twice as long as broad, densely punctate, upper and lower margins smooth; dactylus short and stout, upper margin smooth, two small tubercles on cutting edge. Carpus punctate, three small tubercles on upper margin; upper margin of merus smooth.

Pereopods very slender, particularly posterior pair.

Telson narrowly cone-shaped, without spines; uropods large and round, inner rami each divided by a longitudinal median carina, continued to posterior margin, without spines; outer rami each divided by a longitudinal median carina, transverse suture feebly serrated.

*Habitat*.—*Victoria*: Warragul (J. A. Kershaw).

Type in the National Museum, Melbourne.

Readily separated from *P. strictifrons* by the form of the sternal keel and by the rudimentary squame.

## Genus PARASTACOIDES gen. nov.

Carapace as high as broad, minutely tuberculate. Cervical groove deeply impressed, rounded. Abdomen without spines, lateral margins rounded. First somite with lateral lobes large and rounded.

Telson without transverse sutures, entirely calcareous. Sternal keel narrow, flat or slightly rounded. Upper lip short and broad, straight or slightly concave medianly. Vas deferens on simple short papillae on coxae of fourth pereopods.

Stem of podobranchs without wing-like expansions; no pleurobranchs present; posterior arthrobranchs rudimentary.

Genotype *Astacus tasmanicus* Erichson.*Parastacoides tasmanicus* (Erichson).

(Pl. VII, fig. 30.)

*Astacus (Astacus) tasmanicus* Erichson, Arch. f. Naturg., xii, p. 94, 1846.*Astacus tasmanicus* White, List Crust., Brit. Mus., p. 72, 1847; von Martens, Monats. Akad. Wiss. Berlin, 1868, p. 618.*Astacopsis tasmanicus* Haswell, Cat. Austrl. Mus., Crust., 1882, p. 178; Ortmann, Proc. Amer. Phil. Soc., xli, p. 292; Faxon, Mem. Mus. Comp. Zool., xl, 8, p. 402, 1914 (*Incertae sedis*).



Length of adult specimens, 75 mm.

Rostrum broad, reaching to base of third segment of first antennae, apex blunt; carinae sharp, carried well back on to carapace, lateral carinae blunt, each ending in a rounded boss.

Eyes large. First antennae with inner flagella seven-eighths as long as outer. Outer antennae slender, reaching to third abdominal segment; each squame broad, reaching to base of third segment of first antennae. Inter-antennal spine very long and slender. Exopods of third maxillipedes reaching to anterior margin of ischius.

Carapace as broad as high, twice as long as broad, shorter than abdomen; cervical groove deeply impressed, rounded; branchio-cardiac grooves obsolete, areola broad. Branchiostegites and anterior of carapace studded with numerous small tubercles tipped with short hairs, dorsum of carapace densely punctate.

Abdomen smooth, lateral margins rounded. Telson narrowly cone-shaped, with a spine on each lateral margin near posterior margin, posterior half divided by a longitudinal median groove; uropods rounded, longer than telson, inner rami each divided by a longitudinal median carina, a spine at apical third of outer lateral margin; outer rami each with nine or ten sharp spines along transverse suture, suture placed at apical third, upper portion of uropods divided by two parallel longitudinal median carinae, one carina on posterior portion. Swimmerets short and slender, especially in male.

Sternal keel narrow, flat or slightly rounded; first two pairs of processes small, slender and sharp; third and fourth pairs larger and rounded, slightly grooved; processes between fourth pereopods long and stout. Below lateral processes of third pereopods is a pair of large deep openings, largest in female.

Great chelae short and stout; propodus twice as long as broad, densely tuberculate; upper margin serrated, lower margin smooth, cutting edge with one large and two or three small tubercles; dactylus short and stout, densely tuberculate, with cutting edge smooth or with a few feeble tubercles. Carpus triangular, with a row of small tubercles on upper margin, surface punctate; merus punctate, upper margin feebly serrated.

Gill formula :

Podobranchiae		Arthrobranchiae		Pleuro-branchiae	Total
		Anterior	Posterior		
vii	0 + ep.r.	0	0	0	0 + ep.r.
viii	1	1	0	0	2
ix	1	1	r	0	2 + r
x	1	1	r	0	2 + r
xi	1	1	r	0	2 + r
xii	1	1	r	0	2 + r
xiii	1	1	r	0	2 + r
xiv	0	0	0	0	0
	6 + ep.r.	+ 6	+ 5r	+ 0	= 12 + 5r + ep.r.

*Colour*.—General appearance from above, light chocolate brown; translucent orange below. Pereopods, merus of chelae and tips of chelae translucent orange; underside of carpus violet.

*Habitat*.—*Tasmania*: Near Lake Margaret Power Station, Mt. Lyell (R. Murray, 1935); Strahan; Queenstown.  
Type (female) in Berlin Museum.

Twenty-two specimens examined.

In his key to the subgenera of *Astacus*, Erichson (1864, p. 88) defined *Astacus* (*Astacus*) as having the outer antennae inserted at the side of the inner; the telson and uropods quite calcareous; the bases of the fifth pair of legs with a gill; and the appendages of the first and second abdominal somites of the males being modified as styles.

He included here one Australian species *A. (A.) tasmanicus*, described from one female.

A series of 10 specimens of land crayfishes received from Mr. R. M. Murray, of Mt. Lyell, Tasmania, near the type locality of *A. (A.) tasmanicus*, agree in measurements, sculpture and shape with *tasmanicus*, but differ in three important characters:

- (1) The first abdominal somite of the male is devoid of appendages, as is the case in all species of Parastacidae.
- (2) The outer antennae are inserted under the inner. This character was noticed by von Martens (1868), who said (p. 619) that on comparing Erichson's specimens he could find no difference in the placing of the antennae in *tasmanicus* and in the two species of *Engaeus* (*fossor* and *cunicularius*), which have the outer antennae inserted under the inner. He also noticed that in the European forms with which *tasmanicus* was included, the telson has a complete transverse suture, while *tasmanicus* has transverse sutures only on the outer rami of the uropods, as in *Engaeus*.
- (3) No gills on the fifth pair of legs.

With the other characters corrected the last character remains the only one to prevent the identification of the species.

Erichson defined *Astacus* (*Cherax*) as having the outer antennae inserted at the side of the inner; the fifth pair of legs without gills; the telson and uropods half membranous; and the first abdominal somite of the male without appendages, and those of the second somite formed the same as the following.

He described one species, *A. (C.) preissii*, from south Western Australia. The type is lost; von Martens was unable to

find it in 1868, and, according to McCulloch (1917), it was not in the Berlin Museum in 1914.

Huxley (1878) raised the subgenus to generic rank, under the name *Chaeraps*. Various authors have referred several species to this genus, but all have a well-developed pleurobranch on each of the fifth pair of legs, making their inclusion in Erichson's genus impossible. McCulloch (1917) noted this fact, and considered *intermedius* Smith to be synonymous with *preissii* in spite of the fact that *intermedius* has gills on the fifth legs.

The two species, *A. tasmanicus* (with gills on the fifth legs) and *C. preissii* (without gills on the fifth legs), have been identified only doubtfully by subsequent authors. One is thus forced to the conclusion that Erichson attributed the presence or absence of gills on the fifth legs to the wrong specimens. With this character reversed *preissii* becomes the specimen with the gills, and the genus *Cherax* then contains all the species hitherto doubtfully referred to it; and the specimens which otherwise fit the description of *tasmanicus* Erichson (nec *tasmanicus* Smith) are identified with certainty.

#### Family AUSTROASTACIDAE fam. nov.

First abdominal segment devoid of appendages in both sexes.

Podobranchs without either a bilobed plaited lamina or a lateral wing-like expansion. Epipods of first maxillipedes without branchial filaments. The fourth pereopods without gills.

Each first antenna with the second flagellum small or absent.

Carapace strongly vaulted posteriorly. Abdomen small. First somite without lateral lobes. Telson and uropods entirely calcareous, not divided by transverse sutures.

#### Genus AUSTROASTACUS gen. nov.

Carapace higher than broad, highly vaulted posteriorly. Abdomen small, swimmerets long; first somite without lobes or spines.

Telson and uropods entirely calcareous, without transverse sutures.

First antennae each with either one or two flagella. Second antennae inserted below first. Upper lip short and broad.

Sternal keel flattened or feebly raised. Vas deferens on simple short papillae on coxae of fourth pereopods. Posterior pleurobranchs absent. Podobranchs without wing-like expansions.

Genotype *Engacus hemicirratulus* Smith and Schuster.

#### Key to Species of AUSTROASTACUS gen. nov.

First antennae each with one flagellum

HEMICIRRATULUS (Sm. and Sch.)

First antennae each with two flagella . . . . . CYMUS sp. nov.

*Austroastacus hemicirratulus* (Smith and Schuster).

(Pl. X, figs. 1-3; Pl. XI, figs. 1-3.)

*Engaeus hemicirratulus* Sm. and Sch., Proc. Zool. Soc. Lond., 1913, p. 123, pl. 20-22, figs. 34, 35, 37, 38.*Male*.—Length of average adult specimen, 70 mm.

Rostrum broad, apex blunt, with two conspicuous tufts of long bristly setae at apex; carinae indistinct, but each indicated by a row of long setae.

Eyes large. First antennae each with one flagellum. Second antennae short and slender, one-eighth longer than first; squames each with a very short inner lobe terminated by a long slender sharp spine. Interantennal spine short, broad, bluntly pointed. Exopods of third maxillipedes absent.

Carapace punctate, minutely tuberculate on branchiostegites; posterior twice as broad as anterior; one and one-half times higher than broad, three times longer than broad. Carapace very short posteriorly, highly vaulted, not covering top of last pereopod, and only part of podobranchs of second and third pereopods. Cervical groove and branchio-cardiac grooves strongly impressed, areola narrow.

Sternal keel obsolete, feebly rounded, lateral processes small, sharp below second pereopods, posterior pair rounded, deeply grooved; processes between fourth pereopods long and slender.

Abdomen punctate, with numerous tufts of long bristly setae; first segment broad and rounded, without lobes or spines at lateral margins. Telson large and rounded, more than twice the size of uropods, entirely calcareous, without spines, but having a large round swelling in middle below anterior margin; uropods shorter than telson, small and slender, calcareous throughout, without trace of transverse sutures, each with a smooth carina in middle ending in a sharp spine almost on posterior margin; telson and uropods covered by numerous tufts of long bristly setae.

Great chelae with numerous punctures and tufts of long bristly setae; propodus very stout, two and one-half times longer than broad, bordered by a row of large tubercles on upper, lower and posterior margins, three or four large tubercles on cutting edge; dactylus stout, with three or four large tubercles on cutting edge, several tufts of long bristly setae on upper margin; a smooth longitudinal ridge on upper and lower surface of propodus and dactylus; upper margin of merus smooth or feebly serrated; upper margin of carpus with a single row of large tubercles.

Gill formula:

Podobranchiae		Arthrobranchiae		Pleurobranchiae	Total
		Anterior	Posterior		
vii	ep.	0	0	0	ep.
viii	1	1	0	0	2
ix	1	1	1	0	3
x	1	1	1	0	3
xi	1	1	1	1	4
xii	1	1	1	1	4
xiii	1	1	1	1	4
xiv	0	0	0	0	0
6 + ep.		+ 6	+ 5	+ 3	= 20 + ep.



Hooked filaments only on the inner side of podobranchiae. Remaining branchiae without hooks.

*Female*.—Length of average adult specimen, 80 mm.

Similar to male, but differs in having the carapace broadest in middle, posterior only slightly broader than anterior. Abdomen proportionately broader and longer than in male.

*Colour*.—Anterior of carapace pale brown, anterior edges of rostrum and antennal scale orange; remainder of carapace greyish-brown, more brownish towards outer edge, usually mottled with irregular whitish spots on branchiostegites. Abdomen greyish-brown, brown on lateral edges and tail fan. Pereopods brownish-white, dark brown at tips; great chelae bright orange, dactylus and propodus greyish-brown, tubercles on inner edge whiter. Abdominal swimmerets pale brown.

*Habitat*.—*Victoria*: Thorpdale; Warragul; Moyarra; Kongwak; Valley View (J. Greenwood, 1935); Bena; Trafalgar; Korumburra; Warburton; Erica.

Types in National Museum, Melbourne.

MS. notes and plates illustrating this species were prepared many years ago by Professor Sir Frederick McCoy for use in the unpublished continuation of his *Prodromus of the Zoology of Victoria*. The name used in his notes is *Hemicirratulus hystrix* (gen. and sp. nov.). McCoy's material was subsequently loaned to G. Smith, who described this species (with Schuster, 1913) as a species of *Engaeus*, using McCoy's generic name for the specific name. McCoy's plates have been used in the present paper.

### *Austroastacus cymus* sp. nov.

(Text fig. 2.)

*Male*.—Length of average adult specimen, 39 mm.

Rostrum short and broad, reaching to base of second segment of first antennae, apex blunt and straight; carinae feeble, reaching half-way to apex, continued by rows of long stout setae.

Eyes large. First antennae each with two flagella, inner flagellum short and slender, one-fifth as long as outer. Second antennae long and slender, reaching to cervical groove. Each squame very slender, apex sharp. Exopods of third maxillipedes absent.

Carapace two and one-half times longer than broad, punctate, minutely tuberculate on branchiostegites. Cervical groove and branchio-cardiac grooves strongly impressed, areola narrow.

Abdomen two-thirds as long as carapace, very slender, with numerous tufts of long stout setae. Telson small, narrowly cone-shaped, without spines; uropods slender, each divided by a longitudinal median carina, outer rami each produced to a blunt point, inner rami rounded. Telson and uropods covered by numerous tufts of long stout setae.

Sternal keel raised and blunt between second and third pereopods.

Great chelae densely punctate, covered by numerous tufts of long stout setae; propodus twice as long as broad, upper margin with five or six small tubercles, lower margin smooth, cutting edge with two small tubercles;

dactylus stout, with one small tubercle on cutting edge, upper margin smooth; upper and lower surfaces of both propodus and dactylus divided by a longitudinal carina. Carpus densely punctate, a row of small tubercles on upper margin; upper margin of merus feebly serrated.

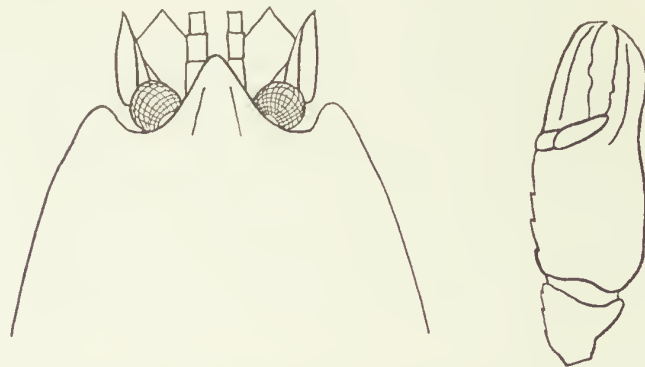


FIG. 2. *AUSTROASTACUS CYMUS* sp. nov.

*Female*.—Length of average adult specimen, 53 mm.

Similar to male, but differs in having a much larger abdomen and tail fan. The abdomen is almost as long and broad as the carapace, and the uropods are as large as the telson.

*Colour*.—Wholly bright orange.

*Habitat*.—*Victoria*: Dondangadale (between Myrtleford and Whitfield) (E. Clark, Dec., 1935).

Types in National Museum, Melbourne.

A series of 38 specimens, ranging in size from 4 mm. to 53 mm. long examined. One female had eggs attached to the swimmerets; another female, found in a small burrow leading off the main burrow, had several newly-hatched young (from 4 mm. to 10 mm. long).

This species burrows in swampy patches in the valley and on the dry land on the tops and sides of heavily-timbered hills. Entrances to burrows in swampy ground have cones three or four inches high, with an opening in the top; the burrows are eighteen inches to three feet deep. On the hills no cones are formed, the burrows being indicated only by small round holes, usually underneath fallen logs or stones; these burrows are from eighteen inches to four feet six inches deep.

## BIBLIOGRAPHY.

- Abbott, C. C. Notes on the Habits of Certain Crayfish. Amer. Nat., vii, 1873, p. 80.  
 Are the "Chimneys" of Burrowing Crayfish Designed? Amer. Nat., xviii, 1884, p. 1, 157.  
 How the Burrowing Crayfish Works. The Inland Monthly, i, 1885, p. 31.
- Borradaile, L. A. On the Classification of the Decapod Crustaceans. Ann. Mag. Nat. Hist., 7th ser., xix, 1907, pp. 457-486.
- Calman, W. T. Notes on a Crayfish from New Guinea. Ann. Mag. Nat. Hist., viii (8), 1911, p. 366-368.
- Clark, E. Notes on the Habits of Land Crayfishes. Vict. Nat., liii, 1936, pp. 65-68.
- Dana, J. Family Astacidae. Report U.S. Explor. Exped., xii, Crust., pt. 1, 1852, pp. 520-528.
- Erichson, W. F. Uebersicht der Arten der Gattung *Astacus*. Arch. f. Naturg., xii, 1846, pp. 86-103; l.c., pp. 375-377.
- Faxon, W. Observations on the Astacidae in the United States Museum and in the Museum of Comparative Zoology, with Descriptions of New Species. Proc. U.S. Nat. Mus., xx, 1898, pp. 643-694.  
 Notes on the Crayfishes in the United States National Museum and the Museum of Comparative Zoology, with descriptions of new species and subspecies, to which is appended a catalogue of the known species and subspecies. Mem. Mus. Comp. Zool., xl, No. 8, 1914, pp. 351-52; 401-02.
- Flecker, H. and P. O. The Haunt of the North Queensland Spiny Crayfish. Nth. Qld. Nat., iv, 41, 1936, pp. 18-20, 2 pls.
- Gould, C. On the Distribution and Habits of the Large Freshwater Crayfish (*Astacus* sp.) of the Northern Rivers of Tasmania. Proc. Roy. Soc. Tasmania, August, 1870, pp. 42-44.
- Gray, J. New Species of the Genus *Astacus*. Eyre's Journ. Exped. Disc., Central Australia, i (Appendix), pp. 407-411, pl. 3.
- Hale, H. M. Observations on the Yabbie (*Parachaeraps bicarinatus*). Austrl. Mus. Mag., ii, No. 8, 1925, pp. 271-274.  
 Handbook Crustacea of South Australia, 1927, pp. 72-77, figs. 69-73.  
 A Remarkable Freshwater Crayfish (*Parachaeraps bicarinatus*). Sth. Austrl. Nat., xi, 1930, pp. 42-43.
- Harris, A. J. The Habits of *Cambarus*. Amer. Nat., xxxvii, No. 441, 1903, p. 601-08.
- Haswell, W. A. Catalogue of Australian Museum, Crustacea. 1882, pp. 174-179.
- Heller, C. Reise der Fregatte Novara, Zool., ii, pt. 3, Crust., 1865, pp. 100-104.
- Hess, W. Beitrage zur Kenntniss der Decapoden-Krebse Ost-Australiens. Arch. f. Naturg., xxxi, 1865, p. 164, pl. vii, fig. 17.
- Huxley, T. H. On the Classification and Distribution of the Crayfishes. Proc. Zool. Soc. Lond., 1878, pp. 752-788.  
 The Crayfish. International Scientific Series, xxviii, 1880.
- McCoy, F. Recent Zoology and Paleontology of Victoria. Ann. Mag. Nat. Hist., ser. 3, xx, 1867, p. 189.  
 Prodromus of the Zoology of Victoria, i, Dec. 2, 1878, p. 17, pl. 15; l.c., Dec. 3, 1879, p. 45, pl. 29; l.c., ii, Dec. 16, 1888, p. 225, pl. 14.
- McCulloch, A. R. Revision of the Freshwater Crayfishes of South Western Australia. Records West. Austrl. Mus., i, pt. 3, 1914, pp. 228-235, pls. xxxii, xxxv.

- Notes on Variation in *Astacopsis serratus* Shaw. Records Austrl. Mus., No. 11, 1917, p. 237-38, pl. xliii.
- Milne-Edwards, M. *Astacus australasiensis*. Hist. Nat. Crust., ii, 1837, p. 332, pl. 24, figs. 1-5.
- Milne-Edwards, M., and Audouin. Arch. du Mus. d'Hist. Nat., ii, 1841, p. 36.
- \*Mulder, F. J. Notes on a Freshwater Crayfish. Geelong Nat., sec. ser., v, 4, 44, 1913, p. 95.
- Nobili, G. Ann. Mus. Civ. St. Nat. Genova, xl, 1899, p. 244.  
Boll. Mus. Zool., Torina, 1903, xviii, p. 1.
- Ortmann, A. E. Die Decapoden Krebse des Strassburger Museum III. Zoolog. Jahrb., Syst. vi, p. 7, pl. 1, fig. 2, 1891.  
Proc. Amer. Phil. Soc., xli, p. 291, 1902.  
The Crawfishes of Western Pennsylvania. Annals Carnegie Mus., iii, 1905, p. 387.  
The Crawfishes of the State of Pennsylvania. Mem. Carnegie Mus., ii, No. 10, 1906, pp. 343-524.  
Semon's Zoolog. Forsch. in Austral., v, p. 21.
- Raff, J. W. Abnormal Development of the Head Appendages in the Crayfish *Parachanna bicarinatus* Gray. Proc. Roy. Soc. Vict., xxxi, p. 325, pl. 15, 1919.
- Roux, J. A propos des genres *Astaconephrops* Nobili et *Cheraps* Erichson. Zool. Anz. Leipzig, 37, 1911, pp. 104-106.  
Nouvelles especes de decapodes d'eau douce provenant de Papouasie. Leyden Museum Notes, xxxiii, 1911, pp. 81-106, figs. 2-5.
- Shaw, G. Zoology of New Holland, i, p. 21, pl. 8, 1794.
- Smith, G. W. Cambridge Nat. Hist., iv, 1909, p. 157.  
Trans. Linn. Soc. London, ser. 3, ix, 1908, p. 70.  
A Naturalist in Tasmania, 1909.  
The Freshwater Crayfishes of Australia. Proc. Zool. Soc. Lond., 1912, pp. 144-170, pls. xiv-xxvii.
- Smith, G. W., and Schuster, E. H. J. The Genus *Engaeus*, or the Land-Crayfishes of Australia. Proc. Zool. Soc. Lond., 1913, pp. 112-127, pls. xii-xxvii.
- Spence-Bate, C. Report Voy. H.M.S. *Challenger*, Crust. Macr., xxiv, 1888, pp. 192-206, pls. xxvii-xxviii.
- Tarr, R. S. Habits of the Burrowing Crayfishes in the United States. Nature, xxx, 1884, pp. 127-28.
- Thomson, G. M. Notes on Tasmanian Crustacea, with descriptions of new species. Proc. Roy. Soc. Tasmania, 1892, p. 50, pl. 1.
- von Martens, E. On a New Species of *Astacus*. Ann. Mag. Nat. Hist., 3, xvii, 1866, p. 359.  
Überblick der neuhollandischen Flusskrebse. Monatsber. Akad. Wiss. Berlin, 1868, pp. 615-619.
- Watson, K. A New *Astacopsis* from North Queensland. Mem. Qld. Mus., x, pt. v, 1935, p. 232, pl. xxxiv.  
*Astacopsis fleckeri*. Mem. Qld. Mus., xi, pt. 1, 1936, p. 52.
- White, A. List Crust., British Museum, 1847, p. 72.  
Descriptions of Two Species of Crustacea in the British Museum. Proc. Zool. Soc. Lond., 1850, xviii, p. 95, pl. xv.

\* An account of a freshwater crayfish from Mortlake, based on a single specimen (which cannot now be found) which he proposed, if it should prove to be a new species, to call *Astacoides quineyi*. The account is inadequate and useless for the identification of any of the four species found in that locality. The name has therefore been omitted from the catalogue as *nomen nudum*.



## EXPLANATION OF PLATES.

## Plate I.

- Fig. 1. Podobranch of *Euastacus serratus* (Shaw) ; 1a, transverse section of same.  
Fig. 2. Podobranch of *Astacopsis gouldi* sp. nov. ; 2a. transverse section of same.  
Fig. 3. Podobranch of *Cherax destructor* sp. nov. ; 3a transverse section of same.  
Fig. 4. Sternal keel of *Cherax albidus* sp. nov.  
Fig. 5. Sternal keel of *C. destructor* sp. nov.  
Fig. 6. Sternal keel of *C. punctatus* sp. nov.  
Fig. 7. Sternal keel of *Astacopsis tricornis* sp. nov.  
Fig. 8. Sternal keel of *Geocharax gracilis* sp. nov.  
Fig. 9. Sternal keel of *Eugaeus fossor* Erichson.  
Fig. 10. Sternal keel of *E. villosus* sp. nov.  
Fig. 11. Sternal keel of *Pseudengaeus strictifrons* sp. nov.

## Plate II.

Head ; a, interantennal spine and upper lip ; b, great chela, male ; c, great chela, female.

- Fig. 12. *Euastacus serratus* (Shaw).  
Fig. 13. *E. yarraensis* (McCoy).  
Fig. 14. *E. serratus* s.sp. *hirsutus* (McCulloch).

## Plate III.

- Fig. 15. *E. nobilis* (Dana).  
Fig. 16. *E. nobilis* s.sp. *kershawii* (Smith).  
Fig. 17. *E. fleckeri* (Watson).

## Plate IV.

- Fig. 18. *Cherax tenuimanus* (Smith).  
Fig. 19. *C. quadricarinatus* (von Martens).  
Fig. 20c. Gynandromorph of *C. quinquecarinatus* (Gray).

## Plate V.

- Fig. 20. *C. quinquecarinatus* (Gray).  
Fig. 21. *C. bicarinatus* (Gray), drawn from a specimen from Gray's type material.  
Fig. 22. *C. bicarinatus* (Gray), drawn from a specimen from Smith's type material.  
Fig. 23. *C. destructor* sp. nov.

## Plate VI.

- Fig. 24. *C. albidus* sp. nov.  
Fig. 25. *C. punctatus* sp. nov.  
Fig. 26. *Geocharax gracilis* sp. nov.

## Plate VII.

- Fig. 27. *Astacopsis franklinii* (Gray).  
Fig. 28. *A. gouldi* sp. nov.  
Fig. 29. *A. tricornis* sp. nov.  
Fig. 30. *Parastacoides tasmanicus* (Erichson).

## Plate VIII.

- Fig. 31. *Engaeus fossor* Erichson.  
 Fig. 32. *E. quadrimanus* sp. nov.  
 Fig. 33. *E. phyllocercus* Sm. and Sch.  
 Fig. 34. *E. sericatus* sp. nov.  
 Fig. 35. *E. cunicularius* Erichson.

## Plate IX.

- Fig. 36. *Engaeus villosus* sp. nov.  
 Fig. 37. *E. affinis* Sm. and Sch.  
 Fig. 38. *E. victoriensis* Sm. and Sch.  
 Fig. 39. *E. tuberculatus* sp. nov.  
 Fig. 40. *Pseudengaeus strictifrons* sp. nov.  
 Fig. 41. *P. sternalis* sp. nov.

## Plate X.

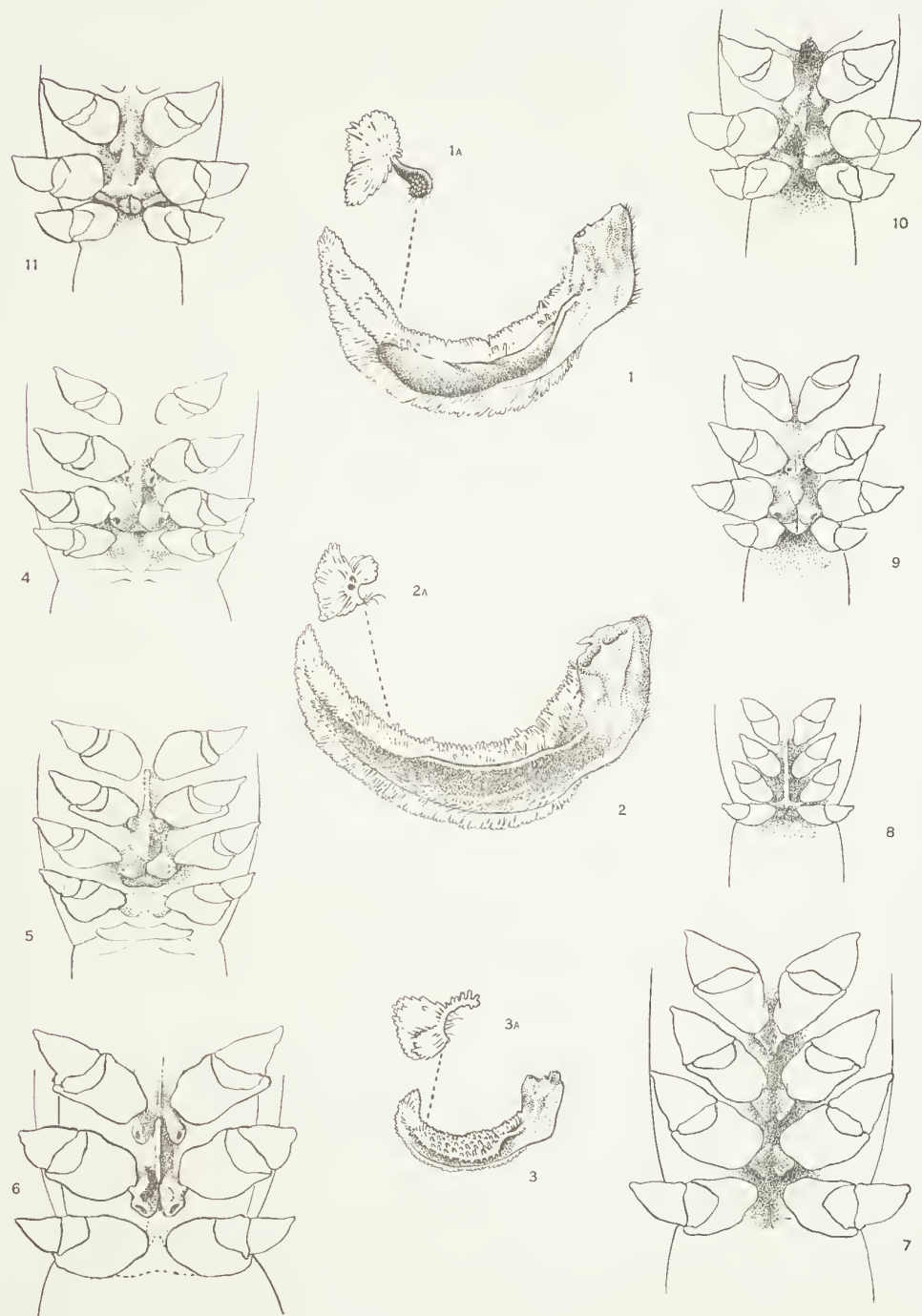
*Austroastacus hemicirratulus* (Smith and Schuster).

- Fig. 1. Under side of male, nat. size.  
 Fig. 1a. First abdominal appendage of male,  $\times 2$ .  
 Fig. 2. Dorsal view of female, nat. size.  
 Fig. 2a. Carapace of female viewed from front,  $\times 2$ .  
 Fig. 2b. Rostrum,  $\times 2$ .  
 Fig. 2c. Inner side of left chelae, nat. size (reversed on plate).  
 Fig. 2d. Outer side of ditto.  
 Fig. 2e. Outer side of right chelae, nat. size.  
 Fig. 2f. Inner side of ditto.  
 Fig. 2g. Telson,  $\times 2$ .  
 Fig. 3. Young specimen, nat. size.

## Plate XI.

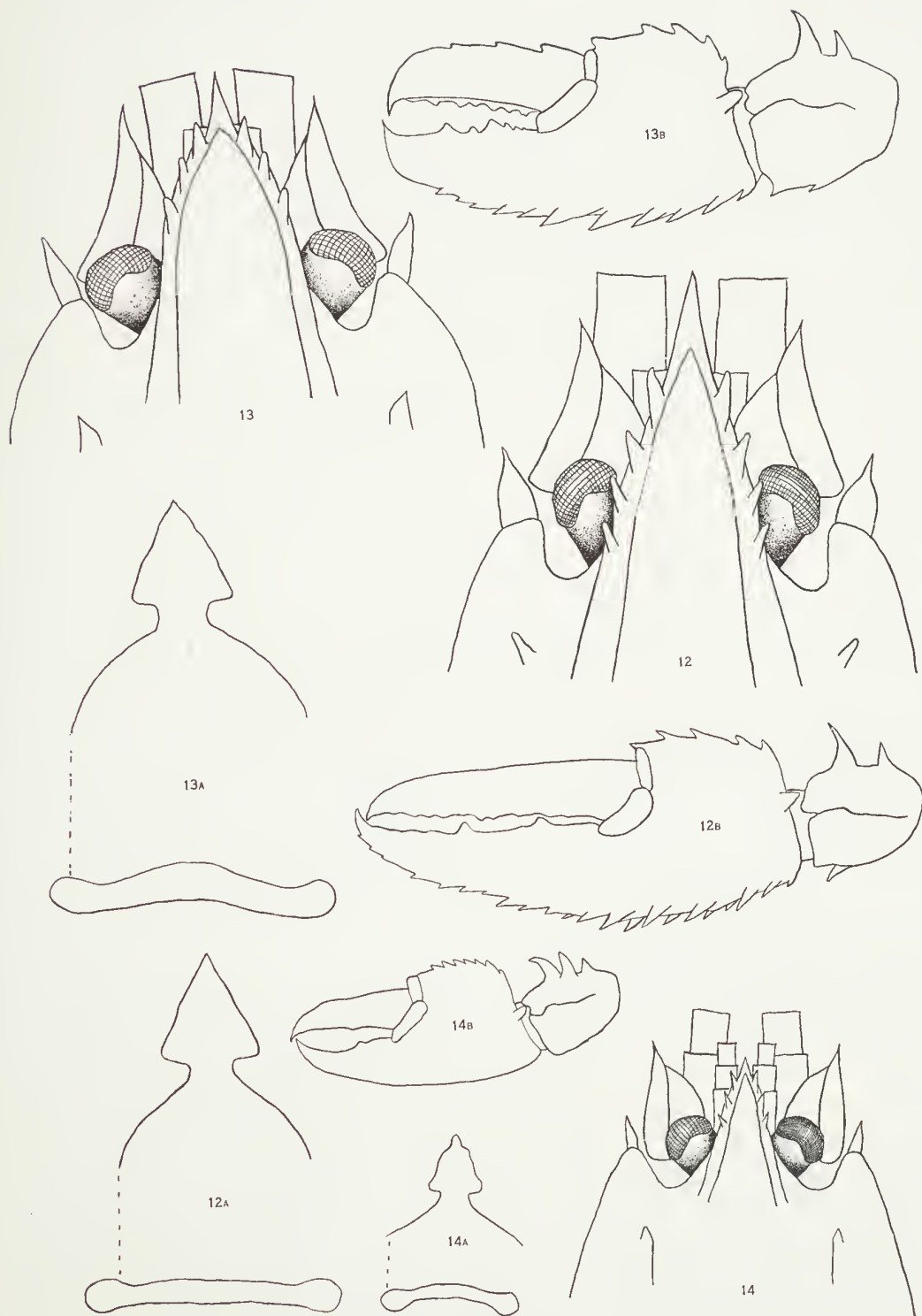
*Austroastacus hemicirratulus* (Smith and Schuster).

- Fig. 1. Side view of male, nat. size.  
 Fig. 1a. Dorsal view of male.  
 Fig. 1b. Rostrum,  $\times 3$ .  
 Fig. 1c. Ditto, side view.  
 Fig. 1d. Four final segments of first antenna,  $\times 50$ .  
 Fig. 1e. Three terminal segments of second antennae,  $\times 50$ .  
 Fig. 1g. Ditto.  
 Fig. 1h. Underside of head,  $\times 6$ .  
 Fig. 1i. Branchiostegite removed to show podobranchs in position.  
 Fig. 1k. Podobranchs removed to show remaining gills.



GJB

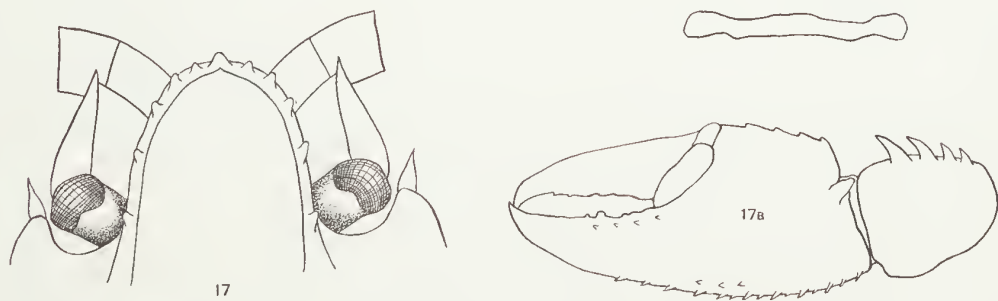
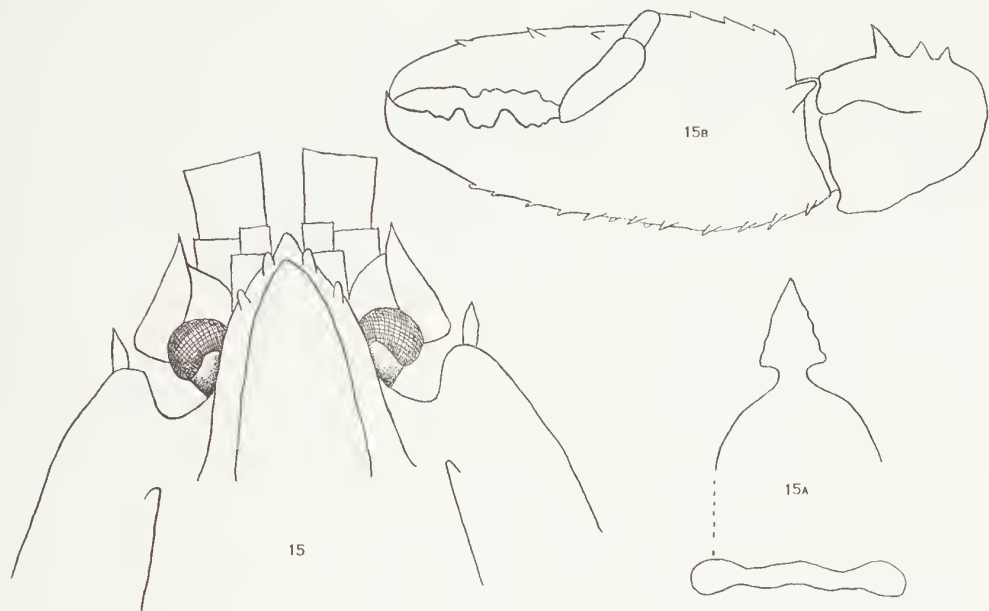
Australian Parastacidae



E. C.

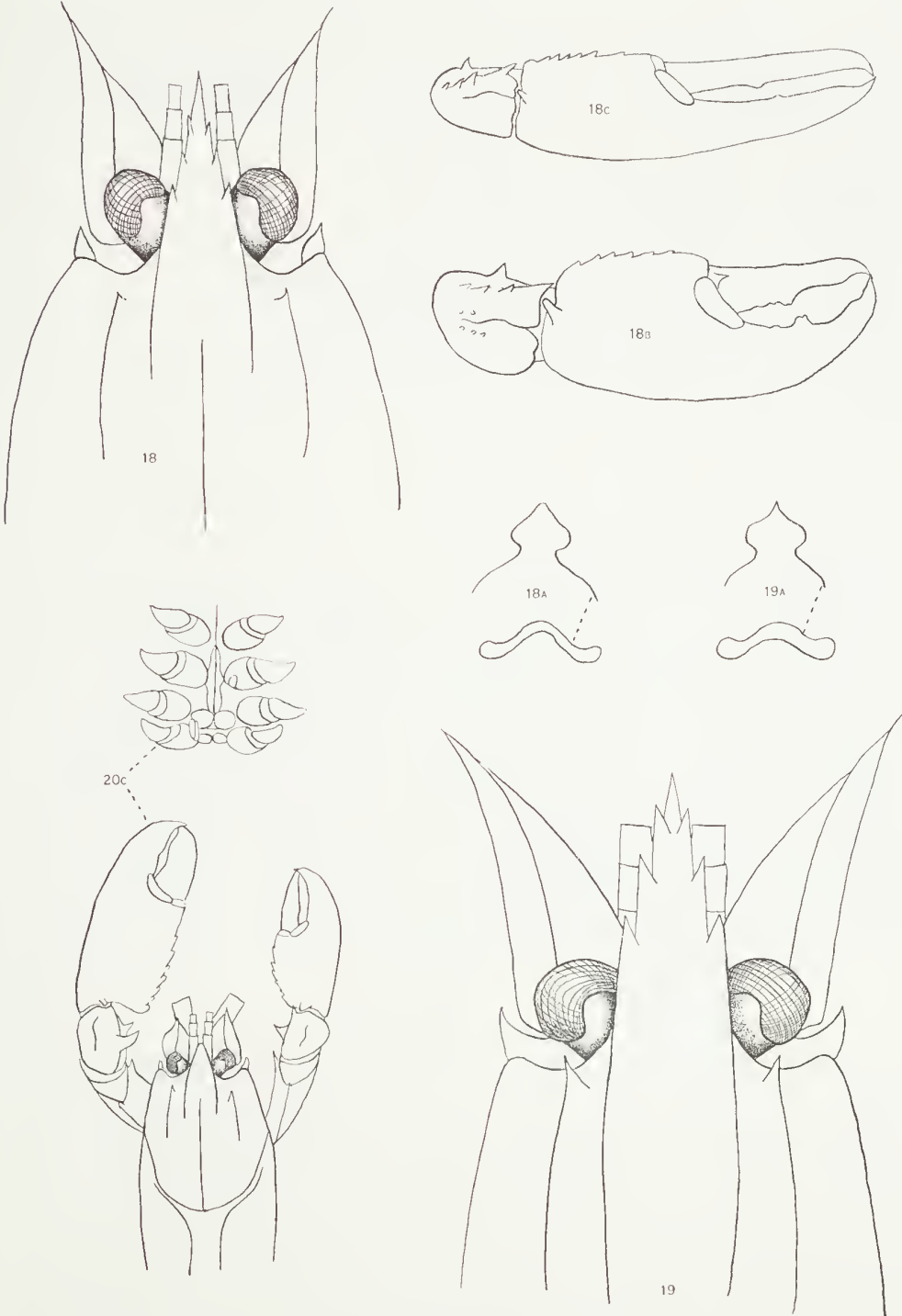
Australian Parastacidae





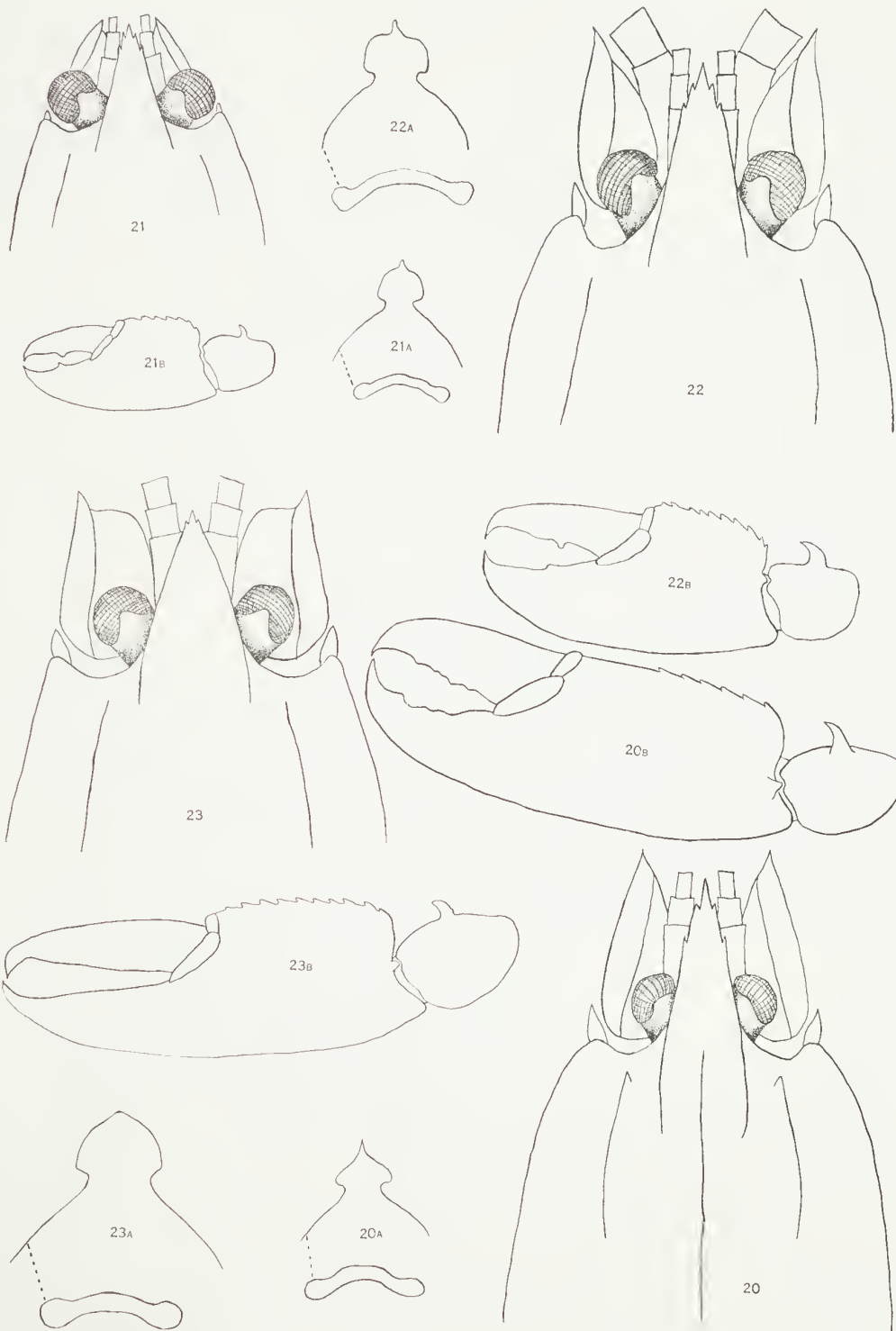
E. C

Australian Parastacidae



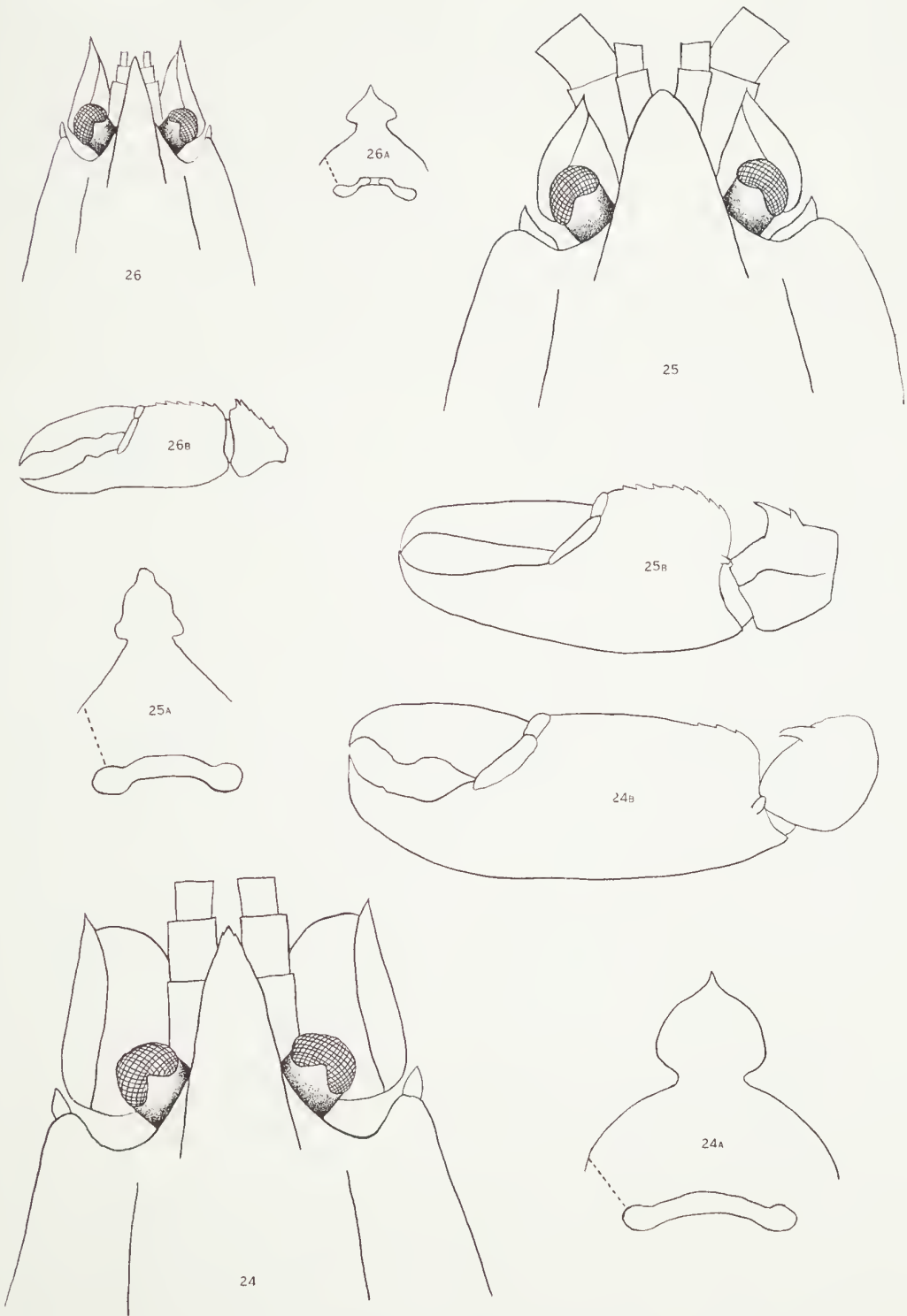
E. C.

Australian Parastacidae



E. C.

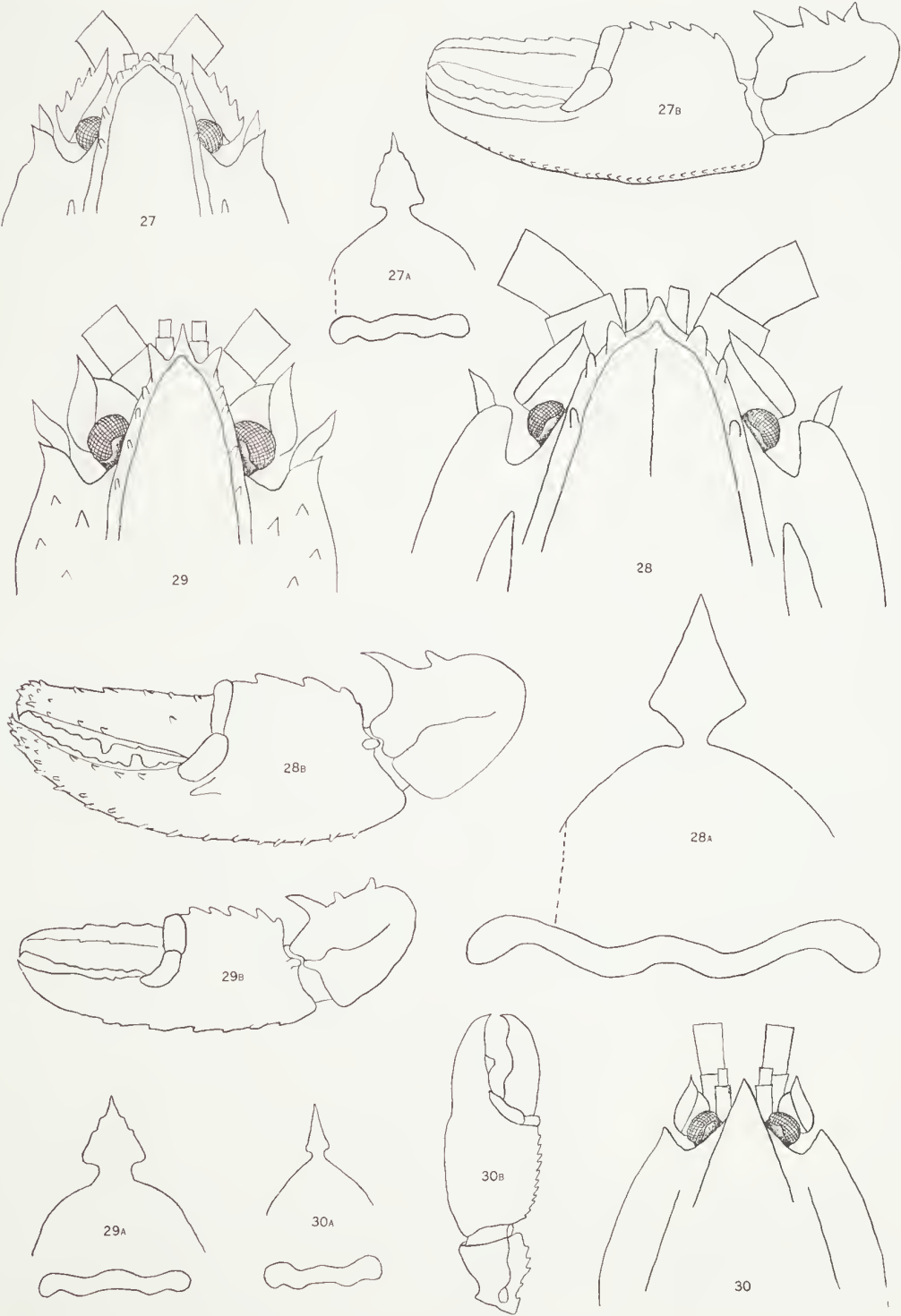
Australian Parastacidae



E. C.

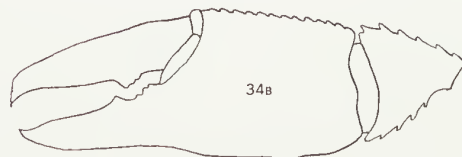
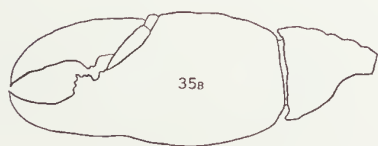
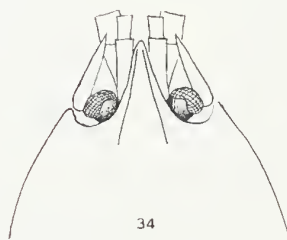
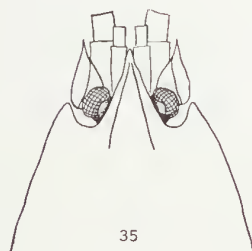
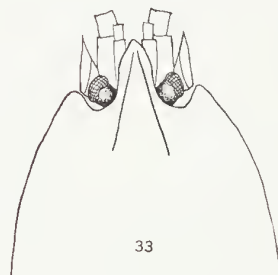
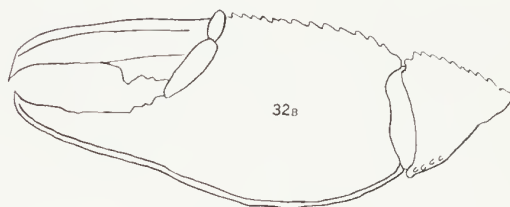
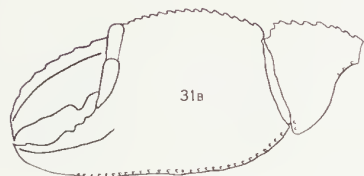
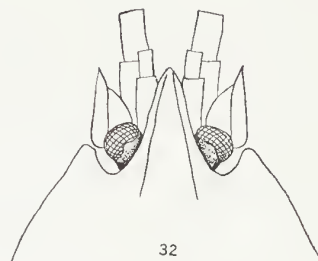
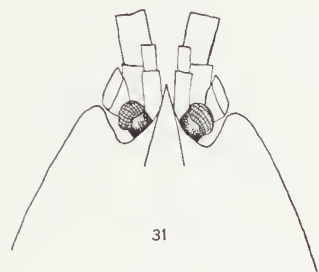
Australian Parastacidae





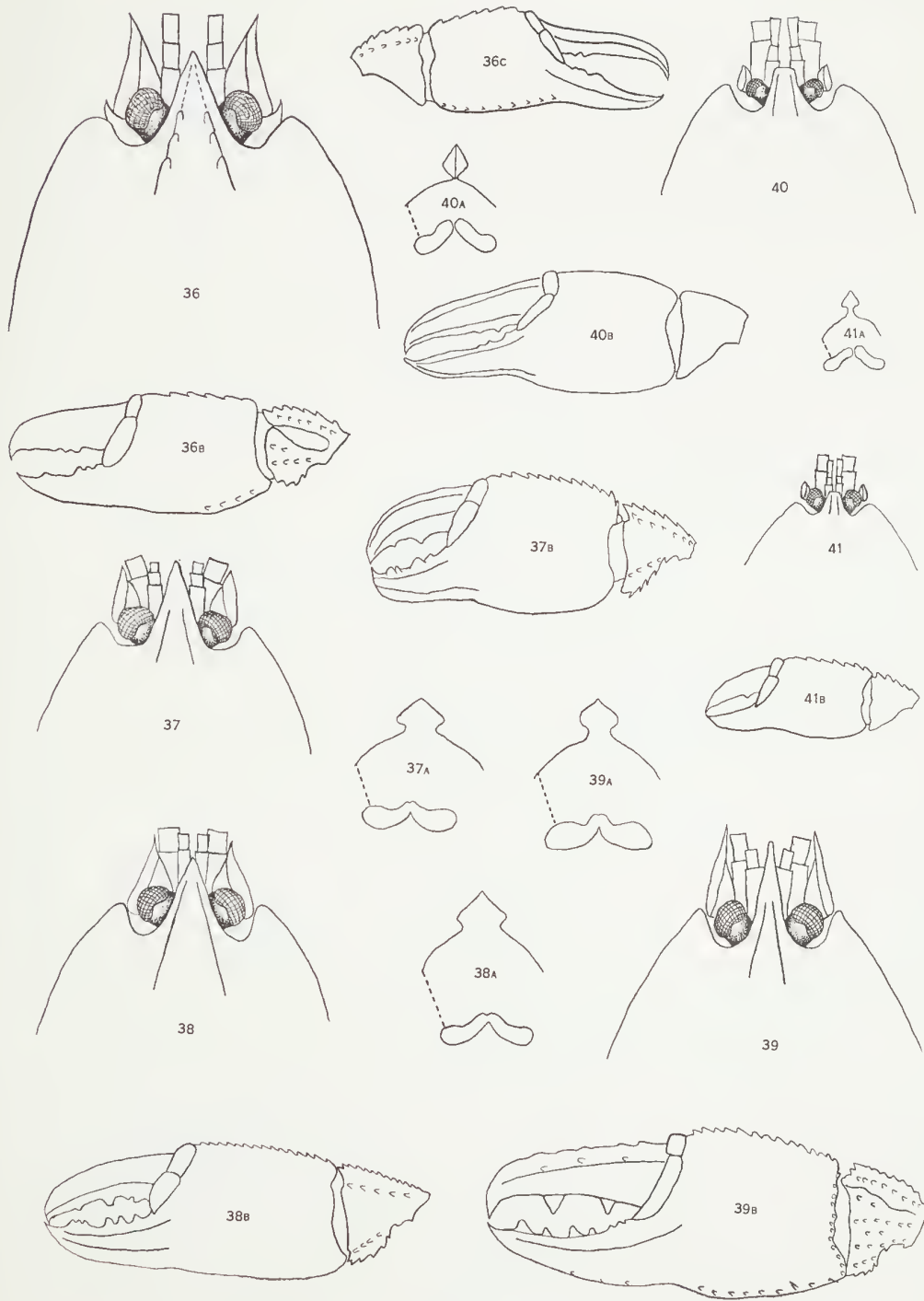
E. C.

Australian Parastacidae



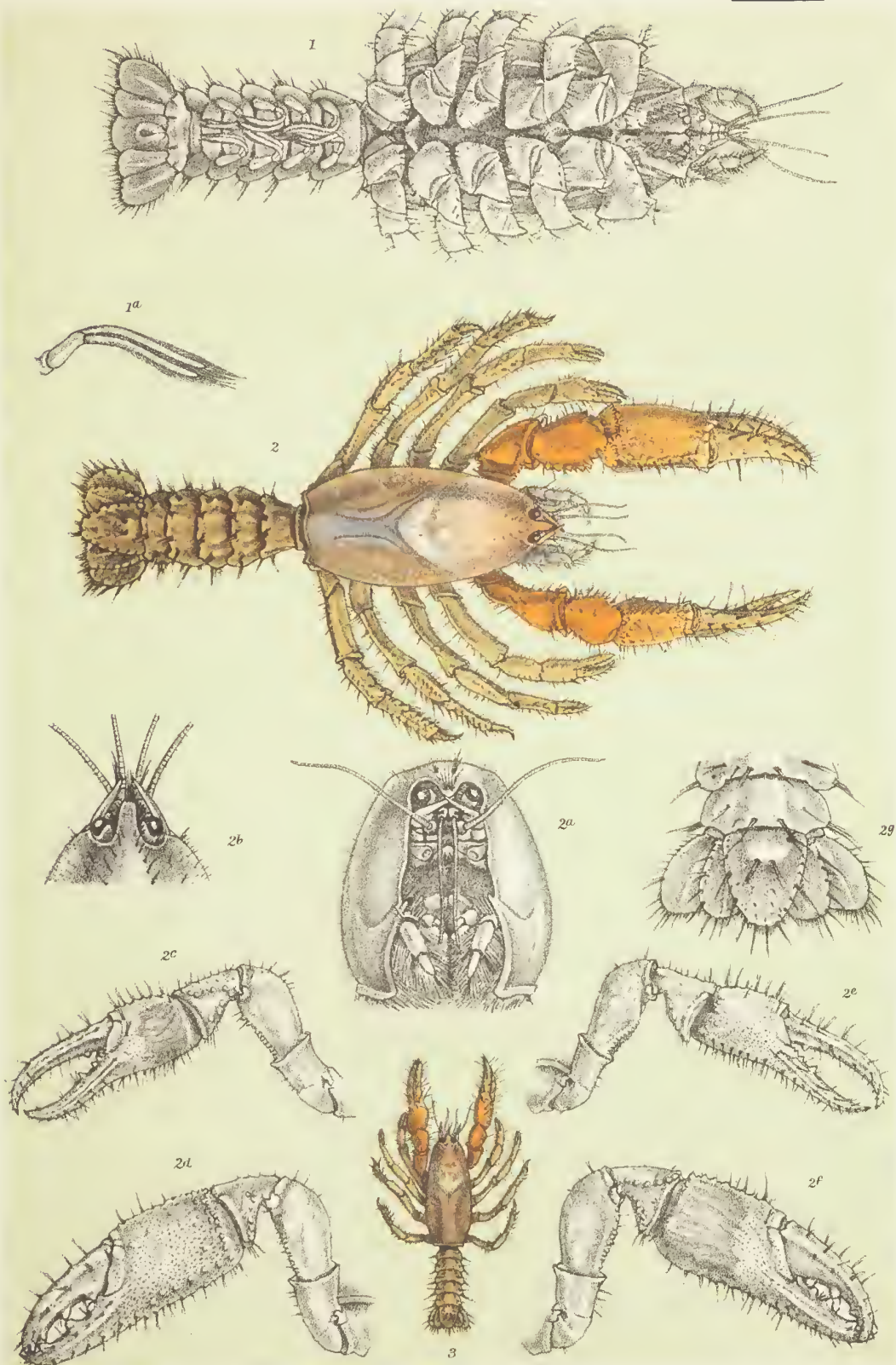
E. C.

**Australian Parastacidae**



E. C.

**Australian Parastacidae**



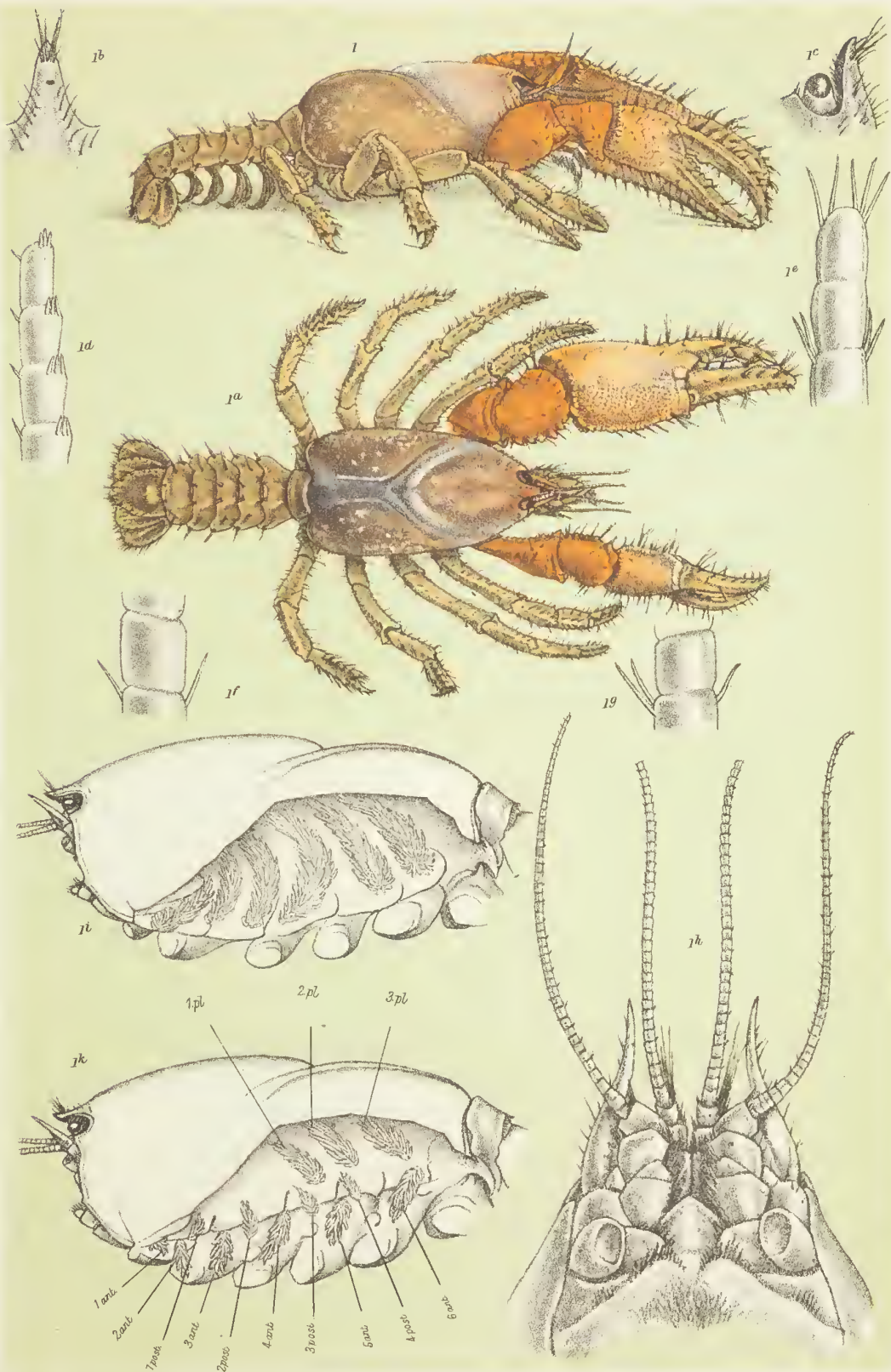
D<sup>r</sup> Wild del & lith

Prof M<sup>o</sup> Goy. drew

Steam Litho Gov<sup>t</sup> Printing Office

*Austroastacus hemicirratulus* (Sm. and Sch.)





*D. Wild. del & lith*

Prof. McCoy directs

Steam litho. Govt. Printing Office

*Austroastacus hemicirratulus* (Sm. and Sch.)