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REVISION OF THE GENUS *EUASTACUS* (CRAYFISHES, FAMILY PARASTACIDAE), WITH NOTES ON THE DISTRIBUTION OF CERTAIN SPECIES.[1]

By Ellen Clark

Plates I-IX, Fig. 1.

Introduction.

In a previous paper (2) an attempt was made to clear up the synonymy of the Australian Parastacidae, but it was not possible to make a complete survey of the group as material from many districts was not available. Since that time, however, much material from localities not previously represented has been collected or received for identification. Special attention was given to obtaining specimens from New South Wales, the type locality of most species of the genus.

With the material now available it has been possible to make a complete revision of the genus *Euastacus*; this revision has resulted in several alterations in nomenclature, the reasons for which are explained below.

The full synonymy of each species is included with its description, and the distribution (as far as is known) is indicated. Since difficulties arose in finding suitable maps of Victoria to illustrate the distribution, two special maps (Plates VIII and IX) were compiled from data on plans prepared by the State Rivers and Water Supply Commission and maps issued by the Geological Survey.

Nomenclature.

Genus EUASTACUS Clark.

Euastacus Clark, Mem. Nat. Mus. Vict., x, 1936, p. 10.

Carapace spinous or tuberculate; cervical groove deeply impressed, rounded. Rostral carinae spinous or tuberculate. Abdomen spinous or tuberculate; first segment with lateral lobes large and rounded. Telson more or less completely divided by a transverse suture, membranous posteriorly. Stems of podobranchs each produced into a broad wing-like expansion, covered by numerous long setae, terminated by sharply recurved hooks.

Genotype: *Euastacus elongatus* Clark.

In the original description of the genus the genotype was

1. Results of work assisted by a grant from the Commonwealth Research and Endowment Fund.

stated to be *Astacus serratus* Shaw, the reasons for the alteration shown above are given on page 11.

Crayfishes of the genus *Euastacus* are characterized by their large size and the armature of spines and tubercles on the carapace, abdomen and legs. They have been found in most of the rivers of Victoria; in the south-east of South Australia; and in the coastwise rivers of New South Wales and Queensland as far north as Coen. One species, *Astacopsis australasiensis* (Milne-Edwards), was recorded in 1903 from Sorong in the north-west of New Guinea (27), but the genus has not otherwise been recorded from any locality outside the mainland of Australia.

Prior to 1936, eleven species of spiny-tailed crayfishes, now included in the genus *Euastacus,* had been described; these, with type locality and the date of description are:

Cancer serratus Shaw (28), New Holland, 1794.
Astacus australasiensis Milne-Edwards (20), New Holland (later given as Sydney), 1837.
Astacoides nobilis Dana (4), ? New South Wales, 1852.
Astacoides spinifer Heller (13), New Holland, 1865.
Astacus armatus von Martens (31), Murray River, Australia, 1866.
Astacopsis paramattensis Spence-Bate (30), Paramatta River, Sydney, Australia, 1888.
Astacopsis sydneyensis Spence-Bate (30), Sydney, Australia, 1888.
Astacopsis serratus var. *yarraensis* McCoy (18), Yarra River, Victoria, 1888.
Astacopsis serratus var. *hirsutus* McCulloch (19), Bellemore Falls, Kangaroo River, New South Wales, 1917.
Astacopsis kershawi Smith (29), Moe River, Victoria, 1912.
Astacopsis fleckeri Watson (33), Root's Creek, North Queensland, 1935.

Since these species were described, much doubt has been thrown on their identity and validity, most authors recognizing only one species, *Astacus serratus* (Shaw), as valid, while others included also *Astacoides nobilis* Dana.

In the following pages the history of each of the names is given; six of them are accepted as valid species, five are shown to be synonyms, and the two varieties are raised to full specific rank; with the addition of three new species described herein the genus now has a total of nine species.

Cancer serratus Shaw was described in 1794, and the description was accompanied by a large coloured figure. Since

that date, the name *serratus* has been applied by most authors to each of the various species of spiny crayfishes found in the rivers of eastern Australia.

In 1898 Faxon (7) pointed out that the name *Cancer serratus* was preoccupied, having been used by Forskal in 1775 for the crab now known as *Scylla serratus;* he reinstated Heller's name *Astacoides spinifer*. In the same paper he listed four of the other previously described forms, mentioning that he had not seen examples of them, but, from the descriptions and figures, he considered each of them, with the exception of *nobilis,* synonymous with *spinifer*.

McCoy (17), described and figured as *Astacoides serratus* (Shaw), the species found in the Murray River, and included as synonyms *spinifer* and *armatus*. In a later paper (18), he described as *Astacopsis serratus* var. *yarraensis* the form found in the Yarra and adjacent rivers.

Smith (29) included all described species under *serratus,* which he considered one large variable species, although he admitted that the various forms differed markedly from each other. In the same paper he described as *Astacopsis kershawi* the form found in the Moe River, Victoria; this name is shown herein to be synonymous with *nobilis*.

McCulloch (19) placed as one large variable species, *serratus*, all the crayfishes from the Murray River in Victoria, South Australia and New South Wales; the Yarra River, Victoria; from Gippsland, Victoria; from numerous localities in New South Wales; and from Stanthorpe, Queensland. He separated as a distinct variety *Astacopsis serratus* var. *hirsutus,* a very hairy form from the Kangaroo River, New South Wales.

In 1936 (2) in a revision of the Australian members of the family Parastacidae, the genus *Euastacus* was erected for the Australian species previously contained in the genus *Astacopsis*. In that paper the name *serratus* was assigned to the species found in the Murray River and its tributaries in Victoria, New South Wales and South Australia. This species was made the genotype of the new genus. At the same time, *hirsutus* was retained as a variety of *serratus,* and *yarraensis* was raised to full specific rank; *nobilis* was reinstated for the form found in the coastwise rivers in Victoria and New South Wales, with *kershawi* retained as a sub-species, inhabiting various coastwise rivers in Victoria.

Since the publication of that revision, extensive enquiries have been made into the range of the genus, and a considerable number of specimens from numerous localities have been

collected, or received from other collectors. In this way a comprehensive series of the genus has been accumulated from localities not previously represented in our collections. Particular attention was given to the Sydney district, since New South Wales is the type locality of seven of the species previously described.

Careful examination of the material revealed nine distinct species, each of which is described and figured in the following pages. Of these, six belong to known species and three are new. Three species came from Sydney and the surrounding districts; and as was to be expected, they are identical with the species described from this district early last century.

Concerning the three species from the Sydney district, the first is *nobilis* Dana, of which the majority of the specimens obtained are small, the largest of them measuring up to seven inches in length from rostrum to telson. These specimens agree in every way with specimens collected in various coastwise rivers in Victoria and New South Wales. The second is *hirsutus* McCulloch; comparison with other forms has warranted making it a full species in place of a variety. The third species is *serratus* Shaw; examination of the large series of fully grown specimens proves that *serratus* Shaw and *spinifer* Heller are synonymous, and since the name *serratus* is unique for the genus, it must be retained. Several small specimens six or seven inches long, are identical with the description and figure of *paramattensis* Spence-Bate, other specimens about two inches long are identical with the description and figure of *sydneyensis* Spence-Bate, proving that both *paramattensis* and *sydneyensis* are synonymous with *serratus*.

From this it is evident that there are at least three species of the genus found around Sydney; *serratus, nobilis* and *hirsutus*. The synonymy of each species is given above the description of the species concerned.

The history of the nomenclature of the species found in the Murray River and its tributaries is somewhat confusing. The earliest record of a crayfish from the Murray is by Gray (10) in 1845 when, in a paper dealing with specimens collected by Eyre, he referred to a large species found in the Murray River; he gave no description, but remarked that it was "of a size ranging to 4½ lbs., and quite equal in flavour to the finest lobster." The next record is by Blandowski (1) in 1858; during his tour of north-western Victoria he collected "a beautiful species of spined lobster, two other varieties of crawfish, and three kinds of shrimps—all found in the Murray River."

It was not until 1866 that the species was described by von Martens (31), from a single female 330 mm. long, and named *Astacus armatus*. In a later paper (32) he placed *armatus* with *spinifer* Heller as synonyms of *serratus* Shaw.

McCoy (16) referred to the species as *Astacoides serratus* and in a later paper (17) described in full detail and figured the species as *serratus,* and all following authors (with the exception of Faxon, who used *spinifera*) have referred to this species as *serratus*.

Comparison of a large series of specimens from the Murray River with a series from Sydney shows that *serratus* and the Murray River species are distinct; therefore von Martens' name *armatus* must be reinstated.

Examination of material from the Murray River system has revealed two distinct species; this fact was not recognized when my previous paper (2) was published. In that paper specimens from Echuca were accepted as typical, and were described and figured as *serratus* Shaw. These specimens, it has now been observed, agree in all characters with those found in the Goulburn River system and other southern tributaries of the Murray River, and in the Murray River itself from Echuca west to Swan Hill; but differ in several characters from those in the northern tributaries, in the southern tributaries east of Cobram, and in the Murray River itself east of Cobram and west of Swan Hill.

The most outstanding differences between the two species are the length of the outer antennae, and the shape of the great chelae. In his description, von Martens states that "the hands are exactly similar in size and in the shape of the teeth situated on the cutting edges," but he gives no indication of the size of the chelae or whether they are very slender or stout; nor does he give any indication as to the length of the antennae. As a result of these omissions, it is not possible to say which of the two species von Martens had before him. The habitat is given as Murray River, Australia.

Since either of the two species will fit von Martens' description, it has been considered wiser to give the name *armatus* to the northern species, as this is the one that has been taken by the majority of previous authors as typical of the Murray River form. The southern species is redescribed herein as *elongatus* sp. nov., based on the specimens from Echuca which were previously, but erroneously, identified as *serratus* Shaw. These are the specimens on which the genus *Euastacus* was founded; therefore the new species *elongatus* becomes the genotype of the genus *Euastacus*.

Systematic Descriptions

Key to species of *EUASTACUS* Clark.

Rostrum very long and broad, apex long and sharp, carinae with sharp spines.
Second antennae reaching to, or beyond, telson.
Great chelae long and slender .. .. ELONGATUS sp. nov.
Second antennae reaching third or fourth abdominal segment.
Great chelae long and very stout .. .. ARMATUS (von Martens)
Great chelae short and stout .. .. YARRAENSIS (McCoy)
Rostrum long and broad, apex short, carinae tuberculate or with blunt spines.
Two rows of short broad spines or tubercles on each branchiostegite; abdomen spinose .. .. SERRATUS (Shaw)
Carapace and abdomen without large spines or tubercles; entire animal densely hirsute .. .. HIRSUTUS (McCulloch)
Rostrum short and broad, apex blunt, carinae tuberculate.
Abdomen with several rows of small sharp spines on each segment SUTTONI sp. nov.
Abdomen without spines or tubercles except on lateral margins FLECKERI (Watson)
Abdomen with three rows of sharp spines and a large rounded ridge on dorsum of each segment .. .. NOBILIS (Dana)
Abdomen with two rows of spines and a flattened ridge on dorsum of each segment .. .. BISPINOSUS sp. nov.

Euastacus elongatus sp. nov.

Plate I.

Euastacus serratus (Shaw), Clark, Mem. Nat. Mus. Vict., x, 1936, p. 12, pl. 1, fig. 1; pl. 2, fig. 12; Victorian Year-Book, 1936-37, p. 34.

Length of average adult specimen 300 mm.

Rostrum very long and broad, reaching end of third segment of second antennae, apex long and sharp; lateral carinae obtuse, each with three or four sharp spines. A blunt, punctate carina ending in a small sharp spine at base of each carina, and a small sharp spine on a large rounded boss posterior-laterally to it.

Second antennae long and slender, reaching beyond end of telson. Squame smooth, inner lobe short and broad, terminal spine long, stout and sharp. Interantennal spine triangular, apex blunt, lateral margins serrated.

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

Abdomen spinose. First segment with a long stout sharp spine on each lateral lobe, a short stout blunt spine above each lateral spine. Second segment with two short slender sharp spines on each lateral margin; a long stout sharp spine and a large broad, forwardly directed, sharp spine above the lateral spines. Third segment with a slender sharp spine at each lateral margin; a long stout sharp spine, directed slightly forwards, above each of the lateral spines. Fourth and fifth segments each with a short slender sharp spine at each lateral margin; a short slender sharp spine, a long stout forwardly directed sharp spine, and a large broad forwardly directed sharp spine above each lateral spine. Sixth segment with a very short sharp spine near each lateral margin; a short sharp backwardly directed spine above each lateral spine.

Telson broad, slightly longer than broad, almost completely divided by a

transverse suture, with a spine on each lateral margin at suture and three or four small spines on surface; inner rami of uropods each with a spine on lateral margin near posterior margin, median carina feeble, ending in a sharp spine near posterior margin; outer rami of uropods each with numerous spines along the transverse suture, three small spines on outer lateral margin. Lobes at base of uropods without spines.

Sternal keel bluntly rounded between first and third pereopods, sharp below great chelae; first pair of lateral processes very small and sharp, second pair larger, 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 slender, propodus two and one-half times as long as broad, upper margin with four sharp spines. Lower margin with two rows of large sharp spines posteriorly and a single row of smaller spines anteriorly, cutting edge with two large and several small tubercles, a few small tubercles on upper surface below base of dactylus; dactylus very long and stout, apex long and slender, several small tubercles on cutting edge; upper margin usually smooth or with one spine near base, two or three small sharp spines near apex. Carpus with two long sharp spines on upper margin, upper surface deeply grooved; merus with two large and five small sharp spines along upper margin.

Habitat.—Victoria: Echuca, Murray River (type locality) (Dr. W. J. Harris); Shepparton, Goulburn River (A. D. Butcher); Broken River (E. Clark); Ten Mile, Upper Goulburn River (E. Clark); Jamieson River (A. Hordern); Howqua River (E. Clark).

The extremely long second antennae and the slender chelae at once distinguish this species from any other known member of the genus. The specimens from the headwaters of the Goulburn River, Howqua and Jamieson Rivers, differ from the others only in having shorter antennae.

Euastacus armatus (von Martens).

Plate II.

Astacus armatus von Martens, Ann. Mag. Nat. Hist., ser. 3, xvii, 1866, p. 359.

Astacopsis spinifera (Heller), Faxon, Proc. U.S. Nat. Mus., xx, 1898, p. 670; Mem. Mus. Comp. Zool., xl, 1914, p. 402.

Astacus serratus Shaw, McCoy, Ann. Mag. Nat. Hist., ser. 3, xx, 1867, p. 189; von Martens, Monats. Akad. Wiss. Berlin, p. 615, 1868.

Astacoides serratus (Shaw), McCoy, Prodromus Zool. Vict., i, dec. ii, 1878, p. 17, pl. 15.

Astacopsis serratus (Shaw), Haswell, Cat. Austrl. Mus., Crust., 1882, p. 174; Ortmann, Proc. Amer. Philos. Soc., xli, p. 292, 1902; Smith, Proc. Zool. Soc. Lond., 1912, p. 157, pl. 16; McCulloch, Rec. Austrl. Mus. no. 11, 1917, p. 237; Hale, Handbook Crust. Sth. Australia, 1927, p. 75, fig. 6 and fig. 73.

Length of average adult specimen 300 mm.

Rostrum very long and broad, reaching beyond end of third segment of second antennae, apex long and sharp; lateral carinae obtuse, each with three or four sharp spines. A blunt, punctate carina ending in a small sharp spine at base of each carina, and a small sharp spine on a large rounded boss posterior-laterally to it.

Second antennae reaching fourth abdominal segment. Squame smooth, inner lobe very short and broad, terminal spine long and stout, sharp. Inter-antennal spine large, triangular, apex blunt, lateral margins serrated.

Carapace more than twice as long as broad, broader than high, longer than abdomen. Branchiostegites studded with numerous small tubercles; several sharp spines and a few large tubercles in irregular rows on upper margin.

Abdomen spinose. First segment with a long stout sharp spine on each lateral lobe, a short stout blunt spine above each lateral spine. Second segment with two short slender sharp spines on each lateral margin; a long sharp spine, very large at the base, and a short sharp spine very broad at the base, directed slightly forward, above the lateral spines. Third segment with a slender sharp spine at each lateral margin; a long sharp spine, very large at the base, and a short sharp spine, very large at the base, above each lateral spine. Fourth and fifth segments each with a long slender sharp spine at each lateral margin; a short broad sharp spine, a long sharp spine very broad at the base, and a short sharp spine very broad at the base, above each lateral spine. Sixth segment with a very short broad sharp spine near each lateral margin, a very short broad sharp spine above each lateral spine.

Telson broad, slightly longer than broad, almost completely divided by a transverse suture, with a spine on each lateral margin at suture, and three or four small spines on surface; inner rami of uropods each with a spine on lateral margin near posterior margin, two or three small sharp spines along outer lateral margin; outer rami of uropods each with numerous spines along the transverse suture, some examples with two or three small spines on outer lateral margin. Lobes at base of uropods without spines.

Sternal keel broadly rounded between first and third pereopods, sharp below great chelae; first pair of lateral processes very small and sharp, second pair larger, 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 slender, propodus two and one-half times as long as broad, upper margin with four sharp spines, lower margin with two rows of large sharp spines posteriorly and a single row of smaller spines anteriorly, cutting edge with two large and several small tubercles, a few small tubercles on upper surface below base of dactylus; dactylus very stout, apex short and blunt, cutting edge with two large and several small tubercles, upper margin smooth, two or three small spines near apex. Carpus with two long sharp spines on upper margin, upper surface deeply grooved; merus with two large and five small sharp spines on upper margin.

Habitat.—Victoria: Wahgunyah, Murray River; Cobram, Murray River (P. J. O'Connor); King River (M. Webb); Ovens River, Wangaratta; Dondangadale River; Buffalo River (E. Clark); King River.

New South Wales: Hay, Murrumbidgee River (E. G. Austin); Narrandera, Murrumbidgee River (L. C. Haines); Deniliquin, Edward River.

South Australia: Blanche Town, Murray River (G. Brooks); Renmark, Murray River (M. Kennewell); Morgan, Murray River (Sth. Austrl. Mus.); Mannum, Murray River.

Readily separated from *E. elongatus* sp. nov., by the large stout chelae, the more spinose telson and uropods; and the structure and size of the abdominal spines; the larger and

more numerous spines on the pereopods, and by the shorter length of the second antennae.

This species has previously been figured by Hale (11), Huxley (14), McCoy (17), and Smith (29).

Euastacus yarraensis (McCoy).

Plate III.

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

Astacopsis serratus (Shaw); Smith, Proc. Zool. Soc. Lond., 1912, p. 158, pl. xvii; McCulloch, Rec. Austrl. Mus., no. 11, 1917, p. 238.

Euastacus yarraensis (McCoy), Clark, Mem. Nat. Mus. Vict., x, 1936, p. 14, pl. II, fig. 13; Vict. Year-Book, 1936-37, p. 35.

Length of average adult specimen 300 mm.

Rostrum long and broad, reaching end of third segment of second antennae, apex long and sharp; lateral carinae obtuse, each with two or three small blunt spines. A blunt punctate carina, ending in a small blunt spine at base of each carina, and a small tubercle on a rounded boss posterior-laterally to it.

Second antennae reaching third or fourth abdominal segment. Squame smooth, inner lobe short and broad, terminal spine long stout and sharp. Interantennal spine triangular, apex blunt, lateral margins serrated.

Carapace twice as long as broad, broader than high, as long as abdomen. Branchiostegites studded with numerous small tubercles and an irregular row of several large tubercles on upper margin of each branchiostegite.

Abdomen spinose. First segment with a long slender sharp spine on each lateral lobe, and a small blunt spine above each lateral spine. Second segment with two or three long slender sharp spines along each lateral margin; a short sharp spine and a broad blunt spine above the lateral spines. Third, fourth and fifth segments each with a long slender sharp spine at each lateral margin; two long sharp spines and one short broad blunt spine above each lateral spine. Sixth segment with a slender sharp spine near each lateral margin, two small sharp spines above each lateral spine.

Telson longer than broad, almost completely divided by a transverse suture, a spine on each lateral margin at suture, and several short sharp spines on upper surface; inner rami of uropods each with a small sharp spine on outer lateral margin near posterior margin, median carina feeble, ending in a small sharp spine near posterior margin; outer rami each with a feeble longitudinal median carina, numerous sharp spines along the transverse suture, and two or three small spines on the outer lateral margin. Lobes at base of uropods without spines.

Sternal keel narrow, rather sharp; first three pairs of lateral processes small, blunt; fourth pair large, blunt, deeply grooved; processes between fourth pereopods long and stout.

Great chelae stout, propodus almost twice as long as broad, upper margin with four blunt spines, lower margin with two rows of short spines, cutting edge with two large tubercles, three or four small tubercles in a row on upper surface below cutting edge; dactylus stout, upper margin smooth, two or three small spines near apex, cutting edge with six or seven large tubercles. Carpus with one large and one small spine on upper margin; merus with two large and three small spines along upper margin.

Habitat.—Victoria: Yarra River (type locality); Kennedy Creek, tributary

of Curdies River, Cobden (W. A. Hall); Barwon River (W. Kershaw); Plenty River (S. A. Keartland); Watts River; Badger Creek; Bunyip River (W. Kershaw); Tarago River, near Warragul (Geo. F. Hill); Yea River (C. W. Brooks, Yea State School); King Parrot Creek; Acheron River (A. D. Butcher); Murrundindi River.

Readily separated from *E. armatus* (von Martens) by the armature of the carapace and abdomen, the form of the chelae, and the length of the antennae.

Euastacus serratus (Shaw).

Plate IV.

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

Potamobius serratus (Shaw), White, Proc. Zool. Soc. Lond., 1850, xviii, p. 95, pl. 15.

Astacopsis serratus (Shaw), Haswell, Cat. Austrl. Mus. Crust., 1882, p. 174; Smith, Proc. Zool. Soc. Lond., p. 157, 1912, pl. 16; McCulloch, Rec. Austrl. Mus., no. 11, p. 237, 1917.

Astacoides spinifer Heller, Reise Novara. Zool., ii, pt. 3, Crust., 1865, p. 102, pl. 9.

Astacopsis spinifer (Heller), Spence-Bate, "Challenger" Reports, xxiv, 1888, p. 195, pl. 28.

Astacopsis spinifera (Heller), Faxon, Proc. U.S. Nat. Mus., xx, 1898, p. 670; Faxon, Mem. Mus. Comp. Zool., xl, 1914, p. 402.

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 paramattensis Spence-Bate, "Challenger" Reports, xxiv, 1888, p. 202, pl. 27; Faxon, Proc. U.S. Nat. Mus., xx, 1898, p. 675.

Astacopsis sydneyensis Spence-Bate, "Challenger" Reports, xxiv, 1888, p. 204, pl. 23; Faxon, Proc. U.S. Nat. Mus., xx, 1898, p. 675.

Length of largest specimen 222 mm.

Rostrum long and broad, reaching almost to end of third segment of second antennae, apex short and sharp, lateral carinae obtuse, each with a few small tubercles. A blunt, punctate carina ending in a small blunt spine at base of each carina, and a rounded boss posterior-laterally to it.

Second antennae slender, reaching to fourth abdominal segment. Squame smooth, inner lobe large and broad, terminal spine short and blunt. Inter-antennal spine long and slenderly triangular.

Carapace twice as long as broad, broader than high, as long as abdomen. Branchiostegites with numerous short, broad obtuse spines placed in two irregular rows below each branchio-cardiac groove; a row of large, slender and sharp spines continued to anterior of carapace below cervical groove, remainder of each branchiostegite studded with numerous small tubercles; several small sharp spines on anterior of carapace below rostrum; entire carapace densely punctate.

Sternal keel slender and sharp; a small, slender, sharp spine on keel below the third maxillipedes, great chelae, first and second pereopods; a slender sharp spine on keel between the spines of first and second pereopods. Lateral processes erect, upper margin sharp, processes between third pereopods

deeply grooved, flattened; processes between fourth pereopods short and stout.

Abdomen spinose. First segment with a long slender sharp spine on each lateral lobe, and a short broad obtuse spine above it. Second segment with three long spender sharp spines along each lateral margin; a long slender sharp spine above the lateral spines, and a short broad obtuse spine above it. Third, fourth and fifth segments each with a long slender sharp spine at each lateral margin; two rows of long slender sharp spines and a short broad obtuse spine above the lateral spines. Sixth segment with two long slender sharp spines near lateral margins, and several small sharp or obtuse spines on the upper surface.

Telson longer than broad, almost completely divided by a transverse suture; a spine on each lateral margin at suture, and one or more spines above it; numerous small sharp spines on calcareous portion of telson, three or four small sharp spines on membranous portion. Inner rami of uropods each with a spine on outer lateral margin near posterior margin, and two or three small sharp spines along the obsolete median carina, carina ending in a small sharp spine near posterior margin. Outer rami of uropods each with numerous small sharp spines along the transverse suture, numerous small sharp spines along the outer margin of each ramus. Lobes at base of uropods without spines.

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

Habitat.—New South Wales: National Park (L. G. Russell); Sydney (E. M. Stephen); Baulkham Hills, near Parramatta (A. R. McCulloch); Yarramalong Mount, near Gosford (J. H. Wright and W. Barnes); Berowra Creek, near Hornsby; Ourimbah, near Gosford; Wahroonga; Fitzroy Falls, Kangaroo River (Melbourne Ward), caught in streams above the falls. *Blue Mountains (N.S.W.)*: Pools below Govett's Leap (M. Ward); Wall's Cave (E. Clark); Blackheath (E. Skehan).

The armature of the carapace and abdomen distinguishes this species from each of the other members of the genus, the very slender sharp spines on the abdomen being the main characteristic.

The specimens from the vicinity of Sydney are dark green or brownish green, but the specimens from the localities in the Blue Mountains are a vivid shade of red.

Euastacus hirsutus (McCulloch)

Astacopsis serratus var. *hirsutus* McCulloch, Records Austrl. Mus., no. 11, 1917, p. 238, pl. 43.

Euastacus serratus s.sp. *hirsutus* (McCulloch), Clark, Mem. Nat. Mus. Vict., x, 1936, p. 14, pl. ii, fig. 14.

Length of largest specimen 92 mm.

Rostrum slender, reaching to base of the third segment of first antennae, apex blunt; carinae blunt, with three or four small blunt spines along each

carina. A small blunt spine at base of each carina, with a small tubercle posterior-laterally to it.

Second antennae reaching to third abdominal segment. Squame smooth, sharply pointed, inner lobe broad. Interantennal spine long and slenderly triangular.

Carapace more than twice as long as broad, broader than high, much shorter than the abdomen. Branchiostegites and anterior of carapace studded with numerous small tubercles; areola and dorsum of carapace densely punctate. Entire carapace densely hirsute.

Abdomen hirsute. First segment without spines on lateral lobes. Second segment with small sharp spines along each lateral margin. Third, fourth and fifth segments each with a small sharp spine at each lateral margin. There are no other spines or tubercles on the abdomen. Entire abdomen densely hirsute.

Telson and uropods each densely hirsute.

Sternal keel broad and blunt; first pair of lateral processes small and sharp, second pair larger, blunt; posterior pair very large and blunt, deeply grooved; processes between fourth pereopods long and stout.

Great chelae stout; propodus three times as long as broad, apex sharp, upper margin with five or six blunt spines, lower margin with two rows of small tubercles, cutting edge with one large and three or four small tubercles, upper surface minutely tuberculate. Dactylus long and slender, apex sharp, upper margin with a smooth carina, one or two small tubercles near base, cutting edge with several small tubercles. Carpus with four sharp spines on upper margin, upper surface deeply grooved. Merus with several small sharp spines along upper margin. The whole of the great chelae and all the pereopods densely hirsute.

Habitat.—New South Wales: Belmore Falls Creek, Kangaroo River (type locality), in streams above the falls (Melbourne Ward); Sublime Point, Bulli Pass (Consett Davis).

Types in the Australian Museum, Sydney.

Described from a large series comprising two paratypes, received on loan from the Australian Museum, and fresh material from Messrs. Ward and Davis. The large number of specimens examined has shown the species to warrant specific rank.

The specimen from Bulli was collected in a burrow some three feet below the soil surface, near Sublime Point, about 1,300 ft. above sea-level.

Euastacus suttoni sp. nov.

Plate V.

Length of largest specimen 200 mm.

Rostrum very broad, reaching base of third segment of second antennae, apex short and blunt; lateral carinae obtuse, carried well back on to carapace. An obtuse punctate carina ending in a small tubercle at base of each carina, and a large rounded boss posterior-laterally to it.

Second antennae short, reaching second abdominal segment. Squame smooth, inner lobe broad, terminal spine short and sharp. Interantennal spine long and slender, lateral margins serrated.

Carapace densely punctate, almost twice as long as broad, slightly broader than high, as long as abdomen. Branchiostegites densely studded with small tubercles. Cervical groove very deep; branchio-cardiac grooves prominent; areola broad.

Abdomen spinose. First segment with a long slender sharp spine on each lateral lobe, and usually another small spine above each lateral spine. Second segment with three or four long slender sharp spines along each lateral margin; and three or four rows of short, sharp spines above them. Segments three, four, five and six each with one long slender sharp spine near the lateral margin, and several rows of short, sharp spines above the lateral spines, the spines numerous on dorsum of each segment. The number of rows of spines varies considerably on both sides of each segment on each of the specimens examined.

Telson long, partly divided at middle by transverse suture, posterior half membranous, a row of three or four sharp spines along each lateral margin of calcareous portion, and numerous small sharp spines on upper surface. Uropods longer than telson, membranous portion relatively long; inner rami each with five or six sharp spines along the outer lateral margin, median carina feeble; outer rami each with numerous small blunt spines along the transverse suture, median carina obsolete. Lobes at base of uropods without spines.

Sternal keel very slender and sharp; lateral processes almost upright, slender and sharp, increasing in size and sharpness from first to fourth, posterior pair deeply grooved; processes between fourth pereopods long and slender.

Pereopods slender.

Great chelae stout, propodus slightly more than twice as long as broad, four small sharp spines along the upper margin, lower margin with an anterior row of small obtuse spines along a prominent carina, and a posterior row of relatively large sharp spines; cutting edge of propodus with three or four large tubercles and several small tubercles, an obtuse spine on the upper surface of propodus at base of cutting edge; several small tubercles in a group near lower margin. A row of three or four sharp spines on underside of propodus from base of dactylus towards carpus. Dactylus with three or four large tubercles and several small tubercles along cutting edge, three or four small sharp spines along upper margin. Carpus stout with three large sharp spines on upper margin, upper surface deeply grooved; merus with a few small sharp spines along the upper margin.

Habitat.—Queensland: Wyberba (E. Sutton).

The armature of the abdomen and the form of the rostrum separate this species from other members of the genus. The numerous small sharp spines, irregularly placed on the abdomen, are very distinctive.

Euastacus fleckeri (Watson).

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, p. 18.

Euastacus fleckeri (Watson), Clark, Mem. Nat. Mus. Vict., x, 1936, p. 17, pl. 3, fig. 17.

Length of largest specimen examined 210 mm.

Rostrum short and broad, reaching base of third segment of second

antennae, apex blunt; lateral carinae rounded, each with three or four tubercles; a punctate carina, ending in a small tubercle, at base of each carina.

Second antennae reaching base of telson; squame smooth, inner lobe broad, terminal spine 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 segment with a long sharp spine on lateral lobes; second segment with four or five sharp spines on each lateral margin; remaining segments each with one spine on each lateral margin. There are 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 an 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 the transverse suture. Lobes at base of uropods without spines.

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, lower margin with one or two rows of small tubercles, several small tubercles on upper surface of propodus. Dactylus with two or three small tubercles on cutting edge, upper margin smooth, several small tubercles on upper margin above the cutting edge. Carpus with four or five sharp spines along upper margin, upper surface flat; merus with four or five small spines on upper margin.

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

Readily separated from *E. nobilis* (Dana) by the absence of spines or tubercles from the dorsum of the abdominal segments, the absence of spines on the telson and uropods, and by the form of the carpus.

In the description of the great chelae, Mem. Nat. Mus. Vict., x, 1936, p. 18, a printer's error occurs. The description of the propodus is cut short at the phrase "cutting edge of propodus with one large and 3 or 4 small tubercles" and is followed by the end of the description of the dactylus beginning with the phrase "on cutting edge, upper margin smooth." The corrected description is given above.

Euastacus nobilis (Dana).

Plate VI.

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

Astacoides nobilis Dana, 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 (Dana), von Martens, Monatsber. Akad. Wiss. Berlin, p. 616, 1868.

Astasopsis nobilis (Dana), Haswell, Cat. Austrl. Mus., Crust., 1882, p. 175; Faxon, Proc. U.S. Nat. Mus., xx, p. 675, 1898; Faxon, Mem. Mus. Comp. Zool., xl, 8, 1914, p. 402.

Astacopsis serratus (Shaw), Smith, Proc. Zool. Soc. Lond., p. 157, 1912; McCulloch, Rec. Austrl. Mus., no. 11, p. 237, 1911.

Euastacus nobilis (Dana), Clark, Mem. Nat. Mus. Vict., x, 1936, p. 15, pl. iii, fig. 15; Clark, Vict. Year-Book, 1936-37, p. 35.

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

Euastacus nobilis s. sp. *kershawi* (Smith), Clark, Mem. Nat. Mus. Vict., x, 1936, p. 16, pl. iii, fig. 16; Clark, Vict. Year-Book, 1936-37, p. 35.

Length of average adult specimen 263 mm.

Rostrum broad, reaching base of third segment of second antennae, apex long, slender and sharp; lateral carinae obtuse, continued well back on to carapace, punctate, each with one large tubercle at apex, and two or three smaller tubercles posterior to it. A blunt, punctate carina, and a large rounded boss with a small tubercle, posterior-laterally to it.

Second antennae reaching fourth abdominal segment. Squame smooth, inner lobe broad, terminal spine long, slender and sharp. Interantennal spine broadly triangular.

Carapace more than twice as long as broad, broader than high, as long as abdomen. Branchiostegites sparsely studded with small tubercles, two or three small blunt spines anteriorly on each branchiostegite below cervical groove, with or without larger tubercles along the dorsum of each branchiostegite. Entire carapace sparsely punctate.

Abdomen spinose and tuberculate. First segment with a long sharp spine on each lateral lobe. Second segment with three long slender sharp spines at each lateral margin, a large sharp spine above the lateral spines, and a very large rounded boss above these spines. Third and fourth segments each with a long stout sharp spine at each lateral margin; a very slender long sharp spine and a broad sharp spine above the lateral spines, and a very large rounded boss above these spines, much smaller on fourth segment. Fifth segment with a long stout sharp spine at each lateral margin, two slender sharp spines above the lateral spines. Sixth segment with a small sharp spine near each lateral margin, and a small sharp spine above it.

Telson long and broad, with a long, slender sharp spine on each lateral margin at the transverse suture, several short sharp spines on upper surface. Uropods longer than telson; inner rami each with three or four short sharp spines along the outer lateral margin, median carina very feeble, ending in a small sharp spine near the posterior margin, two small sharp spines along the carina; outer rami each with a spine on outer lateral margin at the transverse suture, numerous very small spines along the suture. Lobes at base of uropods with upper lobe produced to a very short sharp spine.

Sternal keel moderately sharp; lateral processes large and moderately sharp, processes between third pereopods very large and deeply grooved; processes between fourth pereopods long and slender.

Great chelae short and stout, propodus more than twice as long as broad, upper margin with four sharp spines, lower margin with two rows of widely separated short sharp spines, apex sharp, cutting edge with two large and several small tubercles, a broad sharp spine on upper surface near base of cutting edge, another sharp spine at base of dactylus; a few small tubercles

on upper surface below base of dactylus. Dactylus stout, a row of small spines along the upper margin, and a group of small sharp spines near apex, apex sharp, cutting edge with four large and a few small tubercles, two or three small spines in a row above the cutting edge. Carpus with two or three large sharp spines on upper margin, upper surface deeply grooved. Merus with three large and two small spines along the upper margin.

Pereopods armed with numerous long, slender sharp spines.

Habitat.—New South Wales: Blue Mountains, caught in streams leading to Horseshoe Falls and Bridal Veil Falls, above the Falls, (Melbourne Ward); Grose River, Blackheath (E. Clark); Swamp on top of Bulli Pass (Austrl. Museum); Wollongong (W. Kershaw); Parramatta River; Sydney (Australian Museum).

Victoria: Bruthen (J. Barlin); Narracan River (W. Kershaw); Moe River (W. Kershaw); Thomson River (R. James); Lakes Entrance; Thorpdale (W. Kershaw); Vereker Range, Wilson's Promontory (J. A. Kershaw); Ferntree Gully (S. W. Fulton); Belgrave (S. W. Fulton); Warburton, Yarra River (F. J. Williams); Gordon's Bridge, Yea River (E. Clark); Marysville, Stevenson River (E. Clark).

In a previous paper (2) *kershawi* was retained as a subspecies of *nobilis* on characters that were acknowledged to be slight but constant. Examination of the present comprehensive series from Victoria and New South Wales has shown that there is no constancy, examples of both forms as well as intermediate forms being found in the series. Therefore the name *kershawi* is included under *nobilis* as one very variable species found in the coastwise rivers in New South Wales and Eastern Victoria.

Great variation is shown in the armature of the carapace, even among specimens of the same growth stage and taken from the same locality. In some examples there are numerous small tubercles and several large flattened tubercles on each branchiostegite; others have only two or three large tubercles on each branchiostegite; others have large tubercles on only one branchiostegite; some of the examples have no large tubercles on the branchiostegites.

The number of spines on the carpus varies, even on different appendages of the same individual. Two large sharp spines are found on the upper margin of the carpus of the majority of the specimens examined, but many have three large sharp spines as in the type of the species; several examples have two spines on one carpus and three on the other.

Euastacus bispinosus sp. nov.

Plate VII.

Length of average adult specimen 295 mm.

Rostrum broad, reaching almost to end of third segment of second antennae, apex short and blunt; lateral carinae obtuse, carried well back on

to the carapace, punctate, each with two or three small tubercles near apex. An obtuse, punctate carina ending in a very small tubercle at base of each carina, and a large rounded boss posterior-laterally to it.

Second antennae reaching fourth abdominal segment. Squame smooth, inner lobe broad, terminal spine sharp, short and stout. Interantennal spine broadly triangular.

Carapace less than twice as long as broad, broader than high, slightly shorter than abdomen. Entire carapace densely punctate. Branchiostegites sparsely studded with small tubercles, with or without large flattened tubercles along the dorsum of each branchiostegite, one small blunt spine anteriorly on each branchiostegite below the cervical suture.

First abdominal segment with a short sharp spine on each lateral lobe. Second segment with two slender sharp spines at each lateral margin; a broad blunt spine above the lateral spines, and a rounded boss above these spines. Third and fourth sergments each with a long slender sharp spine at each lateral margin; a long broad blunt spine above the lateral spine, and a broad rounded boss above these spines, smaller on fourth segment. Fifth segment with a long slender sharp spine at each lateral margin, two short broad blunt spines above the lateral spines. Sixth segment with a small sharp spine near each lateral margin, and a very small blunt spine above it.

Telson very long and broad, with a very short sharp spine on each lateral margin at the feeble transverse suture, several short blunt spines on upper surface. Uropods as long as telson, inner rami each with three or four very short sharp spines along the outer lateral margin, median carina almost obsolete, ending in a very small blunt spine near the posterior margin, two or three small blunt spines marking the carina; outer rami each with three or four small blunt spines along the outer lateral margin, transverse suture feeble serrated. Lobes at base of uropods rounded.

Sternal keel moderately sharp; lateral processes large and moderately sharp, processes between third pereopods very large and deeply grooved; processes between fourth pereopods long and slender.

Great chelae long and stout, propodus more than twice as long as broad, upper margin with four sharp spines, lower margin with two rows of short spines, apex sharp, cutting edge with two large and several small blunt spines in a row on upper surface near the cutting edge, several small tubercles in a group on upper surface below the base of dactylus. Dactylus long and stout, one or two small spines on upper margin near base, and two or three near the apex, apex sharp, several large tubercles along cutting edge, four or five small spines in a row on upper surface above the cutting edge. Carpus with two long sharp spines on upper margin, upper surface deeply grooved. Merus with one large and three small spines along the upper margin.

Pereopods armed with numerous short sharp spines.

Habitat.—Victoria: Glenelg River (type locality) (H. Pritchard); Crawford River (J. McEachern); Upper reaches of Wannon River (H. Finlayson).

The two rows of spines on each side of the abdominal segments, in addition to the large rounded boss, at once separate this species from others of the genus. Although somewhat resembling *E. nobilis,* it is separated by the arma-

ture of the carapace and abdomen, and by the form of the rostrum, squame and great chelae.

E. bispinosus is the species that is fully figured, with its complete life history, in the paper under the title "The Life History of the Gippsland Crayfish," Australian Museum Mag., April-June, 1937, p. 186.

DISTRIBUTION.

During the progress of the foregoing revision sketch maps (Plates viii and ix) were prepared to illustrate the known distribution of the genus *Euastacus,* but in connection with three species (*elongatus, armatus* and *yarraensis*), the distribution as shown thereon does not conform with the present river system; their distribution is made intelligible, however, if we accept Professor Gregory's theories (37) of the development of the Victorian river system which are supported by the work of Fenner (36), Jutson (39, 40) and others. Gregory's theories are not accepted by certain authors, e.g. Hills (38) and Edwards (35).

Since crayfishes of the genus *Euastacus* inhabit rivers and creeks, seldom leaving the water to wander for considerable distances on land as is done by members of allied genera, their distribution is more or less dependent upon the river system.

As mentioned in a previous page, the Murray River contains two distinct species *E. elongatus,* sp. nov., and *E. armatus* (von Martens). *E. armatus* occurs in two sections of the Murray, one from its source to Cobram and the other from west of Swan Hill to the mouth of the river; and also in the rivers connecting with these sections both in New South Wales and Victoria. *E. elongatus* inhabits the section of the Murray River between the Broken River and Swan Hill and also the rivers flowing into this section of the Murray.

Strange as this demarcation seems at first sight, it is correlated with the findings in other branches of science.

Mr. A. S. Kenyon, former Chairman of the State Rivers and Water Supply Commission, has kindly supplied me with his notes on the River Murray system (see Appendix). He considers that in times of flood the sections of the Murray in which *armatus* occurs, together with the Edward, form the Murray proper and that the section where *elongatus* is found may be considered an extension of the Goulburn. This theory of the distribution of the flood waters supplies one reason for the curious distribution of the two species in the Murray.

E. elongatus, as already mentioned, is found in tributaries

entering the Murray between Cobram and Swan Hill. The principal of these is the Goulburn and its tributaries. *E. elongatus* is found in the Upper Goulburn and its tributaries

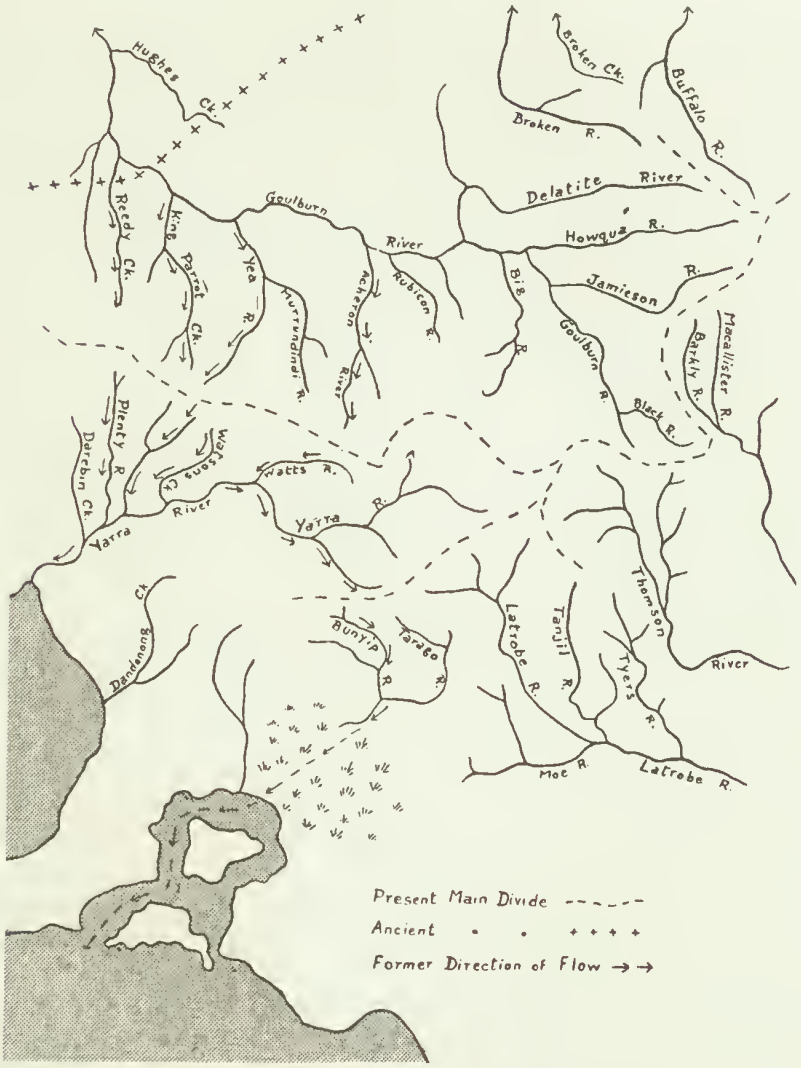

FIG. 1.

Map illustrating Gregory's theory of river development in Victoria.

from the north and east (the Jamieson, the Howqua and the Delatite Rivers), but in tributaries from the south, such as the Acheron and Yea Rivers and King Parrot Creek, *elongatus* gives place to *yarraensis,* which occurs also in all

streams south of this part of the watershed flowing into Port Philip and the Kooweerup Swamp.

This apparently anomalous distribution of *elongatus* and *yarraensis* supports the views of Professor J. W. Gregory and of some other physiographers.

According to Gregory (37) the Cobaw and Strathbogie Ranges formed the original watershed between the Goulburn and the Yarra River systems, and owing to river capture the watershed has moved southward to its present position. King Parrot Creek, the Plenty River and the Lower Yarra probably formed one river, the upper part of which (King Parrot Creek) has been captured by the Goulburn. Also the Yea River and Steel's Creek formed one stream which crossed the basin of the Upper Yarra, where it was joined by a tributary formed by the Acheron and the Watts; the united streams then passed through the Beenak Gap into Kooweerup Swamp and thence to Western Port. The Acheron and the Yea have been captured by the Goulburn.

A glance at the sketch map (fig. 1) shows that this interpretation of the development of the present river system offers a reasonable explanation of the apparently anomalous distribution of *yarraensis*.

Returning to the distribution of *elongatus,* it has been observed that it inhabits the headwaters of the Goulburn River and certain tributaries. Up to the time of writing, no specimen of the genus has been received from the section of the Goulburn River between Alexandra and Seymour, although numerous attempts have been made to obtain specimens. Whether the species will be found to inhabit the entire length of the Goulburn or whether it inhabits only the upper reaches of the river, remains to be seen.

With the distribution of *elongatus* as it stands at present, we find that the species follows out the old river system indicated by Fenner (36). Fenner considered that the Goulburn River originally flowed north to the Murray by way of the Barjarg Gap, and that the Broken River originally flowed south-west through the Black Swamp and on to the Goulburn. It is interesting to see that *elongatus* is found all along the Broken River, in the Goulburn from its junction with the Broken to the Murray, and in the headwaters of the Goulburn and the surrounding rivers.

The distribution of a fourth species, *E. nobilis* (Dana), is also curious as far as the present river system is concerned.

South of the Main Divide this species occurs in all rivers from the Latrobe River east to New South Wales and in the

coastwise rivers of that State as far north as Sydney. In Victoria it also inhabits the headwaters of the Yarra River and its tributaries above Warburton, but so far only small specimens averaging six inches in length from rostrum to telson have been received from this area.

North of the Main Divide it inhabits the Stevenson River and the headwaters of the Yea. On the map (Plate IX) the Stevenson River is indicated but is not named. In rises on Mt. Grant and flows past Marysville to join the Taggerty, the combined rivers then joining the Acheron at Buxton. Small specimens have been taken at Gordon's Bridge on the Yea River, but comparatively large specimens have been taken from the Stevenson—one male measured 9½ inches from rostrum to telson.

In setting out the above facts regarding the distribution of the four species, no attempt is made to assert that they are proof of any of the theories mentioned, but the evidence obtained regarding the rivers which at some previous time must have been connected since the genus *Euastacus* is dependent upon the river system for its dispersal, has been put forward so that it may be of some assistance to future workers both on the distribution of the Australian crayfishes and on the development of Victorian physiography. As has been mentioned previously consideration of the theories is the only way in which the otherwise anomalous distribution of the genus can be explained.

APPENDIX.

The following paragraphs, which have a bearing on the distribution of *E. elongatus* and *E. armatus,* are taken from Mr. A. S. Kenyon's unpublished notes on the Murray River system:—

The Murray River, though generally looked upon as one and the same river throughout its course, is truly so only in times of low and moderate flow. Taking its rise in the Australian Alps, it flows in a normal manner along its valley to the foothills, rolling along its bed vast masses of boulders, shingle and gravel. Emerging upon the old lacustrine plains at Corowa and Yarrawonga, it leaves the stones and gravel behind, carrying onward only the sand resulting from their grinding higher up, with the silts and clays in suspension derived from the erosion of its banks and from the land slides, in wet seasons, on the steep sides of the mountain valleys.

Shortly after it enters the plains and receives the waters of the Ovens River, the Murray begins, definitely at Cobram and Tocumwal to assume a deltaic character; and in flood times completely loses its identity in what can best be named and described as the Moira Marshes.

Into the Moira Marshes also pour the floods of the Goulburn River. From

the Marshes emerge two Rivers—one passing Deniliquin is named the Edward, while the other passing Echuca, retains the title of the Murray; but in times of high flood at least, it would be more correct as far as the source of the water might govern the question, to call the Edward the Murray—and the Murray the Goulburn.

Following on with the Murray, it, after receiving the Campaspe contribution at Echuca, has a very short existence as a normal stream, entering another series of marshes, which may be termed the Gunbower Marshes, just below Perricoota. From this network of swamps and flooded areas, emerge the Gunbower Creek with its attendant system, leaving in the main channel running between Murray Downs and Swan Hill, only an insignificant remnant of the original flood volumes poured in by the Upper Murray, the Ovens, the Goulburn, the Campaspe and other tributaries.

Below Swan Hill, the overflows gradually return until at the Wakool Junction the Murray, now restored to its single character, enters the Mallee canyon and continues within its confines until it approaches the Murray Mouth Lakes.

The Edward River below Deniliquin behaves somewhat similarly to the Murray River, becoming deltaic in character and spreading across country by the Niemur and Wakool River to join the Thule and Merran waters. It also picks up the waters of the Billabong Creek, a real river, but mixed with overflows from the Murrumbidgee River. It might be said that the Murray River ceases at Tocumwal, the Billabong Creek at Jerilderie and the Murrumbidgee River at Narrandera. Everything below being a deltaic jumble.

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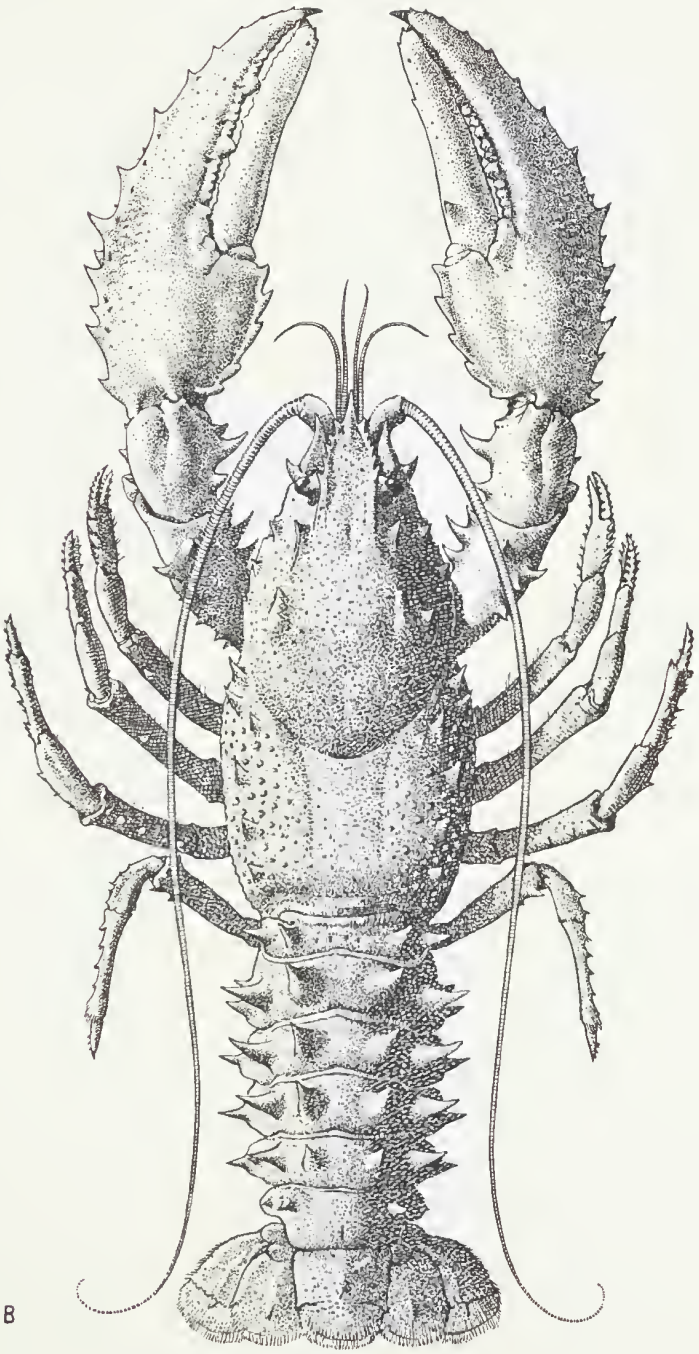
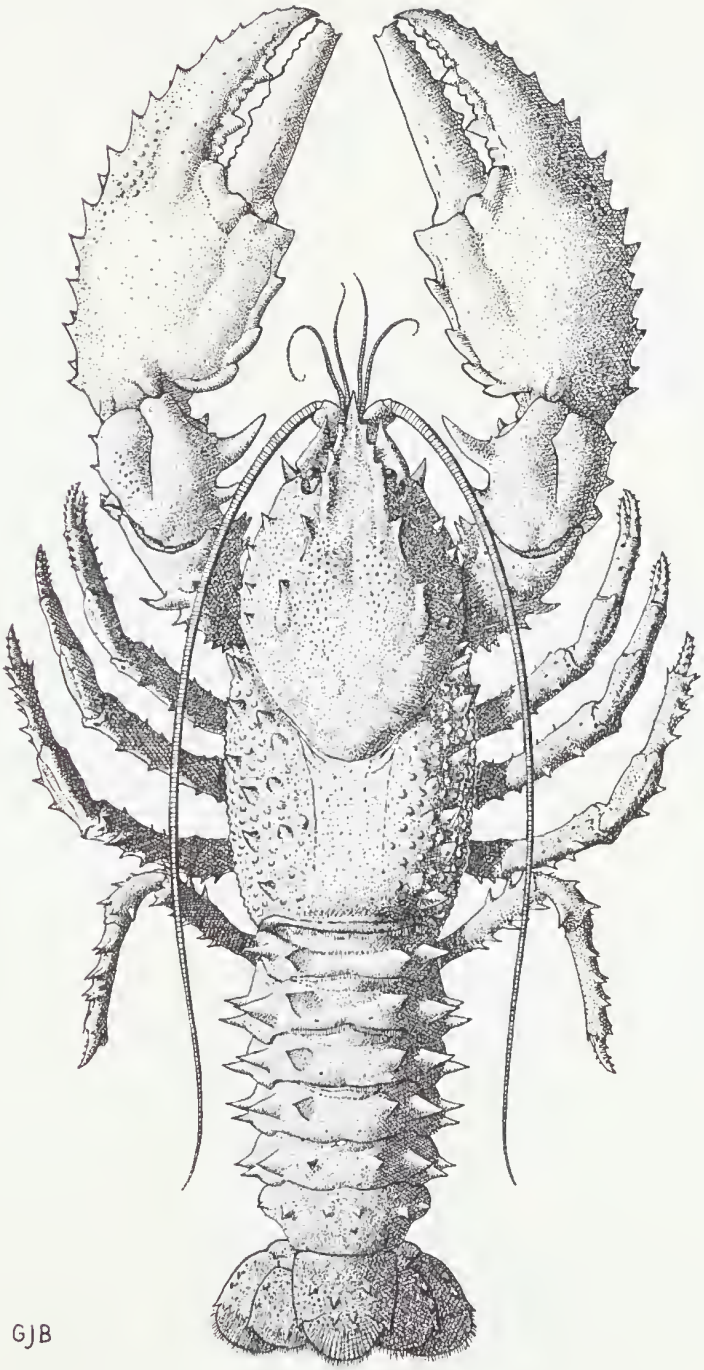
PLATES.

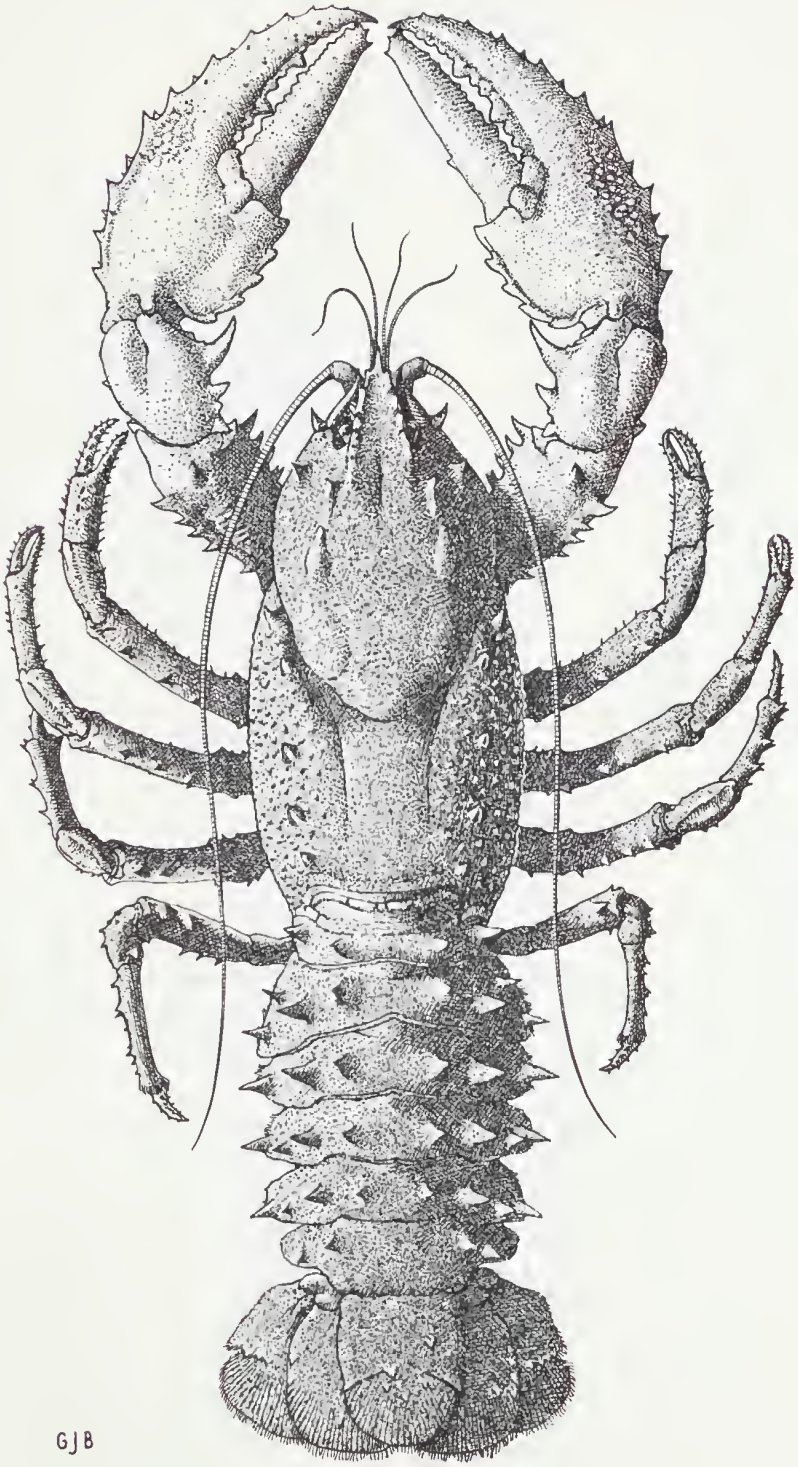
I. *Euastacus elongatus* sp. nov.
II. *E. armatus* (von Martens).
III. *E. yarraensis* (McCoy).
IV. *E. serratus* (Shaw).
V. *E. suttoni* sp. nov.
VI. *E. nobilis* (Dana).
VII. *E. bispinosus* sp. nov.
VIII. and IX. Locality Maps.



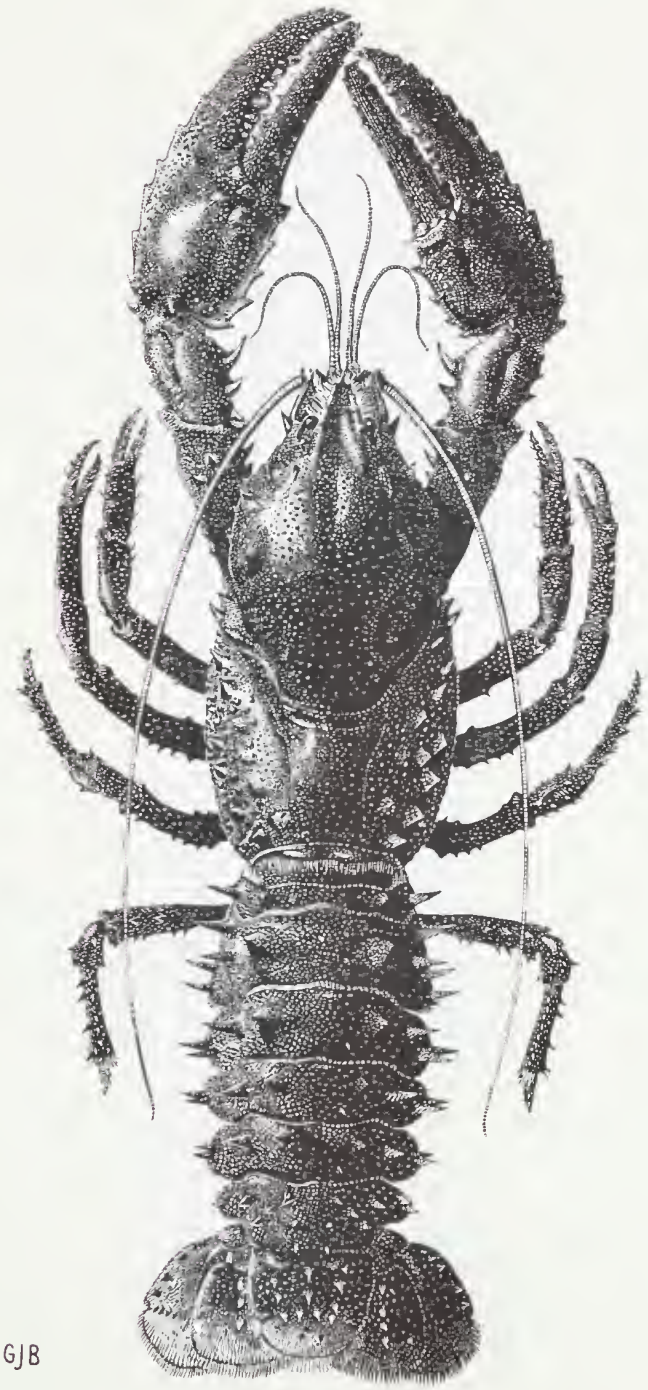
Euastacus elongatus Clark



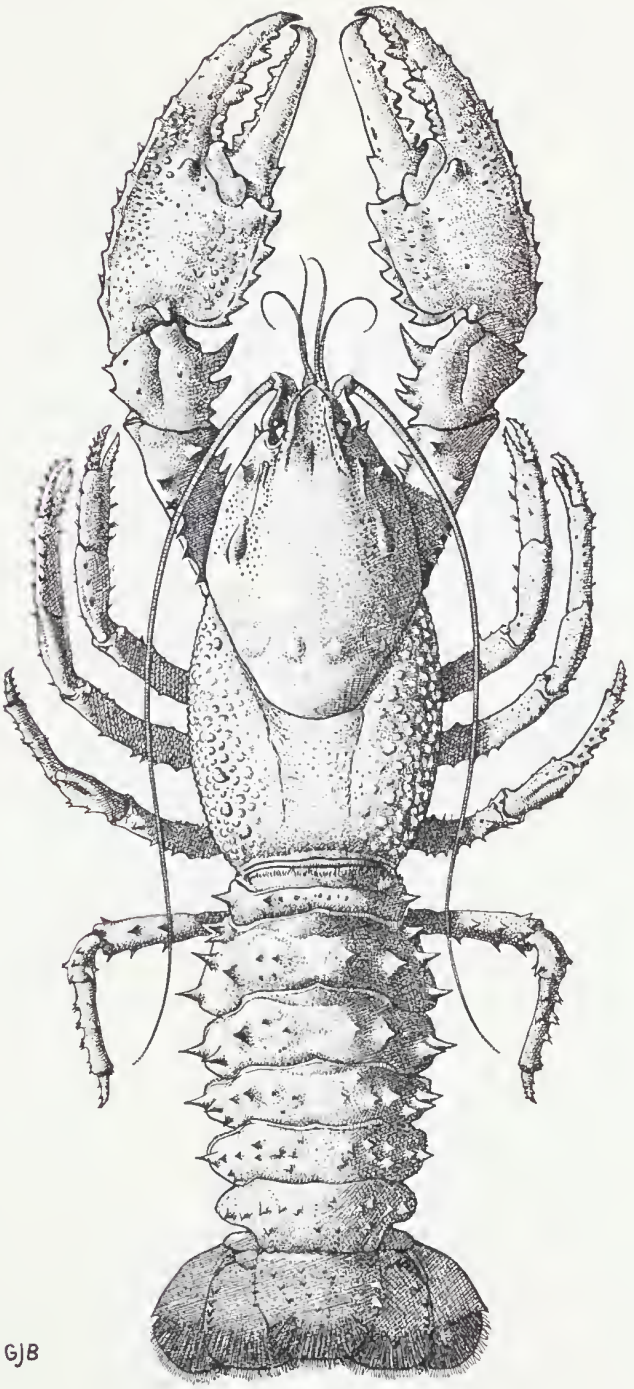
Euastacus armatus (von Martens)



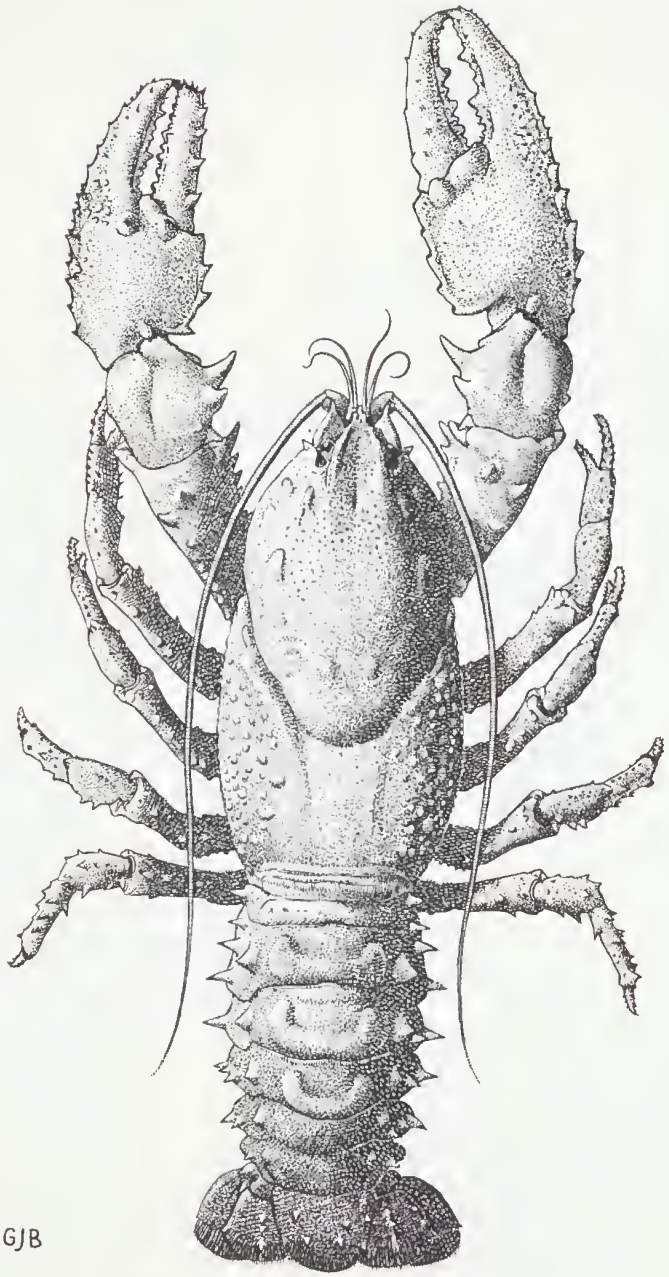
Euastacus yarraensis (McCoy)



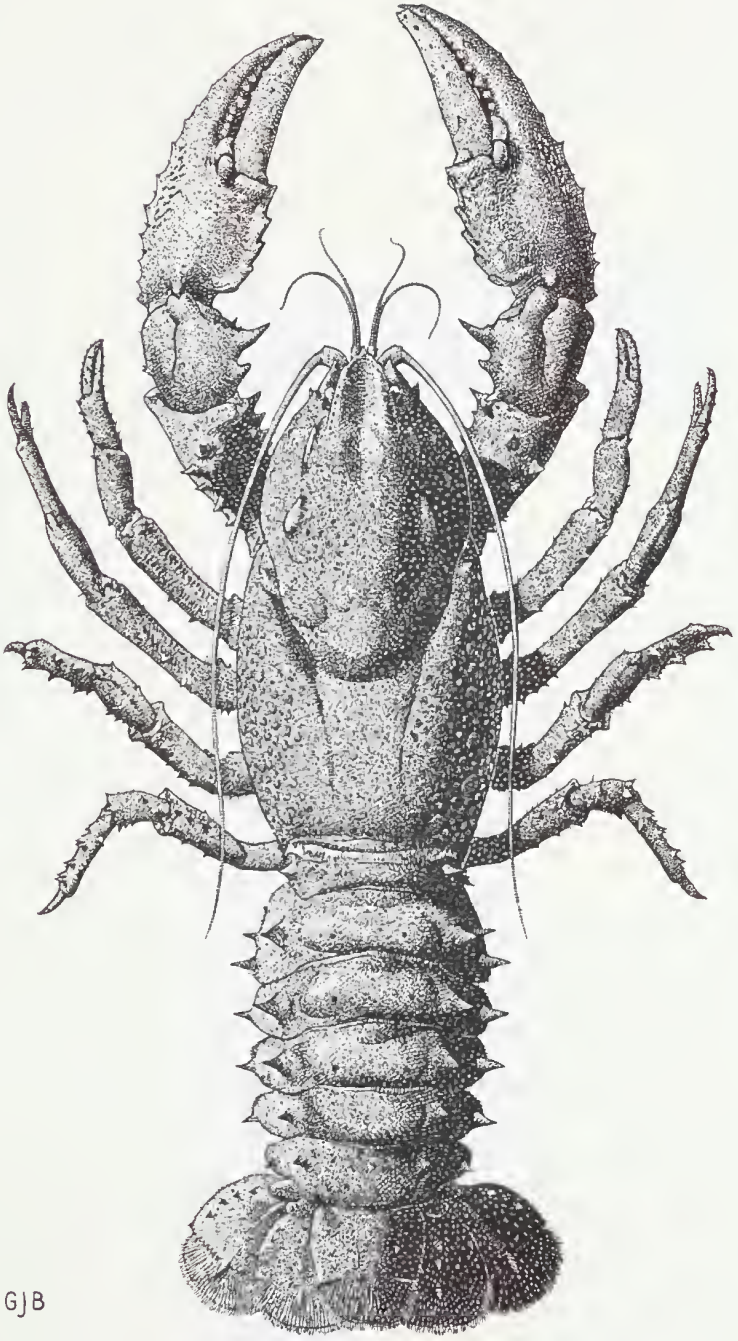
Euastacus serratus (Shaw)



Euastacus suttoni Clark



Euastacus nobilis (Dana)



Euastacus bispinosus Clark

Locality Map: part of Victoria and Riverina District, N.S.W.

Del. E. Clark.

Locality Map: part of Central and Southern Victoria