Eunephrops luckhursti, a new deep-sea lobster from Bermuda (Crustacea: Decapoda: Nephropidae)

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Abstract.—Eunephrops luckhursti, the fourth species of the genus, is described from material trapped at depths of about 800 m off Bermuda. It resembles E. cadenasi Chace, from the Bahamas and Caribbean Sea, in having a median carina on the second to fifth abdominal somites, but differs in having much shorter scaphocerites, more acute pleura on the abdominal somites, and in color in life.

The species named below was taken during exploratory trapping operations in deep water off Bermuda conducted by John P. (Sean) Ingham, Pathfinder Fisheries Ltd., and Brian Luckhurst, of the Division of Fisheries, Bermuda. William McCallan, another local fisherman using deep water traps, has been documenting and studying the catches from these traps since 1984. The traps used off Bermuda are described in Luckhurst (1986:209): “The traps used for this exploratory fishing are Antillian (sic) arrowhead traps of the type presently employed for catching reef fish and spiny lobsters in inshore waters. Several different trap sizes have been tested ranging in size from $3 \times 3 \times 1.5$ feet ($91 \times 91 \times 46$ cm) to $8 \times 8 \times 4$ feet ($244 \times 244 \times 122$ cm) ... The traps are made principally of steel reinforcing rod with some stick supports. Traps are baited with various chopped reef fish ... The traps have been fished over a wide depth range to the west and south of the Bermuda platform.”

Types are deposited in the National Museum of Natural History, Smithsonian Institution (USNM) and the Bermuda Natural History Museum (BNHM).

Abbreviations used in the account below include: A1, antennule; A2, antenna; cl, postorbital carapace length; cm, centimeters; fm, fathoms; m, meters; mm, millimeters; MXP3, third maxilliped; P1-5, pereopods (P1-3 are chelate, P1 is the major cheliped, P4-5 are walking legs); sta, station; tl, total length, measured from tip of rostrum to posterior margin of telson. All measurements are in millimeters.

Family Nephropidae Dana, 1852
Subfamily Nephropinae Dana, 1852
Eunephrops Smith, 1885
Eunephrops luckhursti, new species
Figs. 1, 2, 3a, b, 4

Type material.—Holotype: Off Bermuda, 32°14.55′N, 64°47.74′W, depth 450 fm (824 m), leg. S. Ingham, crab trap, 18 Feb 1991: 1 ♀, cl 51 mm (USNM 284136).
Paratypes: Off south shore of Bermuda, depth 820 m, S. Ingham sta 7, 7 Dec 1991: 1 ♂, cl 57 mm (BNHM 1991-090-012).—Off Bermuda, 1992, no other data: 3 ♀♀, cl 39 and 54 mm (USNM 284137) and cl 44 mm (BNHM).

Diagnosis.—Carapace lacking submedian postcervical spines. A2 peduncle with outer spine at base of scaphocerite. Scaphocerite minute, extending to or barely overreaching base of penultimate segment of A2. P2 and P3 with fingers about $\frac{1}{2}$–$\frac{3}{4}$ as
long as palm. Abdominal somites 2–6 each with longitudinal median carina dorsally.

Description.—Rostrum extending beyond end of antennular peduncle. Lower margin of rostrum unarmed, appearing smooth, with few, very low, serrations visible only under magnification. Anterior pair of lateral rostral teeth larger than and directed more anterolaterally than posterior pair. Postsupraorbital spines smaller than supraorbital, 1 placed behind each supraorbital, both situated anterior to small postorbital and small postantennal spines. Supraorbital ridge absent. Postcervical spines absent. Carapace covered with tubercles, larger anteriorly; surface sparsely pubescent between tubercles.

First abdominal somite with shallow, transverse groove. Anterolateral angle of pleuron acute, sharp but not spiniform. Abdominal somites 2–6 each with longitudinal median carina dorsally. Longitudinal groove over bases of pleura faint. Pleura of somites 3–6 acute, forming sharp point.

Telson longer than wide, lateral margins bulging slightly near midlength, tuberculate there. Posterolateral spines strong.

Scaphocerite minute, barely extending to or overreaching base of penultimate segment of A2 peduncle. Apex usually rounded, rarely acute. Larger spine present on A2 peduncle at base of scaphocerite.

MXP3 extending about to end of rostrum. Merus and carpus each with blunt, lower distal spine, that of merus larger.

Major chelipeds (P1) very strong, heavy, subequal, longer than carapace and rostrum combined, extending beyond rostrum with distal part of merus. Chela length about 3 times width; lateral surfaces with broad longitudinal carina formed by tubercles, distalmost on inner surface largest, each carina bordered by upper and lower shallow, longitudinal depressions. Upper margin of palm formed by single carina, irregularly tuberculate, lower margin bicarinate to about middle of fixed finger. All carinae ornamented with large and small blunt spines. Dactylus tuberculate dorsally, slightly shorter than palm, shorter than fixed finger. Cutting edge of chela evenly tuberculate or with some larger teeth and smaller, uniform tubercles. Carpus about half as long as chela (measured dorsally), with 2 rows of spines on outer face, distalmost spines largest; dorsal surface with low row of rounded spines; upper, inner margin sparsely spined, distalmost largest of all spines on carpus; lower margin with single row of spines; other spines of various sizes placed on surface and distal margin. Merus as long as palm (measured on outer edge), inner and outer edges each with irregular row of spines, each with distal tooth.

P2 extending beyond rostrum with chela. Fingers about ½–⅓ palm length. Carpus twice as long as dactylus. Merus more than twice as long as carpus.

P3 extending beyond rostrum with chela and distal part of palm. Fingers about ⅓–¼ palm length. Carpus about ⅓ as long as palm and half as long as merus, latter as long as chela.

P4 extending beyond rostrum with dactylus. Carpus about twice as long as dactylus. Merus twice as long as carpus.

P5 short but overreaching penultimate segment of A2 peduncle.

In both sexes, sternite of P2 ending in narrow, acute, bifid process, sharper in males; sternites of P3 and P4 wider, longer, and rounded.

Gonopod as figured.

Color (Fig. 4).—Carapace, A1 and A2 peduncles, and chelifeds almost uniform red. A1 and A2 flagellae pink proximally, beige or clear distally. Ischium and basal part of merus of P2-5 red, carpus and propodus clear, extremities pink. Ridges on abdominal somites, telson, and uropods red, uropodal setae clear.

Measurements.—Male, cl 57 mm (cl plus rostrum 81 mm; tl 170 mm); females, cl 39, 44, 51, and 54 mm (cl plus rostrum 55, 57, 70, and about 63 mm, respectively; tl 11.7, 12.5, 15, ca. 15 cm, respectively). The largest specimen, the male, is 170 mm long; other measurements of largest male: P2
palm length 24.2 mm, movable finger length 6.9 mm; P3 palm length 25.8 mm, movable finger length 5.9 mm.

Distribution.—Known only from Bermuda in depths of 800–824 m.

Etymology.—Named for Brian Luck-
Fig. 2. *Eunephrops luckhursti*, new species, a–f. Female holotype, cl 51 mm; g. Male paratype, cl 57 mm. a, Chela; b, P2; c, P3; d, P4; e, P5; f, Tail fan; g, Gonopod. (Setae omitted).

Remarks.—The species of *Eunephrops* are all known from localities in the northwestern Atlantic. *Eunephrops luckhursti* is the fourth species of *Eunephrops* to be recognized. It agrees with *E. cadenasi* Chace, 1939, and differs from both *E. bairdii* Smith, 1885 and *E. manningi* Holthuis, 1974, in having a distinct median carina on abdominal somites 2–5. It also differs from *E. cadenasi* in having much shorter scaphocerites (Fig. 3b, *E. luckhursti*; 3d, *E. cadenasi*) and in color as well (see below). *Eunephrops luckhursti* is a smoother species than *E. cadenasi*, with much smaller tubercles on the carapace and chelipeds; the spinulation of the major chelae is much less pronounced than in *E. cadenasi*. The pleura of abdominal somites 2–6 are acute and more pointed in *E. luckhursti* (Fig. 3a) than in *E. cadenasi* (Fig. 3c).

The color of *E. luckhursti* is quite different from that of *E. cadenasi* (see Paulmier 1993:pl. 24; Poupin 1994:pl. 2a,b). In *E. cadenasi* the chelipeds and abdominal ridges are primarily beige or yellow; the carapace is marked with yellow anteriorly; and the walking legs are clear or beige proximally, red distally. In *E. luckhursti* the carapace is uniformly dark red, the legs are dark red distally and light yellow anteriorly, and the chelipeds and abdominal pleurae are more deeply red.
pace, chelipeds, and abdominal ridges are red (Fig. 4).

The five known specimens of E. luckhursti are somewhat smaller than those of E. cadenasi, the largest specimen having a total length of 170 mm, a carapace length (including rostrum) of 81 mm. The holotype of E. cadenasi is 224 mm long (Chace 1939). Holthuis (1974) reported males with carapace lengths (including rostrum) of 46 to 135 mm, with the carapace lengths of females somewhat smaller, 40 and 50 mm. Paulmier (1993) recorded a specimen 490 mm long; that specimen has a carapace length of 110 mm. Poupin (1994) reported specimens with a carapace length (including rostrum) of 39 to 116 mm.

The smallest female, cl 39 mm, has an extra rostral spine on the right side, both scaphocerites very small and rounded, and both major chelae evenly toothed. The female with cl 44 mm has the rostrum bifid at the apex and the left scaphocerite longer than the right, extending about to the middle of the penultimate segment of the peduncle. The largest female, cl 54 mm, has a broken rostrum; the scaphocerite is rounded on one side, pointed on the other; both chelae have enlarged teeth as well as evenly spaced smaller ones.

The length of the fingers and palm of both P2 of all available specimens of E. luckhursti (n = 5 specimens, 9 legs) and E. cadenasi (n = 8 specimens, 13 legs) were measured. In E. luckhursti the propodus ranged from 3.1 to 3.8 times as long as the dactylus (mean 3.4 times). In E. cadenasi ranged from 2.9 to 3.9 times as long as the dactylus (mean 3.5 times). These two species and E. manningi cannot be separated using this feature, but it can be used to distinguish all three of these species from E. bairdii.

The depth ranges of E. luckhursti and E. cadenasi are similar, the former having been taken in depths around 800 m, the latter in slightly shallower water. The holotype of E. cadenasi was taken at a depth of 300–315 fm (549–576 m), the allotype at 250 fm (458 m) (Chace 1939). Holthuis (1974) noted that E. cadenasi had been taken in depths between 373–434 and 591 m. Paulmier (1993) suggested that its optimal depth was below 450 m, and Poupin (1994) studied one lot taken at 607 m. Specimens of E. cadenasi in the USNM collections were
taken in depths of 275 to 340–380 fm (503 to 622–695 m).

Material of *E. luckhursti* was compared directly with the following specimens of *E. cadenasi* from the Leeward Islands in the USNM collections: USNM 170673, female, cl 65.3 mm, west of St. Martin, depth 360 fm (659 m); USNM 170674, ovigerous female, cl 76.3 mm, northeast of Nevis, depth 317 fm (580 m); USNM 170675, ovigerous female, cl 66.4 mm, northeast of St. Kitts, depth 344 fm (630 m); USNM 170676, male, cl 53.6 mm, north of St. Kitts, depth 365 fm (668 m); USNM 170677, male, cl 78.5 mm, off Dominica, depth 275 fm (503 m); USNM 170678, female, cl 85.9 east of St. Kitts, depth 350–370 fm (641–677 m); USNM 170679, 2 females, cl 57.9 and 89.9

Fig. 4. *Eunephrops luckhursti*, new species. Female holotype, cl 51 mm. Off Bermuda. Color in life. Photo by Brian Luckhurst.
A new crayfish of the genus Orconectes from western Tennessee (Decapoda: Cambaridae)

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Abstract — A new crayfish, Orconectes pagei, is described from northern and eastern flowing tributaries of the Tennessee River in western Tennessee. The species occurs in small to medium streams with sand substrate. Form I males of O. pagei differ from all other members of the genus Orconectes in being both pigmented and possessing a first pleopod with a short, laterally flattened central projection and a short, dorsoventrally flattened mesial process.

Recent re-examination of crayfishes collected from western Tennessee in the late 1970’s and early 1980’s housed in the Illinois Natural History Survey’s Crustacean Collection, revealed the presence of several unidentifiable form II males and females from two locations in the Big Sandy River drainage. Subsequent field work in that drainage in 1996 resulted in the collection of several form I males of that unidentifiable taxon. That species, described herein as Orconectes pagei, is assigned to the nominate subgenus Orconectes. This subgeneric assignment is based on the overall similarity in the shape of the form I male pleopod of O. pagei to other members of the subgenus. O. pagei represents the only epigean member of this subgenus and raises the total number of taxa assigned to it to seven. The remaining members of Orconectes {Orconectes) are Orconectes (O.) australis australis (Rhoades, 1941), O. (O.) australis packardi Rhoades, 1944, O. (O.) incomptus Hobbs & Barr, 1972, O. (O.) inermis inermis Cope, 1872, O. (O.) inermis testii (Hay, 1891), and O. (O.) pellucidus (Tellkampf, 1844). A subgenus that contains both epigean and troglobitic members is not uncommon in the family Cambaridae. Other described subgenera with both ecotypes include Cambarus (Erebicambarus), C. (Jugicambarus), Procambarus (Austrocambarus), and P. (Ortmannicus).

Orconectes pagei, new species

Figs 1 & 2, Table 1

Diagnosis. — Body and eyes pigmented. Rostrum flat anteriorly, slightly concave posteriorly, terminating in long acumen; median carina absent. Rostral margins thickened, slightly converging distally; terminating in spines (see Variation). Areola 25.0-31.5% (X = 28.3, n = 40, SD = 1.4) of total length of carapace. Narrowest part of areola just anterior of midpoint, 5.8-15.0 (X = 9.2, n = 40, SD = 1.9) times as long as wide with 2 to 4 (mode = 3, n = 40, SD = 0.5) punctations across narrowest part. One large cervical spine on each side of carapace. Postorbital ridges well developed, terminating in large spines. Suborbital angle weakly developed. Antennal scale broadest slightly proximal to midlength. Ischia of third pereiopods of form I and form II males with hooks; hooks overreaching basioischial articulation in form I males only. Chela with 3 rows of tubercles along mesial margin of palm; small tufts of setae over mesial margin of palm, fingers, and dorsomesial surface; dorsal surfaces of finners with well defined longitudinal ridges. Ventral surface of chela with tubercle at

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