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PROCEEDINGS

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THE ARCTURIDÆ IN THE U. S. NATIONAL MUSEUM.*

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When Mr. Beddard wrote the Report on the Isopoda collected by the 'Challenger' in 1886, but five species of *Arcturus* had been recognized. He added thirteen. Since his report no additional species have been described. In this paper five species taken by the 'Albatross' and one by the Point Barrow Expedition are described as new and a subspecies is raised to specific rank.

The structure and habits of the Arcturidæ are such that deep-water species are likely to occupy only restricted areas. The young are few in a brood and are cared for by the parent until well able to care for themselves, clinging to the mother's antennæ until ready to undertake a more independent existence, perhaps on the very object on which the mother is foraging for herself and brood. With habits of this kind the chances of a wide distribution for any one species must be very much less than is the case where free-swimming young are produced in large numbers.

The character of the marsupium of *Arcturus* is sufficient to separate this genus from *Astacilla*. The dactyls of some species of *Arcturus* are biungulate as in *Astacilla*.

Two species of *Astacilla* are described as new, one from the Straits of Magellan and a blind species from deep water (1,825 fathoms) off Martha's Vineyard. The finding of a blind *Astacilla* in deep water is a matter of no little interest. Mr. Beddard

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truly says of deep-sea Isopoda: *"Although the number of deep-sea species which have well-developed eyes is so large, they nearly all (all except three) belong to the two allied genera *Arcturus* and *Astacilla*, which thus form almost the only exception to the general statement that deep-sea Isopoda are blind." Of *Astacilla* he says: † "Unlike *Arcturus*, *Astacilla* is almost exclusively an inhabitant of the shallow waters, only one species, indeed, *Astacilla granulata*, ranging into deep water."

KEY TO THE SPECIES OF *Arcturus*.

a. End of the abdomen notched, as seen from above.
  b. Body smooth and free from spines ..... *beringanus.*
  b′. Body spiny.
    c. Head and six segments of the thorax each with a pair of spines on the dorsum ..... *longispinis.*
    c′. Head and segments of the thorax with not less than two pairs of spines to the segment.
      d. Second and third articles of the antennæ without spines except at the articulations ..... *hystrix.*
      d′. Second and third articles of the antennæ with spines on the bodies of the articles..... *murdochi.*
a′. End of the abdomen without notch.
  b. Thorax without spines above the epimera.
    c. Abdomen acute or subacute at extremity.
      d. Eyes elevated on peduncles..... *oculatus.*
      d′. Eyes not elevated on peduncles.
        e. Extremity of abdomen notched in a lateral view.
          f. Thorax very tubercular..... *stebbingi.*
          f′. Thorax not tubercular..... *abyssicola.*
        e′. Extremity of abdomen without notch.
          f. Fourth segment of the thorax much longer than the preceding segments. *glabrus.*
          f′. Fourth segment of the thorax but little longer than the preceding segments.
            g. Thorax with large swellings or tubercles..... *tuberosus.*
            g′. Thorax without tubercles..... *myops.*
    c′. Abdomen rounded at extremity.
      d. Abdomen notched at its extremity in lateral view ..... *spinifrons.*
      d′. Abdomen without notch at its extremity.
        e. Epimeral spines present..... *anna.*
        e′. Epimeral spines wanting..... *coppingeri.*

* Report on the Isopoda collected by the 'Challenger,' p. 166.
† *Op. cit.*, p. 107.

b′. Thorax with spines above the epimera.
  c. Spines present in front of the ocular space.
    d. Spines, spinules, or spiny tubercles very numerous on the thorax.
      e. Spines all long and slender .... *multispinis.*
      e′. Spines all short or with a few long ones.
        f. All spines short.
          g. Third segment of antennæ spinulose..... ..... *furcatus.*
          g′. Third segment not spinulose.... *glacialis.*
        f′. Spines long and short.
          g. With three spines extending back from the abdomen..... *spinosus.*
          g′. With two spines extending back from the abdomen..... *americanus.*
    d′. Spines of the thorax comparatively few.
      e. Last segment of the abdomen with a carinate median line.
        f. Second segment of abdomen with spines ..... *cornutus.*
        f′. Second segment without spines..... *tenuispinis.*
      e′. Last segment without carina.
        f. Abdomen armed with a long median spine which projects beyond the end of the segment.
          g. Upper surface of abdomen smooth. *purpureus.*
          g′. Upper surface spinulose ..... *studeri.*
        f′. Abdomen without median spine..... *brunneus.*
  c′. Spines absent in front of the ocular space.
    d. Head free from spines..... . . *feildeni.*
    d′. Head with spines present between the eyes.. *baffini.*

Arcturus baffini (Sabine).

Idothea baffini Sabine, Appendix to Parry's First Voyage, p. 50, pl. i, figs. 4–6, 1824.

Arcturus tuberculatus Latreille in Cuvier, Règne Animal, ed. 2, IV, p. 139, 1829.

Arcturus baffini Westwood, Trans. Entom. Soc. Lond., vol. I, p. 72, 1836.
Milne-Edwards, Hist. Nat. Crust., III, p. 123, pl. xxxi, fig. 1, 1840.
Sars, Crust. Norw. North Atlantic Expd., p. 97, pl. ix, figs. 1–21, 1885.
Beddard, Report on the Isopoda collected by the 'Challenger,' pl. xx, fig. 12, 1886.

The best figures of this species are, in my opinion, those of Professor Sars. It is the oldest and best known species of the genus, and has been taken over a larger range than any other. Its characters are so well marked that it can be readily separated from any other species in the collection.

Arcturus feildeni Miers.

Arcturus baffini var. *feildeni* Miers, Ann. and Mag. Nat. Hist. (4), XX, 64, 1877.

The head is a little broader than long when the length is measured on the side; the surface presents three areolations, two circular ones a little in front of the line of the eyes and a long transverse one behind the eyes.

The antennæ are equal to the body in length—36 mm.; the fourth and fifth joints are each 11 mm.

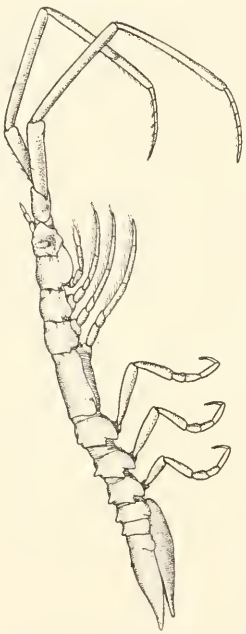

Fig. 5.—*Arcturus feildeni*. (×1½.)

The four anterior segments of the thorax are without spines or tubercles; two slight areolations near the anterior border of the second and third segments do not correspond to the spines of *baffini*, as they exist on that species in addition to the spines. The fourth segment is equal in length to the two preceding. The three posterior segments of the thorax and the two anterior segments of the abdomen are each provided with a pair of small blunt spines.

The middle surface of the abdomen is without any indication of the prominent spiny projections of *baffini;* the median line, on the other hand, shows when dried a slight irregular median groove. The conical lateral projections of *baffini* are altogether wanting in this species. The epimera are also much modified in *feildeni;* they are much less pointed, and are directed downwards, making them inconspicuous from a dorsal view. The surface of the body is glabrous. The above description is based on a single specimen labeled 'Camp Clay, Cape Sabine; Lieut. [now General] A. W. Greely.' (No. 12416, U. S. N. M.) A much larger and less typical specimen is labeled '*Arcturus baffini* var. *tuberosus*, Davis Straits.' This is identical with the Cape Sabine specimen, except that the spines of the posterior segments are reduced to very low tubercles. The range of variation, as indicated by the two specimens, is easily within specific limits; both are far removed from *A. baffini*. Length of specimen from the front to the abdomen 50 mm. (No. 20333, U. S. N. M.).

Arcturus longispinis sp. nov.

This species, though well marked, partakes strongly of the characters of *baffini*, the type of the genus.

The head is deeply concave in front; the margin does not form a true curve, but shows slight projections between the median and outer antennæ. The eyes are triangular and conspicuously protruding. The

basal joints of the median antennæ are oblong and flattened; the outer antennæ are 52 mm. in length; the first two joints are but little longer than broad, while the three distal joints are long; all are unarmed; the flagellum is composed of about 12 short segments.

The spines of the head and dorsal region are placed like those of *baffini*; with the exception of those on the posterior portion of the thorax, they are much longer than in any specimen of *baffini* that I have seen; the spines of the head are 6.5 mm. in length, while those of the second, third, and fourth segments are but little shorter. The spines on these segments are united at the base by a low ridge which curves up on the spines, giving them the appearance of parts of a single structure. Between the anterior spines and the epimeral projections on their respective segments are low protuberances; ridges also run from the bases of the spines along the margins to the posterior angle of the segments, leaving a deep transverse groove below the spine. The spines of the first thoracic segment are very small and inconspicuous; it is possible that this segment may not be normal in regard to the spines, as it is partially overgrown by a colony of Polyzoa.

The epimera of the second, third, and fourth segments increase in size posteriorly; they are flattened on the exposed surface and evenly rounded below; there is a depression on the exposed face. Viewed from above, the epimeral projections are covered by large rounded tubercles on the lower margins of the segments. The epimera of the fifth, sixth, and seventh segments decrease in size posteriorly, and are broad and wedge-shaped; the spines of these segments are the same in character as those of the anterior segments, but are much smaller, measuring on the fifth 3 mm., the sixth 2.3 mm., seventh 2 mm.

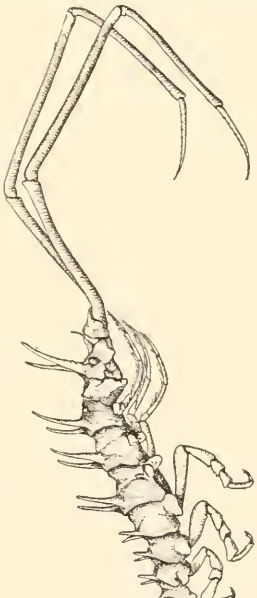

Fig. 4.—*Arcturus longispinis.* (× 1½.)

The first abdominal segment is very short, with two small spines above and two conical projections below; the second segment has two long spines above, pointed backward, and none below; the terminal segment has two spines pointing backward inserted at about the middle of the dorsal surface; at this point the segment is rapidly depressed to the terminal points; the lower margin has two pairs of triangular projections; *A. baffini* has but one pair.

Station 3599, latitude 52° 05′ 00″ N., longitude 177° 40′ 00″ W., 55 fathoms. Type (No. 20530, U. S. N. M.).

Arcturus glabrus sp. nov.

The head is wider than long, measured in the constriction in front of the eyes and on the median line, but longer than wide if the side of the head is taken.

The antennæ are longer than the body in both sexes; much longer in the female than in the male.

There are no spines or tubercles on the head or posterior to it. The segments of the thorax and abdomen are smooth to the eye and are finely reticulated under a lens. The fourth segment differs in the sexes; in the male it is a little longer and more slender than the two preceding segments taken together; in the female it is shorter and stouter; so different is the appearance that the sexes can be readily separated in a dorsal view. The anterior margins of the second, third, and fourth segments are notched on the median line.

Fig. 5.—*Arcturus glabrus*, ♂. (× 1¼.)

The abdomen is composed of two segments, anchylosed, the usual second segment being only indicated by a swelling above and a short suture at the side. There are no lateral projections on the abdomen; the epimera of the posterior part of the thorax cannot be seen from above. The dactyls of the posterior feet are biungulate. The length of the body of a male is 31 mm.; of the antennæ 38 mm.; female, body 28 mm.; antennæ 45 mm.; female, body 24 mm.; antennæ 39 mm.

A number of specimens of this species were taken by the 'Albatross' at Station 3599, in Bering Sea, lat. N. 52° 05′, long. W. 177° 40′, in 55 fathoms (No. 20529 U. S. N. M.).

Arcturus beringanus sp. nov.

The head is excavated in front; the lateral projections are broad; deep constrictions or depressions exist both in front and behind the eyes. The antennæ when laid off on the body reach the base of the abdomen; the fourth and fifth articles are very long; the flagellum is composed of seven or eight articles; the antennulæ reach to the end of the second article of the antennæ.

Fig. 6.—*Arcturus beringanus*. (× 2¼.)

The first and last three segments of the thorax are nearly equal in length; the fourth segment is a little more than twice as long as any of the others. The posterior margins of the segments are concave on each side of the median line to the posterior angle of the segments, making a more or less acute point at the middle of the segment and lobate posterior angles.

The abdomen is elongated and slender; the first and second segments are clearly defined; a third is indicated by a deep and irregular constriction; the terminus is incised.

A large number of specimens show a light line running along the median line of the dorsal surface and along the sides in line with the eyes. The dark colored or shaded portions of the surface are made up of numerous black spots. Now and then a large female is very light in color, the lines being but slightly indicated.

The largest specimens are 18 mm. in length.

Station 3252, lat. 57° 22′ 20″ N., long. 164° 24′ 40″ W.; depth 29½ fathoms; specimens very numerous. (Type, No. 20529, U. S. N. M.) Station 3253, lat. 57° 05′ 50″ N., long. 164° 27′ 15″ W.; depth 36 fathoms; four specimens. Station 3637, lat. 57° 06′ 30″ N., long. 170° 28′ 00″ W.; depth 32 fathoms; one female with a single young clinging to the antennæ.

Arcturus tenuispinis sp. nov.

This species is very close to *A. cornutus* Beddard. The head is deeply excavated in front; a pair of spines arise in front of the interocular space and extend forward, diverging a little more than those of *A. cornutus*. The first segment of the antennæ extends beyond the lateral projections of the head not more than 0.2 of a mm.; the second joint measures about 1.4 mm. on the upper surface, the third joint 5 mm., and the fourth 13 mm. in length; the fifth joint is lost or broken in both specimens. The antennulæ reach the middle of the third segment of the antennæ. The first and second thoracic segments are both armed with epimeral spines and a pair farther back and higher up on the segment; the other segments of the thorax have epimeral spines only; the first segment of the abdomen has a pair of spines in line with the epimeral spines of the thorax; the second segment is altogether unarmed; the last segment has two paired spines and one unpaired; the latter is at the terminus of a dorsal carina which can only be made out with difficulty. The largest spines on the body are the pair at the sides on the proximal end; the spines at the distal end are slender; the terminal outline of the segment is rounded.

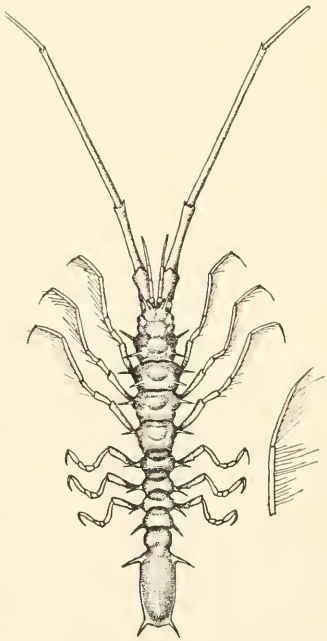

Fig. 7.—*Arcturus tenuispinis*. (× 2.)

A. tenuispinis can be distinguished from *cornutus* by the more slender spines, by the lack of the extra pair on the third and fourth segments of the thorax, the unarmed second segment of the abdomen, the lack of

spines on the joints of the anterior series of ambulatory legs, and by the outline of the abdomen. Length of the largest specimen 23 mm.

Station 2756, off Cape St. Roque, Brazil, lat. 3° 22′ 00″ S., long. 37° 49′ 00″ W., 417 fathoms; two males (No. 21252, U. S. N. M.).

Arcturus americanus Beddard.

Arcturus americanus Beddard, Report on the Isopoda collected by the 'Challenger,' p. 104, pl. xxiii, figs. 5-8, 1886.

Color of specimens in alcohol: Body light straw color; the head is shaded with purple; this shade continues in two broken lines to the sixth segment, where the lines are united, spreading again on the abdomen. Another broken line runs along the second, third, and fourth segments at a little distance above the epimera; on the posterior segments the line is continued close to the epimera. There are two purple rings on the third joint of the antennæ and a broad band near the distal ends of the fourth and fifth joints.

Specimens were obtained at two stations off the east coast of Patagonia: Station 2768, lat. 42° 24′ 00″ S., long. 61° 38′ 30″ W., 43 fathoms; Station 2770, lat. 48° 37′ 00″ S., long. 65° 46′ 00″ W., 58 fathoms; four specimens.

Arcturus multispinis sp. nov.

The head is a little elongated; the front is concave. The eyes are round and stand out from the sides of the head as hemispheres. Two spines are placed near the front in advance of the line of the eyes and a transverse line of six a little behind the eyes; the terminal spines of the row are much smaller than the others.

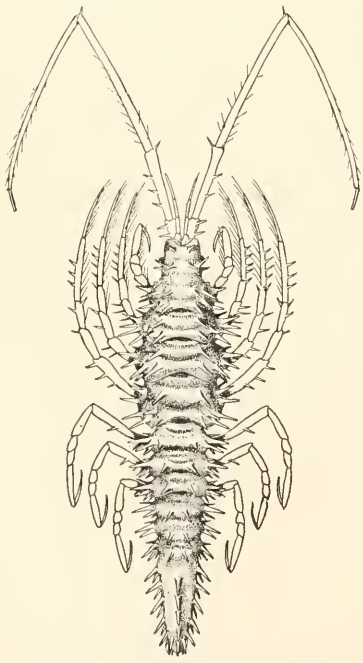

Fig. 8.—*Arcturus multispinis.* (× 2½.)

The antennæ are 28 mm. in length and slender in comparison with those of the Arctic forms; there are two spines on the second segment and two on the third segment of one, and three on the other; the fourth segment is armed with a single spine at its articulation with the fifth segment; the fifth segment is considerably longer than the fourth; the flagellum is short and without joints.

The two spines near the front form the anterior ends of two rows that extend to the last segment of the abdomen; the first four segments of the thorax have a transverse constriction making them in appearance double segments; both the anterior and posterior portions of these segments furnish a pair of spines for the lateral dorsal lines of spines; after

the fourth segment there is but a single pair to a segment; the lines are not continued on the last segment, but are here replaced by a row of five spines on the median line of this elongated segment.

The second segment of the thorax is soldered to the head as in other species, otherwise its dorsal armature is like that of the three following segments. The epimera of the four anterior segments of the thorax are moderately extended and bear from two to four spines; between the epimera and the lateral dorsal lines are two spines; there is another spine just behind the epimera.

The three posterior thoracic segments are much shorter and narrower than the preceding segments; the epimera bear but a single spine; the spines of the lateral dorsal lines are smaller than the anterior spines of the line; on the fifth segment, between the line and the epimera, are three spines; on the sixth two spines, on the seventh one spine. The first two segments of the abdomen are dorsally like the last segment of the thorax; the last segment is elongated and bears five rows of spines—one on the median line and two on each side; there is a longitudinal row of five spines on each valve of the operculum. Length of body 23 mm.

Station 2807, off the Galapagos Islands, lat. 0° 24′ 00″ S., long. 89° 06′ 00″ W., 812 fathoms. One female with eggs (No. 21253, U. S. N. M.).

Arcturus murdochi sp. nov.

Arcturus hystrix Harger in Murdoch, Report Expedition to Point Barrow, Alaska, p. 142, 1885.

This species is closely related to *A. hystrix*, Sars, from off Helgoland and Lofoten, from depths ranging from 350 to 457 fathoms. Both specimens of *A. murdochi* came from 13½ fathoms 10 miles west of Point Franklin, Alaska, collected by the Point Barrow Expedition.

Fig. 9.—*Arcturus murdochi*. (× 3½.)

The head is deeply concave in front; the sides of the head extend forward in front of the eyes and end in bifurcate projections. On the front margin of the head is a single spine, conspicuous in being the only spine occupying the median line throughout the length of the animal. A spine on each side of the median spine divides the space between the eyes, making a row of three spines on the front of the head just in advance of the anterior line of the eyes. The median spine is a little in advance of the other two. A row of eight spines occupies the posterior part of the head; four of them are higher up than the eyes—one pair behind the eyes and one below on the margin of the head; the spines behind the eyes are the smallest.

The antennulæ are very short and small, hardly reaching the antepenultimate joints of the large antennæ; the basal joints are wider and shorter than those shown by Professor Sars in his figures of *hystrix*. The basal joints of the antennæ are small and are concealed from a dorsal view by the lateral projections of the head.

The second joint is about as broad as long and is armed with three short spines; the third joint is armed with two spines pointing outward and upward; the fourth and fifth joints are long and slender, unarmed; the flagellum has but three joints. The first thoracic segment, as in *hystrix*, has a transverse row of eight spines; the thin sides of the segment extend forward under the head; the second and third segments also have eight spines arranged as in the first. The fourth segment is so constricted in the middle as to give it the appearance of two segments anchylosed; this segment has a double row of eight spines; between the two median spines of the posterior row and the constriction are two additional spines; these spines are smaller than those of the median rows, taking the arrangement longitudinally. The fifth, sixth, and seventh segments have spines regularly placed on each side of the median line; next farther down on the segment are two spines longitudinally placed; next, on the margin, are three spines united at the base, the middle one largest. The first abdominal segment is very short, with a transverse row of six spines; on the second segment spines are placed on the two median lines only; these are doubled and crowded. On the terminal segment there are two rows of small spines regularly placed on one specimen and disarranged on the other. The abdomen is terminated by two blunt divergent spines. The specimens are sparsely set with short, stiff hair. All of the legs are armed with a single spine on the basal joint.

This species can readily be distinguished from *hystrix* by the median spine of the head, by the extra pair of spines on the fourth segment of the thorax, by the armature of the antennæ, and by the arrangement of the spines on the abdomen.

As Professor Sars suggests, *hystrix* may be made the type of a new genus; it will then be necessary to place this species with it. (No. 7915, U. S. N. M.)

Astacilla granulata (G. O. Sars).

Leachia granulata G. O. Sars, Arch. Math. Nat., II, p. 351, 1877.
Astacilla americana Harger, Am. Journ. Sci., (3) XV, p. 374, 1878.
Astacilla granulata Harger, Proc. U. S. Nat. Mus., II, p. 161, 1879.
Astacilla granulata Sars, Nor. N. Athan. Expd., Crust., p. 107, pl. ix. figs. 27–35, 1885.

One specimen from the Gloucester fishermen, Grand Banks.

Astacilla diomedeæ sp. nov.

The head is excavated in front, nearly rectangular, a little broader behind than in front. The eyes are but little swollen, are round, and are situated a little anterior to the middle of the margin.

The antennæ are closely like those of *Astacilla nodosa* (Dana).

The first segment of the thorax has the same width as the head; the second and third segments are successively wider and also shorter than the first; the fourth segment is very wide at the anterior end, as in *nodosa*; like the latter, it tapers gradually backward to the fifth segment. The segments posterior to the fourth are longer than the first three and are successively narrower.

The abdomen is constricted at the base and has subparallel sides; from the slight postero lateral protuberance it narrows rapidly to the apex.

The animal is throughout smooth and glabrous; the median line is light in color; on the fourth segment the light color broadens out and the sides are blotched with dark shadings made up of small black spots; all the articles of the antennal peduncles have a narrow ring of black at the distal ends, except the fifth.

Described from a single female dredged by the 'Albatross' in the Straits of Magellan from a depth of 17 fathoms (Station 2774). The marsupium is filled with eggs (No. 21251, U. S. N. M.).

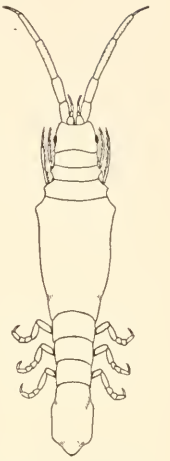

Fig. 10.—*Astacilla diomedeæ*. (× 6.)

Astacilla cæca sp. nov.

The head is deeply excavated to receive the antennulæ; the excavation is deeper at the sides than on the median line; a rostriform point extends between the antennulæ. The lateral prolongations of the head have two paired digital processes near the lower margin; one pair only can be seen from above. The antennæ reach back to the end of the sixth segment. As in other species of the genus, the first thoracic segment is solidly united to the head; the lower margins of the segment are tubercular. The second thoracic segment is short and narrow; the third is a little longer and wider; the fourth or long segment is yet wider at the anterior end, caused by the swellings at the insertions of the legs; after this it tapers gradually to near the posterior end, where the taper is more rapid. The fifth, sixth, and seventh segments are successively narrower. The median line of the head and thorax is tubercular; the head has one tubercle near the front and another on the postcephalic lobe; all thoracic segments have a tubercle on the line; the lateral margins of all are angular; above the epimeral projections of the fifth segment are four paired tubercles. The first segment of the abdomen is narrow and forms a neck between the thorax and the broad and angular terminal segment. The terminal segment has a pair of angular projections on each side of the margin; between the angles the margin is but little arcuate; posterior to the last angular projection the outline is that of an equilateral triangle. Attached to the carapace are several specimens of Foraminifera which Dr. Flint tells me belong to the genus *Truncatulina*.

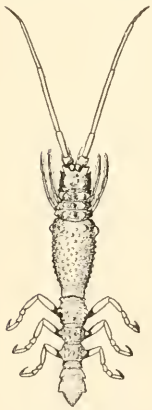

Fig. 11.—*Astacilla cæca*. (× 3.)

Both specimens have been repeatedly examined for a trace of eyes without success.

Length of the large specimen (female) 9 mm., measured from the front.

Station 2714, lat. 38° 22′ 00″ N., long. 70° 17′ 30″ W., 1825 fathoms (No. 12026, U. S. N. M.).