Memoirs of the Museum of Comparative Zoology
AT HARVARD COLLEGE.
Vol. XVIII.

REPORTS ON AN EXPLORATION OFF THE WEST COASTS OF MEXICO, CENTRAL AND SOUTH AMERICA, AND OFF THE GALAPAGOS ISLANDS, IN CHARGE OF ALEXANDER AGASSIZ, BY THE U. S. FISH COMMISSION STEAMER "ALBATROSS," DURING 1891, LIEUT.-COMMANDER Z. L. TANNER, U. S. N., COMMANDING.

XV.

THE STALK-EYED CRUSTACEA.

By WALTER FAXON.

WITH SIXTY-SEVEN PLATES,
Ten of which are colored, and one Chart.

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ERRATA.

On Plate VI., for ÆTHUSA PUBESCENS read ÆTHUSA LATA.

On Plate VII., for RHINOLITHODES CRISTATIPES read GLYPTOLITHODES CRISTATIPES.

On Plate VII., for ECHINOCERUS DIOMEDEÆ read PARALOMIS DIOMEDEÆ.

On Plate VIII., for PARALOMIS ASPERA read LEPTOLITHODES ASPER.

On Plate IX., for PARALOMIS LONGIPES read LEPTOLITHODES LONGIPES.

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deeply furrowed along the median line, the chelipeds and ambulatory legs are knobbed so as to present "a mass of tubercles above." *P. panamensis* appears to be near *P. barbatus* A. M. Edw. from the Azores, but in the latter species the front is broader and the carpus more denticulated.

Family GALATEIDÆ.

PLEURONCODES Stimps.

Ann. Lyc. Nat. Hist. N. Y., VII. 245, 1860.

Pleuroncodes monodon (M. Edw.)?

Plate XV., Fig. 3–3c.

? *Galathea monodon* M. Edw., Hist. Nat. Crust., II. 276, 1837.
? *Pleuroncodes monodon* Stimps., Ann. Lyc. Nat. Hist. N. Y., VII. 245, 1860.
Pleuroncodes monodon? Fax., Bull. Mus. Comp. Zoöl., XXIV. 176, 1893.

Station	3385.	286	fathoms.	16	males,	7	fem. ("half a bushel rejected").
"	3386.	242	"	9	"	14	"
"	3396.	259	"	2	"	2	"
"	3423.	94	"	18	"	11	"

Compared with Milne Edwards's figure* of *P. monodon*, the "Albatross" specimens, especially the males, present a more obese appearance; their greatest width is across the cardiac region, while in the figure of *P. monodon* (which undoubtedly represents a female) it is near the posterior end of the carapace; the cardiac area, in the examples before me, is sunk below the level of the rest of the carapace, and the transverse piliferous lines are more broken at this point, as well as on the gastric region, than appears to be the case in *P. monodon*, to judge from the figure referred to. Unless these discrepancies are due to the inaccuracy of Milne Edwards's draughtsman, the "Albatross" specimens belong to a new species. The type specimens of *P. monodon* came from the coast of Chile.

In *P. planipes* Stimps. the penultimate segments of the ambulatory appendages are flattened and ciliated, and the cardiac area is not depressed as in the "Albatross" specimens. *P. planipes* appears to be a pelagic form. It has been taken off the coast of California and western Mexico.

The lateral expansion of the carapace of *P. monodon* carries the antero-lateral angle some distance outward beyond the antero-lateral spine. This

* Ann. Sci. Nat., Zool., 3ème Sér., XVI., Plate XI. Fig. 6–9, 1851.

point is not brought out in the figure on Plate XV., but the reader is cautioned against inferring that there is any difference in this regard between the "Albatross" specimens and the one figured by Milne Edwards. The length of the rostral horn is somewhat variable, being often considerably longer than in the specimen figured.

MUNIDA Leach.

Dict. Sci. Nat., XVIII. 52, 1820.

About forty-five species of *Munida* are now known. The "Albatross" collection of 1891 contains five species, four of which were previously unknown. Professor Alphonse Milne Edwards's final illustrated report on the *Galateidæ* collected by the "Blake" Expeditions has not yet appeared, but I have before me the types of the ten species of *Munida* briefly diagnosed in his preliminary report which was published in 1880.* The specimens ("Blake" Sta. No. 36) recorded by Milne Edwards as *Munida caribbæa* Stimps. are the same species as those described on the same page as a new species under the name *Munida irrasa*. The specimens doubtfully referred to *Munida caribbæa* Stimps. by Prof. S. I. Smith† are *Munida iris* of Milne Edwards. Stimpson's *Munida caribbæa* is absolutely indeterminable from his brief notice of it,‡ and the types were burned in the great Chicago fire. The name *caribbæa* should, then, be dropped and Milne Edwards's *iris* and *irrasa* should be retained.

Professor Henderson§ considers *Munida valida* Smith to be identical with *Munida miles* A. M. Edw. On comparing the types of *M. miles* with Smith's figure of *M. valida*, it appears that the supraocular spines are much longer and more divergent in the latter than they are in *M. miles*.

Munida obesa Fax.

Plate XVI., Fig. 1, 1ª.

Bull. Mus. Comp. Zoöl., XXIV. 176, 1893.

In this species we see an approach to the genus *Pleuroncodes*, since the sides or latero-inferior walls of the carapace are somewhat swollen, so that

* Bull. Mus. Comp. Zoöl., VIII. 47–52, Dec. 1880.

† Proc. U. S. Nat. Mus., III. 428, Jan. 1881; Bull. Mus. Comp. Zoöl., X. 22, Plate X. Fig. 1, 1882; Proc. U. S. Nat. Mus., VI. 40, Plate III. Fig. 11, 1883; Ann. Rep. U. S. Fish Comm. for 1882, p. 355, 1884; id. for 1885, p. 643, 1886.

‡ Ann. Lyc. Nat. Hist. N. Y., VII. 244, 1860.

§ Rep. Challenger Anomura, p. 126, 1888.

they show a little when the animal is viewed from above. The basal segment of the antennæ, moreover, is more exposed from above than it is in the more typical species of *Munida*.

The lateral rostral spines, or supraocular spines, are curved upward more than the median rostral spine, and the three are nearly parallel; the lateral spines reach about half way to the tip of the median; all three are microscopically spinulose on their upper edge. There are two pairs of spines on the anterior part of the gastric region in line with the lateral rostral spines. Of these two pairs the anterior is the larger. There is also a longitudinal line of spinules in the median line between the two pairs just spoken of. The arrangement of the other spines on the anterior portion of the carapace will be best understood by reference to the figure on Plate XVI. The cardiac area is somewhat sunk below the level of the surrounding parts, its anterior margin is denticulated, with a larger spine on each side. The lateral margins of the carapace are armed with ten or eleven spines, the one on the antero-lateral angle being the longest. The second abdominal segment is ornamented with a transverse row of eight small spines. The other abdominal segments are normally destitute of spines, but in a few of the many specimens before me there are two or four small spinules on the third segment. The pleuræ of the third, fourth, and sixth abdominal segments are acute, the rest blunt. The eyes are large and are provided with rather long cilia on the edge of the cornea. The basal joint of the antenna is armed with a long and sharp spine which reaches forward beyond the eyes; the second joint also has a long spine on each side. The chelipeds are long and hairy; the merus, carpus, and basal part of the propodite are spiny, the fingers long, slender, the cutting edges straight and finely spinulous.* The ambulatory appendages are setose, the upper and lower edges of the merus are spinulose, and there is, moreover, a row of spinules on the outer surface, this external line of spinules being best developed on the proximal end of the segment; the carpus is armed with small spines on the upper margin and

* In some of the males the chela is broader than in others, and the basal part of the propodal digit is curved so that there is a distinct gap at the base of the fingers, with one or two rather prominent teeth on the base of the cutting edge of the dactylus. This difference in the form of the chela is generally found among the males of the different species of *Munida*, and has been referred to by Henderson (Challenger Anomura, p. 127), as a case of dimorphism. I have elsewhere (Amer. Journ. Sci., 3d Ser., XXVII. 42–44, 1884) shown that the two forms of the male in the genus *Cambarus* are alternating stages in the life of the same individual, one phase being assumed during the breeding periods, the other during the intervening seasons of sexual quiescence. Jules Bonnier (Comptes Rendus de l'Acad. Sci., CXI. 987, 1890) has shown that the same condition of things exists among the *Amphipoda*. I have no doubt that the two forms of the male in the genus *Munida* are to be explained in the same way.

one spine on the distal end of the lower margin; the penultimate and terminal joints are unarmed.

Length, 65 mm.; length of carapace, 34.5 mm.; breadth of carapace between epimeral sutures, 21 mm.; length of rostrum, 11 mm.; length of cheliped, 84 mm. (merus, 26 mm., carpus, 10 mm., basal portion of chela, 18 mm., dactylus, 21 mm.).

Station 3389. 210 fathoms. 2 males, 7 fem.
" 3355. 182 " 5 young.

Munida refulgens Fax.

Plate XVII.

Bull. Mus. Comp. Zoöl., XXIV. 177, 1893.

In this species the setæ on the ridges of the thorax and abdomen and on the legs are resplendent with iridescent hues. The carapace narrows anteriorly. The rostrum is long, triangular in cross section, the upper surface scabrous, the lateral margins armed with two to four spines, which are generally unsymmetrically placed on the two sides. The supraocular spines are short. There is a transverse line of spinules back of the base of the rostrum, the two which lie on each side of the median line being larger than the others. Seven marginal spines on each side of the carapace, the ones at the antero-lateral angles the largest. There are no spines on the abdominal segments. The abdominal pleuræ are acute. The basal joint of the antenna has a plate-like expansion, but is not spinose; the second joint is furnished with an external spine. The inferior border of the merus of the third maxilliped is furnished with four spines, the proximal of which is the longest. Chelipeds very long, squamose, and clothed with silky setæ; the merus has a row of spines on the upper margin, another on the inner side, and a row of smaller ones on the outer side; the carpus is provided with three or four spinules at the distal end; the chela is slender, the outer finger flattened, ribbed above, the outer edge rather convex and expanded toward the base; cutting edges of fingers finely denticulated. The anterior border of the merus and carpus of the ambulatory appendages is spinose.

The general color in life is red, deepest on the carapace and chelæ; the transverse setiferous lines of the carapace as well as the dactyli of the ambulatory legs are yellow; eyes black. In the alcoholic specimens the color is retained in the chelæ, and particularly in the rostrum.

Dimensions of largest specimen (male): length, 91 mm.; length of carapace, including rostrum, 43 mm.; breadth of carapace, 34 mm.; length of cheliped, 211 mm.; merus, 90 mm., carpus, 15 mm., basal part of chela, 56 mm., dactylus, 42 mm.

Station	3367.	100	fathoms.	13 males, 18 fem. (7 ovig.).
"	3378.	112	"	15 males, 19 fem. (14 ovig.).
"	3379.	52	"	1 young.
"	3427.	80	"	1 "

In *M. iris* A. M. Edw., the setæ are iridescent, as in this species, but the rostrum lacks the lateral spines, and the supraocular spines are much longer, reaching beyond the eyes. From *M. irrasa* A. M. Edw., which is also an iridescent species, *M. refulgens* differs in the shape of the hand, in the relatively shorter median rostral spine, which is provided with lateral spines, etc.

Munida propinqua Fax.

Plate XVIII., Fig. 1, 1ª.

Bull. Mus. Comp. Zoöl., XXIV. 178, 1893.

The carapace of this species is rather flat; the rostral spines are scabrous, the supraocular reaching to a point beyond the eyes; there is a prominent spine on the gastric area behind each supraocular spine, another on each side behind and external to these, and a pair of very small ones on the median line at the base of the rostrum; besides these there are about four small spines on the anterior half of the carapace. The anterior lateral angle of the carapace is truncated, the lateral border seven-spined. The pleuræ of the abdomen are rounded, short, and broad; the second abdominal segment is furnished with a transverse row of about eight spines, the rest of the segments being destitute of spines; the terga of the second to the fourth segments are very smooth behind the central transverse fossæ. The first joint of the antenna is armed with a long spine, the second joint with one on each side. There is a minute spine at the antero-inferior angle of the carapace. The chelipeds are robust, setose, and spiny; merus spiny on upper and inner parts; carpus spiny on all sides; the hand is furnished with two rows of spines on the lower side, another along the middle of the outer face, and three irregular series along the upper side; both the fingers are spinulose. Ambulatory limbs setose, spiny along the superior and inferior edges.

In small specimens the supraocular spines may be shorter than the eyestalks.

Length, 84 mm.; carapace (including the rostrum), 45.5 mm.; breadth, 26 mm.; length of cheliped, 96 mm.

Station 3384. 458 fathoms. 11 males, 6 fem. (ovig.).
" 3394. 511 " 1 male.
" 3404. 385 " 1 male juv.

This species resembles *M. valida* Smith and *M. miles* A. M. Edw., but the carapace of *M. propinqua* is flatter, the cardiac area is more distinctly circumscribed by a furrow, the abdomen bears spines on the second segment only, and the abdominal segments are not so much sculptured.

Munida gracilipes Fax.

Plate XVI., Fig. 2–2b.

Bull. Mus. Comp. Zoöl., XXIV. 179, 1893.

Carapace rather flat and quadrangular. Supraocular spines less than one half the length of the rostrum, shorter than the ocular peduncle. Four spinules on the gastric area arranged in the form of a square,—two behind each supraocular spine; a longitudinal row of obsolescent spinules in the median line from base of rostrum to the cardiac area; one spine on the cardiac region, a pair on the intestinal region, and one on each side of the cardiac region just back of the cervical suture. The lateral margins of the carapace are armed with about seven spines, the first of which is the largest. The second abdominal segment is armed with a transverse row of six spines, the third with a row of four, the fourth with a row of four, and one median spine behind the transverse row. This is the normal arrangement, but in one specimen out of the four there is an additional pair of spines on the second and third segments back of the transverse row. The pleuræ of the third, fourth, and fifth abdominal segments are acute. Eyes very large, reniform. The chelipeds are very long and slender, the merus spinose (the chief of the spines being on the inner side of the joint), the carpus also is spinose. The hand has about eight spines on the upper margin and one on the lower; there are several acute spines on the outer border of the movable finger, the cutting edges of the fingers are straight, finely denticulated or spinulose.

Length, 24 mm.; breadth, 8 mm.; length of cheliped, 34 mm.

Station 3391. 153 fathoms. 4 specimens.

Munida gracilipes is nearly allied to *M. stimpsoni* A. M. Edw., which it

appears to represent on the Pacific side of America. When compared with the type specimens of *M. stimpsoni* the differences are very evident, though somewhat difficult to describe. The carapace of *M. gracilipes* is much flatter, smoother, and more shining than in *M. stimpsoni;* the transverse ridges are more prominent, fewer in number, and do not show that tendency to break up into imbricated, granulated scales which is so characteristic of *M. stimpsoni.* The supraocular spines are shorter, closer to the median rostral spine, and fused more completely with the latter at the base. The eye is larger, the transverse ridges on the abdominal somites fewer in number. The lateral spines of the carapace and the abdominal spines are more fully developed. The cardiac area is narrower and bounded by more distinct furrows.

Munida microphthalma A. M. Edw.?

? *Munida microphthalma* A. M. Edw., Bull. Mus. Comp. Zoöl., VIII. 51, 1880.
Munida microphthalma ? Fax., Bull. Mus. Comp. Zoöl., XXIV. 179, 1893.

Station 3370. 134 fathoms. 1 fem. ovig., 20 mm. long.

Compared with the type specimens of *M. microphthalma,* the "Albatross" specimen has the rostrum shorter and less strongly upturned; the supraocular spines, too, are shorter (shorter than the eyes). There is no row of spines, but merely a ridge, along the superior or external face of the hand. The second abdominal somite bears only two spines instead of eight, as in the type; but this is of no great importance, since the spines of that segment are altogether absent in one of the "Blake" specimens (Station No. 2), and in one noticed by Henderson in the "Challenger" collections.

M. microphthalma was taken by the "Blake" among the West Indies in 573–1030 fathoms, and by the "Challenger" in the same region in 390 fathoms, north of Kermadec Islands in 600 fathoms, and near Ascension Island in 425 fathoms.

GALACANTHA A. M. Edw.

Bull. Mus. Comp. Zoöl., VIII. 52, 1880.

Galacantha rostrata A. M. Edw.

Plate B, Fig. 1, 1ª.

Bull. Mus. Comp. Zoöl., VIII. 52, 1880.

Station	3362.	1175 fathoms.	1 male.
"	3400.	1322 "	3 males, 2 fem. (1 ovig.).
"	3413.	1360 "	1 fem.

The "Albatross" specimens differ constantly from the typical West Indian form in the following particulars: The spines at the antero-lateral angles of the carapace are more divergent, the anterior spine being more nearly parallel with the axis of the body; the posterior spine is relatively longer; the abdomen is smoother toward the central part of the segments; the dorsal spine of the fourth abdominal segment is smaller. In other regards there is considerable variation among different individuals. The color in life is orange-red, fading into pale yellowish on the carapace and abdomen.

The characters pointed out by Henderson* to separate *G. bellis* from *G. rostrata* can hardly be deemed of specific value, nor does it seem probable that *G. talismanii*† is anything more than individual, age, or perhaps local variation of the same species. *G. talismanii* is a manuscript name of A. Milne Edwards's; but this writer appears to have abandoned its claims to recognition as a valid species, since it is not included in his enumeration of the known species of *Galacantha* given in the "Considérations Générales sur la Famille des Galathéidés."‡ Finally, as far as can be determined by Wood-Mason's short description, *G. areolata*§ differs from *G. rostrata* chiefly in the coarser granulation of the carapace, and may perhaps be viewed to more advantage as an East Indian race of *G. rostrata*. If my suspicions concerning the relationship of the above-named forms be well founded, we behold in *G. rostrata* a somewhat variable abyssal species of world-wide distribution, represented on both sides of the Atlantic, off the Pacific coast of America, in the Banda Sea, and in the Bay of Bengal.

The typical form of *G. rostrata* comes from the West Indian region, 1098–1591 fathoms. It has been figured by S. I. Smith.‖

Galacantha diomedeæ Fax.

Plate XXV.

Bull. Mus. Comp. Zoöl., XXIV. 180, 1893.

Rostrum without lateral spines; distal part turned upward at an angle of less than 95° in most specimens, but in some cases the inclination is greater;

* Ann. Mag. Nat. Hist., 5th Ser., XVI. 418, 1885; Rep. Challenger Anomura, p. 167, Plate XIX. Fig. 6, 1888.

† Henderson, Rep. Challenger Anomura, p. 167, Plate XX. Fig. 1, 1888.

‡ A. Milne Edwards et Bouvier, Ann. Sci. Nat., Zool., 7ème Sér., XVI. 270, 1894.

§ Ann. Mag. Nat. Hist., 6th Ser., VII. 200, 1891.

‖ Bull. Mus. Comp. Zoöl., Vol. X., No. 1, Plate IX. Fig. 2, 2a, 1882; Ann. Rep. U. S. Fish Comm. for 1885, Plate VI. Fig. 1, 1a, 1886.

basal part marginate, the margin running for some distance along the anterior edge of the carapace; a slight keel runs back from the rostrum to the median gastric spine. Gastric spine smaller than in *G. rostrata;* anterior lateral spine much longer than the posterior; there is an additional small spine on each side of the carapace just behind the anterior branchial lobe. Anterior half of the carapace ornamented with setiferous squamous tubercles; on the posterior half of the carapace the tubercles assume the form of interrupted transverse ridges. The median spines of the abdomen are small, diminishing successively in size from the first to the third, which is obsolete in many examples. Upper surface of abdomen rather hairy, the transverse ridges devoid of teeth or tubercles, pleuræ tuberculose, angles rounded. The legs are rough with granular setose tubercles. There are two prominent spines at the distal end of the carpus of the chelipeds, and one at the distal end of the carpus and merus of the ambulatory limbs. The antennæ are twice and a half as long as the body.

Dimensions of a female specimen: length of body, 79 mm.; length of carapace, 39 mm.; breadth of carapace, not including the lateral spines, 25 mm.

This species runs into a well-marked variety in which the anterior lateral spines as well as the median gastric spine are very much smaller than in the typical form. This variety, which I have named *Galacantha diomedeæ*, var. *parvispina*, is figured on Plate XXV., Fig. 2. At one Station (3429) both forms were obtained at the same haul.

G. diomedeæ differs from all other known species of *Galacantha* by the rugose character of the sculpture on the hinder half of the carapace. In the relative proportion of the anterior and posterior lateral spines it agrees with *G. spinosa.* It may be easily distinguished from *G. spinosa* by the entirely different sculpture of the carapace, by the absence of transverse rows of tubercles on the abdominal terga, etc.

Station	3357.	782	fathoms.	1 fem. juv.
"	3363.	978	"	3 males, 3 fem. ovig.
"	3364.	902	"	1 fem.
"	3366.	1067	"	3 males, 1 fem. ovig.
"	3371.	770	"	5 males, 2 fem. (1 ovig.).
"	3373.	1877	"	1 male.
"	3393.	1020	"	3 males.
"	3407.	885	"	2 males, 1 fem.

Station 3429. 919 fathoms 1 male.

Var. *parvispina.*

Station 3418. 660 fathoms. 1 male.
" 3419. 772 " 1 fem. ovig.
" 3424. 676 " 1 male.
" 3429. 919 " 1 male.
" 3435. 859 " 18 males, 17 fem. (6 ovig.).
" 3436. 905 " 6 males, 4 fem. (3 ovig.).

In both *G. rostrata* and *G. diomedeæ* there is a curious sexual difference In the male the proximal half of the telson is furnished on each side with long, amber-colored setæ which are entirely wanting in the female. The same difference between the sexes is found in some species of *Munidopsis.*

G. diomedeæ is often invested with parasites. One of the males from Station 3371 bears a *Peltogaster*, while seven specimens (5 males, 2 females) of var. *parvispina* house a *Bopyrus* in the left branchial chamber.

The eggs of this species measure 3 × 2.5 mm.

MUNIDOPSIS Whiteaves.

Amer. Journ. Arts and Sci., 3d Ser., VII. 212, 1874.

The type species of this genus is *Munidopsis curvirostra* Whiteaves, from the eastern coast of North America. The genus has been redescribed by A. Milne Edwards, under the name *Galathodes* in the Bulletin of the Museum of Comparative Zoölogy, Vol. VIII., p. 53, 1880. In the same paper Milne Edwards proposed the two genera *Orophorrhynchus* and *Elasmonotus* for the reception of certain species closely allied to *Munidopsis*. *Orophorrhynchus* has already been united with *Elasmonotus* by Henderson. *Elasmonotus* was instituted to embrace the species characterized by a flat, quadrangular carapace devoid of spines. But such species are connected with the typical *Munidopsis* by so many intermediate forms, which may be assigned to either genus at the whim of the describer, that I have united *Elasmonotus* and *Munidopsis* as one genus. As the genus *Anoplonotus* of Smith * does not seem to be sufficiently distinct from *Elasmonotus*, it is here merged, with the latter, in *Munidopsis.*

The union of *Munidopsis*, *Orophorrhynchus*, and *Elasmonotus*, necessitates renaming two of Henderson's species, viz. *Munidopsis brevimana* and *Elasmonotus latifrons*, since both of the trivial names had been previously employed

* Proc. U. S. Nat. Mus., VI. 50, 1883.

for other species by A. Milne Edwards (*Elasmonotus brevimanus* and *Galathodes latifrons*). For *Munidopsis brevimana* Hend. may be substituted *Munidopsis ciliata*, a name lately given by Wood-Mason to a *Munidopsis* from the Bay of Bengal, which does not appear to be distinct from Henderson's species.* *Elasmonotus latifrons* Hend. may be called *Munidopsis latirostris*.

The genus *Munidopsis*, taken in this extended sense, contains about seventy species, sixteen of which were discovered during the voyage of the "Albatross" in 1891, and were first described in my preliminary report on the Crustacea of the expedition in 1893.

After the present report was written I received a memoir entitled "Considérations Générales sur la Famille des Galathéidés,"† written by Prof. Milne Edwards conjointly with Mr. E. L. Bouvier. In this memoir the classification of the *Galateidæ* is treated anew and in more detail. All of the genera proposed by the senior author in 1880 are retained, although transformed almost beyond recognition by the imposition of new diagnoses and new limitations. *Galathodes* is restricted to the species characterized by a broad, flat, triangular rostrum, often carinated on its upper side, and armed towards its anterior end with a pair of prominent lateral spines or teeth, in front of which the distal extremity of the rostrum suddenly contracts. This new diagnosis of the genus *Galathodes* eliminates eight of the ten species upon which the genus was originally based, leaving *G. latifrons* and *G. tridens* alone in *Galathodes*, the eight others being transferred to *Munidopsis*. So of the six species of *Orophorrhynchus* of the original paper three are now transferred to *Munidopsis*, one to *Elasmonotus*, one (*O. spinosus*) is ignored, leaving but one of the original species, *O. aries*, in *Orophorrhynchus*, of which genus it becomes the type.

The difficulty encountered by Prof. Milne Edwards in distributing his own species among his own genera would seem clearly to show the artificial nature of the genera proposed, and amply to vindicate the course of those naturalists who have refused to adopt them.

It is true, as Milne Edwards and Bouvier maintain, that the most characteristic of the species ranged by them in the genera *Orophorrhynchus* and *Elasmonotus* differ from the more typical species of *Munidopsis* as much as or more than the species assigned to the genus *Galacantha*. But there is this difference: the species of *Galacantha*, although they differ but slightly in structure from *Munidopsis*, yet form a sharply defined and natural group dis-

* See p. 84.

† Ann. Sci. Nat., Zool., 7ème Sér., XVI. 191–327, 1894.

connected from the latter genus in the absence of transitional species. *Galathodes*, *Orophorrhynchus*, and *Elasmonotus*, on the contrary, are bound by a perfectly graduated series of numerous connecting forms with the typical species of *Munidopsis*.*

In the large and plastic genus *Munidopsis*, evolution has progressed along several lines of species, and for the purposes of a monographer it may be useful to assign names to the extremes of modification found within the limits of the genus, in order that the interrelations of the species may be brought into view. This is the function, as I understand it, of the category of classification known as *subgenus*, in which we see a genus in the process of forming, as it were. By the more or less complete extinction of intermediate species we may assume that genera of the present have come from subgenera of the past, and that future genera will be evolved from subgenera of the present. I would distinguish between genera and subgenera much as the American ornithologists do between species and subspecies.† Viewed in this light, subgenera may play a very useful part in a philosophical system of nomenclature.

Munidopsis bairdii Smith.

Galacantha bairdii Smith, Proc. U. S. Fish Comm. for 1882, p. 356, 1884.
Munidopsis bairdii Smith, Proc. U. S. Nat. Mus., VII. 493, 1884; Ann. Rep. U. S. Fish Comm. for 1885, p. 649, Plate V. Fig. 2, 1886.

Station 3381. 1772 fathoms. 1 male.

Differs from the type, as described by Smith, as follows: the central pair of spines of the gastric area and the anterior pair of spines of the cardiac area are absent; the rostrum has three spines on the right side, four on the left; the posterior margin of the carapace has three spines on the right side, two on the left; the body is slenderer. The differences are perhaps partly individual, partly sexual, Smith's description and figure having been made from a female specimen.

* Professor Henderson in 1885 (Ann. Mag. Nat. Hist., 5th Ser., XVI. 417) proposed the genus *Galathopsis* as a refuge for certain species intermediate between *Munidopsis* and *Elasmonotus*. This only added to the difficulty by drawing two arbitrary lines of division in place of one. In his final report on the "Challenger" Anomura, Henderson suppressed the genus *Galathopsis* and assigned the intermediate species to *Elasmonotus*, expressing at the same time his grave doubts concerning the separability of *Elasmonotus* from *Munidopsis* (Challenger Anomura, pp. 158, 165). It is of interest in this connection to note that Milne Edwards and Bouvier (op. cit., p. 283) incline to place these same species in *Munidopsis* rather than in *Elasmonotus*.

† The Code of Nomenclature and Check-List of North American Birds adopted by the American Ornithologists' Union, being the Report of the Committee of the Union on Classification and Nomenclature, p. 31. New York, 1886.

M. bairdii has been taken off the east coast of the United States in 1497 and 1742 fathoms.

Munidopsis ciliata Wood-Mason.

Plate XVIII., Fig. 3.

Munidopsis brevimana Hend., Ann. Mag. Nat. Hist., 5th Ser., XVI. 414, 1885; Rep. Challenger Anomura, p. 154, Plate XVII. Fig. 1, 2, 1888. (*Nomen præoc.**)
Munidopsis ciliata Wood-Mason, Ann. Mag. Nat. Hist., 6th Ser., VII. 200, 1891.

Station	3353.	695	fathoms.	1 male.
"	3363.	978	"	1 male.
"	3392.	1270	"	1 fem.
"	3393.	1020	"	2 males.

Most of the "Albatross" specimens are more hairy than those described by Henderson. In this respect they agree with *M. ciliata* Wood-Mason. These specimens also show that the number of lateral spines of the carapace, relied upon by Wood-Mason to distinguish his species from *M. brevimana* Hend., is inconstant.

In some specimens there is an extra spine on each side of the front margin of the carapace, between the supraantennal spine and the spine at the antero-lateral angle.

Just as these pages are going to press, the type specimen of *Munidopsis nitida* (A. M. Edw.)† is returned from Paris. It is a male 23 mm. long ("Blake" Sta. 163, Guadaloupe, 769 fathoms), and differs from *M. ciliata* but very slightly. The carapace is less hairy and more polished; the transverse squamiform ridges, which are very evident in *M. ciliata*, are obsolescent. The transverse furrow which divides the terga of the second, third, and fourth abdominal somites into two prominent ridges in *M. ciliata* is but faintly indicated in *M. nitida*. The tubercles on the superior face of the merus of the ambulatory appendages, moreover, are much less pronounced in Milne Edwards's species. In short, *M. nitida* is a less heavily sculptured and less hairy form than *M. ciliata*. The characters that separate the two forms appear to be of racial or varietal, rather than specific, value, but the name *M. ciliata* may be provisionally retained for the Pacific and Indian Ocean form until the distribution of each form is more fully known.

* See pp. 81, 82.

† *Orophorrhynchus nitidus* A. M. Edw., Bull. Mus. Comp. Zoöl., VIII. 59, 1880; *Munidopsis nitida* A. M. Edw. et Bouv., Ann. Sci. Nat., Zool., 7ème Sér., XVI. 275, 1894.

Munidopsis vicina Fax.

Plate XVIII., Fig. 2, 2a.

Bull. Mus. Comp. Zoöl., XXIV. 181, 1893.

Near *M. ciliata*, from which it differs as follows: it is a very much smaller species, the adult ovigerous female being only twenty-nine millimeters long; the anterior margin of the propodite of the ambulatory appendages bears two very prominent spines; on comparing the telson of *M. vicina* with that of *M. ciliata* a marked difference is apparent in the division of the telson by sutures, — a difference most readily comprehended by a glance at Figs. 2 and 3 of Plate XVIII. The pair of long and narrow plates which lie on each side of the small central plate in *M. ciliata* are entirely wanting in *M. vicina*. As in *M. ciliata*, the carapace of *M. vicina* is covered with squamoid tubercles, the rostrum is curved slightly upward, and the chela is short.

Length, 29 mm.; breadth, 9.5 mm.

Station 3360. 1672 fathoms. 1 fem.
" 3382. 1793 " 1 fem. ovig.

The specimen from Station 3360 is a smoother, less setose form than the specimen from Station 3382.

Munidopsis subsquamosa Hend.

Ann. Mag. Nat. Hist., 5th Ser., XVI. 414, 1885; Rep. Challenger Anomura, p. 152, Plate XVII. Fig. 4, 1888.

Station 3360. 1672 fathoms. 1 male.
" 3361. 1471 " 1 fem.

The rostrum is curved upward to a considerable degree in the "Albatross" specimens (most strongly in the female), and there are but three spines on the gastric area, — two in a transverse line at the base of the rostrum, and a smaller one in the median line a little further behind. The outer or lower margin of the hand, too, is more concave than in Henderson's figure of *M. subsquamosa*.

The types of this species were taken off Japan in 1875 fathoms. A nearly allied form, *M. subsquamosa pallida* Alcock,* has been dredged in the Bay of Bengal, 1803 fathoms.

* Ann. Mag. Nat. Hist., 6th Ser., XIII. 331, 1894.

Munidopsis subsquamosa aculeata Hend.

Munidopsis subsquamosa, var. *aculeata* Hend., Rep. Challenger Anomura, p. 153, Plate XVI. Fig. 1, 1888.

Station 3382. 1793 fathoms. 2 males, 1 fem. ovig.

The rostrum is shorter than is represented in Henderson's figure. In the two males the hind border of the sixth abdominal somite is produced in the median line into a prominent rounded process. The outline of the telson in Henderson's figure is apparently very incorrectly drawn.

The eggs measure 3 × 3.3 mm.

The " Challenger " specimens were captured between Marion Island and the Crozets in 1375 fathoms, and off the west coast of Patagonia in 1450 fathoms.

This form is closely allied to *M. crassa* Smith,* from off the east coast of the United States, 1742–2620 fathoms. The latter species is distinguished by its large rostrum and the spine which projects from the outer edge of the eye-stalk just behind the cornea.

Munidopsis villosa Fax.

Plate XIX., Fig. 2.

Bull. Mus. Comp. Zoöl., XXIV. 182, 1893.

The whole surface of the body and limbs is beset with setæ which arise from low squamous tubercles and transverse rugæ on the carapace and from the transverse ridges of the abdominal segments. The rostrum is triangular, the distal half strongly upturned, cylindrical and pointed, the proximal half naked below and slightly carinated in the median line. A pair of tubercles ending in spiny points lie on the anterior part of the gastric region. One spine at antero-lateral angle of carapace, one at the front end of the anterior branchial lobes, and a rudimentary one further behind on the side of the branchial region. Frontal border armed on each side with a spine over the base of the antenna. There is a median spine on the second, third, and fifth abdominal segments, and a rudiment of one on the fourth. The abdominal pleuræ have rounded external angles. The eyes are freely movable and destitute of spines. The second antennal segment is armed with a prominent

* Proc. U. S. Nat. Mus. VII. 494, 1884; Ann. Rep. U. S. Fish Comm. for 1885, p. 645, Plate IV., 1886.

external spine. The chelipeds are robust, setose, and granulate; the merus has a short superior spine and two lateral spines at the distal end; the carpus is similarly equipped, though on one side the superior spine is obsolescent; the chela is broad and strong, the fingers excavated, denticulated on their cutting edges and at their tips. The merus of the first pair of ambulatory appendages has an external distal spine; the carpus of all the ambulatory limbs has two low longitudinal ridges, and the carpus of the first and second pair has a spine on the upper border at the distal end of the joint.

Length, 55 mm.; breadth, 18 mm.; length of carapace, 31 mm.; rostrum, 8 mm.

Station 3394. 511 fathoms. 1 male.

Munidopsis villosa is very closely allied to the West Indian *Munidopsis abbreviata* (A. M. Edw.),* from which it differs as follows: the tubercles and ridges of the carapace are more pronounced and the whole surface of the animal more hairy. The frontal border is armed on each side with a sharp spine, which is wanting in *M. abbreviata*. The median dorsal spine on the fourth abdominal somite is obsolete, while the fifth somite bears a well-developed acute spine, like those on the second and third somites. In *M. abbreviata* the fifth somite is unarmed. The distal half of the rostrum is curved upward much more strongly in *M. villosa* than it is in *M. abbreviata*.

Munidopsis villosa is represented by a single specimen in the "Albatross" collection. It is very much larger than the type specimen of *M. abbreviata* from the "Blake" dredgings, and it is possible that the peculiarities above specified may be due to age or individual variation. But I think it more probable that we have to do with two closely allied or representative species on the Atlantic and Pacific sides of the continent.

Munidopsis ornata Fax.

Plate XX., Fig. 1, 1a.

Bull. Mus. Comp. Zoöl., XXIV. 186, 1893.

Carapace convex, the whole upper surface, including the rostrum, thickly covered with low squamous tubercles; under a magnifying power the surface of each tubercle is seen to be made up of a number of secondary scale-like prominences; the tubercles are not lengthened out transversely to form ridges in any part of the surface; two of the tubercles on the gastric

* *Galathodes abbreviatus* A. M. Edw., Bull. Mus. Comp. Zoöl., VIII. 55, 1880; *Munidopsis abbreviata* A. M. Edw. et Bouv., Ann. Sci. Nat., Zool., 7ème Sér., XVI. 275, 1894.

region take on a spiny character. The rostrum is nearly horizontal, triangular in cross-section, the margins serrate; the anterior border of the carapace is convex between the eyes and the antennæ, but has no spine at this point; lateral border four-toothed, one of the teeth lying at the antero-lateral angle, two on the hepatic region, and one on the edge of the branchial region behind the cervical suture; the posterior border is delicately festooned, but not armed with spines. The abdomen is spineless, its surface punctate, anterior half of the pleuræ of the second segment tuberculate, all the pleuræ rounded. The eye has a transverse granulated tubercle running over the cornea from the inner side. The antennæ are very slender and do not exceed the carapace in length. The chelipeds are moderately robust, the merus tuberculate and armed with a row of short spines along the upper edge; the carpus spino-tuberculate, with two longitudinal furrows on the outer side; hand almost smooth on the inner side, outer side and superior surface roughened with low tubercles; fingers curved slightly upward, spoon-shaped at the denticulate and setose tips. Ambulatory appendages: meri flattened, tuberculate, upper edge produced to a spinose carina; the carpi have three denticulate ridges; propodites scabrous, with an irregular row of spines on under side; the dactyli have black tips and are finely spinulose on their posterior edges.

Length, 23 mm.; length of carapace, 12 mm.; breadth, 8 mm.; length of rostrum, 3 mm.

Station 3404. 385 fathoms. 1 male.

Munidopsis agassizii Fax.

Plate XVIII., Fig. 4, 4ª.

Bull. Mus. Comp. Zoöl., XXIV. 182, 1893.

The carapace of this species is moderately convex, with a deep transverse depression across the anterior part of the cardiac area. The rostrum is long, slightly upturned, and armed near the middle with a pair of lateral spines. The gastric area has three pairs of spines, the anterior pair the largest. There is one spine on each anterior branchial lobe. The cardiac area bears two or three pairs of spines. The lateral margins of the carapace carry from six to eight spines each, and there is a longitudinal series of small spines within the margin on the branchial area. A small spine is situated on the anterior margin between the eye and the antenna. The posterior

border of the carapace is ornamented with six (in one specimen seven) spines. There are also several spines on the sides of the carapace below the epimeral suture. There is a very small spine over each eye. The antennæ are shorter than the body, the first joint bears a long external spine, the second joint two lateral spines, the third joint two lateral spines and one superior. The chelipeds are long and slender, the merus and carpus have no long spines, the propodite carries four spines on the upper edge and several rudimentary spinules; the fingers are spinulose, their cutting edges straight and denticulated. The ambulatory appendages have spiny meri and carpi, the longest spines being one at the distal superior border of each of these joints. The second, third, and fourth abdominal terga bear four spines each, and the pleuræ of the second abdominal somite carry a few spinules. The abdominal pleuræ are rounded.

Length, 23 mm.; length of carapace, 12.4 mm.; breadth of carapace, 8 mm.; length of rostrum, 4.5 mm.

Station 3389. 210 fathoms. 1 male, 1 fem.

This species bears a general resemblance to *M. erinacea* (A. M. Edw.) and *M. spinifera* (A. M. Edw.). It differs from both of these in having a flatter carapace marked by a deeper transverse depression across the cardiac area; in having a larger number of spines on the sides of the carapace; in the presence of spines on the pterygostomian regions, and a small but distinct spine over the eye. It also has strong spines on the superior edge of the hand which are wanting in *M. erinacea* and *M. spinifera*. In the possession of three pairs of gastric spines it agrees with *M. spinifera*, but differs from *M. erinacea*.

Munidopsis hystrix Fax.

Plate XIX., Fig. 1, 1a.

Bull. Mus. Comp. Zoöl., XXIV. 183, 1893.

Carapace setose and thickly covered with small spinous tubercles; three spines of special prominence on the gastric area disposed in the form of a triangle, with apex directed backward; one on the cardiac area; two (rarely six) on the hind margin of the carapace; one on each branchial area. There is a spine at the external angle of the orbit, and the lateral margin of the carapace is spinose. The rostrum is long, lightly curved upward from the base to the tip, and armed with from two to five spines on each side; these spines are unsymmetrically arranged on the two sides. The second, third,

and fourth abdominal segments are conspicuously two-ridged; the second segment has a pair of small spines on the anterior ridge, and another pair nearer the median line on the posterior ridge; the third segment also has a pair of spines on the anterior ridge, and in some specimens a third spine in the median line on the posterior ridge. The abdominal pleurae are truncate. The chelipeds are long, very spiny from the proximal end of the merus to the base of the fingers; the chief spines of the propodite are on the upper margin of the segment; there are two spines near the base of the dactylus. The ambulatory appendages are long, setose, and spinose, excepting the dactylus. None of the legs are furnished with epipodites. A spine over the eye. Antennæ shorter than the body; a spine on the outer side of the first segment, one on each side of the second and third segments, and one on the upper surface of the third segment.

Length of ovigerous female, 48.5 mm.; length of carapace, 26 mm.; breadth, 15 mm.; rostrum, 8 mm.

Station	3417.	493	fathoms.	1 male, 2 fem. ovig.
"	3424.	676	"	4 fem. (2 ovig.).
"	3425.	680	"	7 males, 5 fem. (2 ovig.).

Munidopsis sericea Fax.

Plate XIX., Fig. 3, 3a.

Bull. Mus. Comp. Zoöl., XXIV. 184, 1893.

The whole surface of the body and limbs is covered with a silky pubescence. The rostrum is long, curved gently upward, convex above, but not carinated, armed with a prominent spine on each side near the middle, and with three minute spinules near the base. Gastric region swollen, armed with two conical spines and ten or twelve small spinoid tubercles. The cardiac region has a prominent transverse ridge near the centre, in front of which is a deep depression separating it from the gastric region; the ridge is armed with a pair of short spinules. There is a small spine on the anterior border between the eye and the antenna, a large one at the antero-external angle, three on the border of each anterior branchial lobe (the middle one of these three spines is the largest), and one small one on the border of each branchial region just behind the posterior branch of the cervical groove; there are besides about ten spinous tubercles on each branchial area, and five or six pairs of spinules on the posterior margin of the carapace. Ptery-

gostomian regions granulated. There is a pair of spines on the second, third, and fourth abdominal segments; besides these there are several small spinules on the terga and pleuræ of these segments; the pleuræ are rather narrow, with rounded lateral angles. The chelipeds are wanting in the unique specimen. The ambulatory appendages are spinulose, the spinules of the dactyli restricted to the hind margin. The eye is provided with a a very minute spine. The antennæ are rather longer than the body, the basal joint has a short external spine, a longer one at the lower internal angle, and a smaller one at a higher level on the inner side. The latter spine shows, when the animal is viewed from above, between the eye-stalk and the antenna. The subsequent segments of the antenna are armed as usual in this genus.

Length, 39 mm.; length of carapace, 12 mm.; length of rostrum, 8 mm.; breadth of carapace, 12 mm.

Station 3394. 511 fathoms. 1 male.

Munidopsis margarita Fax.

Plate XX., Fig. 2.

Bull. Mus. Comp. Zoöl., XXIV. 184, 1893.

In this species the rostrum has a gentle upward curve near the tip; it is carinate above, and minutely spinulous on the margins. The surface of the carapace is rough with squamous tubercles and forward-pointed spines. The gastric and cardiac regions are prominent, and separated from one another by a deep depression; a pair of spines on the gastric region, and one spine on the cardiac region attain a special prominence. A long sharp spine outside the eye forms the outer wall of a well-marked orbit. There are eight spines on each lateral margin, six on the posterior margin (including those at the postero-lateral angles). The branchial areas are iridescent. Second abdominal segment: the anterior transverse ridge, which is broken down in the centre, bears on each side a prominent hooked spine, which is enlarged at the base, and denticulated on the outer margin; the posterior ridge is furnished with three hooked spines; the pleuræ of this segment bear each a broad, flattened, forward-pointing tooth with denticulated edges; when the animal is viewed from above, this tooth appears to form the lateral extremity of the pleura, which really lies below it and is rounded. Third abdominal segment: both ridges are spiny and denticulate, three spines being

specially prominent on each ridge. Fourth abdominal segment: armed with but one small median spinule. The sides of the carapace below the epimeral sutures are covered with spiny tubercles, and display an iridescent lustre. The eye has two spines projecting over the cornea from the inner side; the posterior of these spines is very minute. The antennæ are very slender, and about as long as the carapace; the first and second joints are provided with a prominent external spine, the third joint with three spines, viz. one external, one internal, and one superior. The chelipeds are absent in both the specimens. The ambulatory appendages are spinulose on all the segments except the dactyli, which are finely serrate on the hind margin. The legs, and more especially the sternum, are iridescent, like mother-of-pearl. This iridescence is seen in a less degree in several other species of this genus.

Length, 20 mm.; length of carapace, 11 mm.; breadth, 7 mm.; length of rostrum, 3.5 mm.

Station 3404. 385 fathoms. 1 male, 1 fem.

Munidopsis crinita Fax.

Plate XX., Fig. 3, 3a.

Munidopsis crinita Fax., Bull. Mus. Comp. Zoöl., XXIV. 185, 1893.
Galathodes crinitus A. M. Edw. et Bouv., Ann. Sci. Nat., Zool., 7ème Sér., XVI. 279, 1894.

The whole surface is clothed with long setæ, which are longest and densest on the chelipeds and ambulatory appendages. The rostrum is very broad at the base, and ends in three points, the middle of which is the longest; the rostrum is slightly carinate in the median line. The carapace is roughened by low setiferous ridges; the antero-lateral angles are obliquely truncate; a spine over the antenna, and four on the lateral margin, the last one just behind the posterior branch of the cervical suture, the third one obsolescent; hind margin unarmed. A pair of spines on the gastric region behind the base of the rostrum. The abdomen is devoid of spines, and there is no spine over the eye. The antennæ are slender, shorter than the body; the basal joint is provided with a long spine on the external side, and another on the internal side; the second joint has an external spine, the third an internal one. Chelipeds: internal edge of merus five-spined, superior edge also furnished with a row of smaller spines; carpus with one prominent internal spine; hand unarmed, broadest at base of fingers, cutting

edges of fingers toothed. Ambulatory limbs setose, hind border of dactyli spinulose.

Length, 19.5 mm.; carapace, 11.5 mm.; rostrum, 2.6 mm.; breadth of carapace, 7.5 mm.

Station 3384. 458 fathoms. 1 fem.

This species, which belongs to the genus *Galathodes* as recently restricted by MM. A. Milne Edwards and Bouvier, resembles *M. tridentata* (Esmark), *M. latifrons* (A. M. Edw.), and *M. tridens* (A. M. Edw.). It differs from all these species by its dense pilosity, the shortness of the rostrum, and the great breadth of the hand at the base of the fingers. It further differs from *M. tridentata* through the possession of a pair of gastric spines, and through the absence of prominent spines on the meri of the ambulatory appendages; from *M. latifrons* through the presence of gastric spines, and the absence of spines on the tergum of the second abdominal somite; from *M. tridens* through the presence of five internal meral spines and one powerful internal carpal spine borne by the cheliped. *M. tridentata* comes from the eastern Atlantic, *M. latifrons* from the Barbadoes, *M. tridens* from St. Kitts.

Munidopsis scabra Fax.

Plate XXI., Fig. 1, 1a.

Bull. Mus. Comp. Zoöl., XXIV. 186, 1893.

The rostrum is triangular, slightly curved upward, carinated above, the lateral edges and the carina lightly denticulated. The carapace is covered with squamous setiferous tubercles, which end in spiny points. There is a transverse row of six more prominent spiny tubercles on the gastric region. The posterior border of the carapace is ornamented with a denticulated rim (about eight denticles). There is a spine between the eye and the antenna below the anterior margin of the carapace. The abdomen is devoid of spines, the pleuræ have truncated lateral angles. A very short spine projects over the cornea of the eye. The antennæ are shorter than the body; a spine on the outer side of the basal joint, one on each side of the second joint, and one on each side, and one on superior margin of the third joint. The chelipeds are long, spinose, except the fingers; hand long, the basal part longer than the fingers. All the joints of the ambulatory appendages are spiny, except the dactyli.

Length (ovigerous female), 40 mm.; length of carapace, 13.5 mm.; breadth, 14 mm.; rostrum, 5 mm.

Station, 3424. 676 fathoms. 2 males, 1 female ovig.
3425. 680 " 1 male, 1 " "

Munidopsis scabra resembles *M. sharreri* (A. M. Edw.), but may be at once distinguished from the latter by the shortness of the ocular spines, and the great development of the spiny-pointed tubercles of the carapace.

Munidopsis tanneri Fax.

Plate XXII., Fig. 1, 1ª.

Bull. Mus. Comp. Zoöl., XXIV. 187, 1893.

Carapace flat, quadrangular, covered with squamous setiferous tubercles which have a tendency to develop spiny points on the gastric region. This is especially true of a transverse row of six on the anterior part of this region. The rostrum is triangular and horizontal. There is a prominent spine on each side of the anterior margin of the carapace between the eye and the antenna, another at the antero-lateral angle, and two or three on the side of the anterior branchial lobe; the hind border of the carapace is denticulated. A small spine over the eye. Antennæ shorter than the body; one spine on the outer side of the first joint, two lateral and one superior on the second and third joints. Cheliped (present in only one specimen) long, slender; merus and carpus many-spined; propodite spiny along the upper and lower margins; tips of fingers enlarged and denticulated. Ambulatory limbs: a prominent row of spines on the upper edge of the merus and carpus, propodite and dactylus devoid of spines. Abdomen without spines; pleuræ narrow, angles rounded.

Length, 41 mm.; length of carapace, 23.5 mm.; breadth, 15.5 mm.; rostrum, 6 mm.

Station 3396. 259 fathoms. 2 males, 1 fem. (1 male with *Bopyrus.*)
" 3397. 85 " 1 male.

This species is nearly related to *M. scabra,* but differs from the latter species in having the carapace broader and flatter, with squamous tubercles which are not produced into points, except a few on the gastric area. The spine between the eye and the antenna is longer; the propodites of the ambulatory legs are smoother, with no well-developed spines.

Munidopsis hamata Fax.

Plate XXI., Fig. 2, 2a, 2b.

Bull. Mus. Comp. Zoöl., XXIV. 187, 1893.

Body and limbs clothed with short, scattered setæ. Rostrum long, curved slightly upward, basal half furrowed longitudinally, with a row of short spines on each side of the furrow; infero-lateral edges of rostrum also furnished with small spines. Carapace quadrangular, anterior border forming a right angle with lateral border, both borders spinulose; lateral border with an indentation at anterior boundary of anterior branchial lobe; a deep depression back of each anterior branchial lobe, and another across the anterior part of the cardiac region; the upper surface of the carapace is adorned with spinulose tubercles, and a median longitudinal row of more prominent spines runs along the gastric and cardiac regions; the anterior spine of the cardiac region overhangs the transverse depression, the posterior spine of the row springs from the hind rim of the carapace. There is a median hooked spine on the tergum of the second, third, fourth, and fifth abdominal segments, and many spiny tubercles irregularly disposed on these segments; the pleuræ of the third to the sixth abdominal segments are narrow but blunt, those of the second to the fifth are costate. The ocular peduncle is movable, and devoid of a spine. The antennæ are about as long as the body; the basal joint has an inferior spine and a small external spine; the second joint also bears an external spine. The chelipeds are long and slender, all the joints from the ischium to the propodite are equipped with longitudinal rows of small spines; the chela is not broader than the basal part of the propodite, the fingers are straight, their prehensile edges denticulate. The ambulatory appendages are spinulose. There are no epipodites on the five pairs of legs.

Length of a male, 49 mm.; length of carapace, 25 mm.; breadth of carapace, 14 mm.; length of rostrum, 9 mm.; length of cheliped, 47.5 mm. (merus, 15 mm., carpus, 5.5 mm., chela, 19 mm.).

Station 3394. 511 fathoms. 13 males, 16 fem. ovig.

" 3395. 730 " 3 males.

Munidopsis depressa Fax.

Plate XXII., Fig. 2, 2a, 2b.

Bull. Mus. Comp. Zoöl., XXIV. 189, 1893.

Closely allied to *M. hamata*, but differs as follows: the cephalothorax is more swollen, so that the sides of the carapace are visible below the epimeral sutures when the animal is viewed from above. The median row of spines on the carapace consists of a smaller number of spines (two on the gastric region, one on the cardiac region, and one on the posterior margin). The spinules of the lateral margin of the carapace are less developed. The depression on the carapace involves the gastric region to a greater degree. The anterior margin of the carapace is not so straight, and it is not spinuliferous. The antero-lateral spine is more prominent, the eyes smaller, and the antennæ shorter (shorter than the carapace). There is, moreover, no spine on the fifth abdominal segment.

Length, 32 mm.; carapace, 19 mm.; rostrum, 5 mm.; breadth of carapace, 12.5 mm.

Station 3425. 680 fathoms. 1 male.

Munidopsis aspera (Hend.).

Elasmonotus asper Hend., Ann. Mag. Nat. Hist., 5th Ser., XVI. 416, 1885; Rep. Challenger Anomura, p. 163, Plate XIX. Fig. 4, 1888.
Munidopsis aspera Fax., Bull. Mus. Comp. Zoöl., XXIV. 188, 1893.

Station	3357.	782	fathoms.	1 fem. ovig.
"	3358.	555	"	1 male.
"	3370.	134	"	1 fem.
"	3402.	421	"	2 males, 5 fem. (3 ovig.).
"	3403.	384	"	1 male.
"	3406.	551	"	2 males.

This species is subject to considerable variation. In the specimens from Stations 3402, 3403, and 3406, the tubercles of the carapace are more numerous and less spiny than in those secured at the other stations. The ambulatory appendages of all the "Albatross" examples are apparently more spiny than in the types from the "Challenger." The latter came from the Straits of Magellan, 245 fathoms.

Munidopsis quadrata Fax.

Plate XXIII., Fig. 1, 1ª, 1ᵇ, 1ᶜ.

Munidopsis quadrata Fax., Bull. Mus. Comp. Zoöl., XXIV. 188, 1893.
Elasmonotus quadratus A. M. Edw. et Bouv., Ann. Sci. Nat., Zool., 7ème Sér., XVI. 281, 282, 1894.

Carapace quadrangular, the anterior and lateral margins forming a right angle; upper surface flat, spineless, but furnished with low squamous tubercles. Rostrum curved upward, broad at base, narrowing anteriorly to form a long sharp acumen. Central part of gastric region prominent above the anterior branchial lobes, from which it is separated by deep pits. A prominent transverse ridge on cardiac region forming the posterior wall of a deep fossa. Antero-lateral angles rounded. Second segment of abdomen armed with a median spine, which is curved forward; third and fourth segments with a very prominent ridge, which bears an acute median tooth; pleuræ of second segment faintly tuberculate, the others narrow, with the external angles rounded but not truncate. Eye spineless, almost concealed by the base of the rostrum. Antennæ about as long as the carapace; a conspicuous spine on the upper side of the third segment. Cheliped long, tuberculate, with the exception of the fingers; chela slender, fingers not gaping. Ambulatory legs tuberculate, with the exception of the dactyli, which are furnished with small teeth on their posterior margins.

Length of body, 29 mm.; length of carapace, 15.5. mm.; breadth of carapace, 9 mm.; length of rostrum, 6 mm.; length of cheliped, 30 mm.

There is some variation in the length and upward curvature of the rostrum among the different specimens. A female from Station 3424 (Plate XXIII., Fig. 1ᶜ), differs markedly from the males, in having the tubercles on the carapace and appendages much more strongly developed.

Station 3424. 676 fathoms. 2 males, 1 fem. ovig.
" 3425. 680 " 1 male.

Munidopsis carinipes Fax.

Plate XXIV., Fig. 1, 1ª, 1ᵇ.

Munidopsis carinipes Fax., Bull. Mus. Comp. Zoöl., XXIV. 189, 1893.
Elasmonotus carinipes Alcock, Ann. Mag. Nat. Hist., 6th Ser., XIII. 333, April, 1894.
" " A. M. Edw. et Bouv., Ann. Sci. Nat., Zool., 7ème Sér., XVI. 281, 282, May, 1894.

Carapace quadrangular, flat, marked by a median tuberculated ridge on the gastric and cardiac regions; sides converging a little from front back-

ward; the antero-lateral angles form a rounded shoulder. Rostrum broad at base, nearly horizontal; sides converging near tip, which is blunt; upper surface nearly flat, lightly granulated. The rest of the upper surface of the carapace has a coarser granulation. There is a conspicuous hooked tooth on the third and the fourth abdominal segments, and in some specimens there is a rudimentary one on the second and the fifth segments; the teeth on the third and fourth segments have denticulated margins in adult specimens; abdominal pleuræ long and narrow. Chelipeds very long, lightly tuberculate; chela long, slender; fingers rather short, smooth, with straight, denticulated prehensile margins. The meri of the ambulatory legs granulated; superior border produced to a crest, the edge of which is entire; the lower margin of the meri is also entire; the carpi have three tuberculated ridges, one of which is superior, two external; the propodites lightly tuberculated; dactyli smooth, their hind margins armed with about five teeth. Eye spineless, nearly hidden under the rostrum. Antennæ shorter than the carapace; first, third, and fourth joints armed with an external spine.

Length, 30 mm.; carapace, 16 mm.; breadth, 9.5 mm.; rostrum, 5 mm.; cheliped, 40 mm. (merus, 13 mm., carpus, 4.5 mm., propodite, 17 mm., dactylus, 7 mm.).

Station 3353. 695 fathoms. 2 males, 1 fem. ovig.

Near *M. longimana* (*Elasmonotus longimanus* A. M. Edw.), from which it differs in having the rostrum more nearly plane and more tapering, the merus of the cheliped much less strongly tuberculated, the meri of the ambulatory limbs more strongly carinated, with lower margin entire instead of denticulate; the spine on antennal peduncle is more prominent, while the tooth on the second segment of the abdomen is absent, or at best rudimentary. The chelipeds of the female specimen of *M. carinipes* are lost.

Munidopsis inermis Fax.

Plate XXIII., Fig. 2, 2a.

Bull. Mus. Comp. Zoöl., XXIV. 191, 1893.

In this species the whole surface of the body and appendages is naked and free from spines and tubercles. The carapace is rather flat above, with subparallel sides; the gastric region is protuberant, and separated from the hepatic and cardiac areas by conspicuous furrows. The surface of the carapace is punctate, lightly granulate and rugose on the branchial regions.

The rostrum is triangular, blunt at the apex, bent strongly downward, and slightly carinate above. The antero-lateral angle is rounded, and a rounded lobe projects from the anterior margin above the base of the antenna. The abdomen is smooth, naked, devoid of spines and ridges; the abdominal pleuræ are rounded. Ocular peduncle free, spineless. The peduncle of the antenna is also destitute of spines; the flagellum is wanting in the only specimen obtained. The chelipeds are also missing. The ambulatory appendages are smooth, unarmed; the dactyli long (equal to the propodites in length), slightly curved, acute at the tips. The appendages of the third, fourth, and fifth abdominal segments are simple and rudimentary. The merus of the third maxillipeds is short, its antero-internal margin three-toothed; the palpus of this appendage is nearly as long as the merus and ischium combined.

Length 12 mm.; carapace, 6 mm.; breadth, 4 mm.

Station 3354. 322 fathoms. 1 male.

This species nearly resembles *M. polita* (*Anoplonotus politus* Smith), but the carapace of the former is longer and narrower, the rostrum is curved more strongly downward, and the propodites of the ambulatory limbs are much shorter in proportion to the dactyli.

Munidopsis latirostris Fax.

Elasmonotus latifrons Hend., Ann. Mag. Nat. Hist., 5th Ser., XVI. 416, 1885; Rep. Challenger Anomura, p. 160, Plate XIX. Fig. 1, 1888. (*Nom. præoc.*)*

Orophorhynchus latifrons A. M. Edw. et Bouv., Ann. Sci. Nat., Zool., 7ème Sér., XVI. 287, 1894.

Station 3381. 1772 fathoms. 1 fem.
" 3391. 153 " 1 "

In his first description of this species Prof. Henderson describes the eye-stalks as fused with the sides of the rostrum, while in his final report he states that they are slightly movable. In the "Albatross" specimens they are firmly soldered to the rostrum. Henderson also says that the ambulatory limbs have a few short blunt spines on the anterior margin of the meri, carpi, and propodites. In the "Albatross" specimens the spines of the meri are on the posterior margin of the joint, but these specimens agree so well with Henderson's description in other respects that I do not doubt that they belong to the same species. The unique "Challenger" specimen was obtained between Papua and the Admiralty Islands at a depth of 1070 fathoms.

* See pp. 81, 82.

Munidopsis hendersoniana Fax.

Plate XXIV., Fig. 2, 2a, 2b, 2c.

Munidopsis hendersoniana Fax., Bull. Mus. Comp. Zoöl., XXIV. 190, 1893.
Orophorhynchus hendersonianus A. M. Edw. et Bouv., Ann. Sci. Nat., Zool., 7ème Sér., XVI. 287, 1894.

In this species, as in *M. marginata* (*Elasmonotus marginatus* Hend.), *M. edwardsii* (*Elasmonotus edwardsii* W.–M.), etc., the lateral margins of the carapace are produced into sharp crests which overhang the sides of the body. The upper surface of the carapace is rather flat, and is clothed with a close, short pubescence; the sides of the carapace are nearly parallel. The rostrum is long, acute, nearly horizontal, the upper surface roof-shaped. There is a prominent tooth at the external orbital angle, and another smaller one at the antero-external angle of the carapace; otherwise the carapace is unarmed. The eye-stalks are immovable, their proximal ends being anchylosed with the ocular segment; they project forward far beyond the eye, forming sharp horns one half as long as the rostrum; seen from above, the eye-stalks appear like lateral spines of the rostrum; they are pubescent, like the carapace. The antennæ are shorter than the body; their basal segments are armed with a prominent triangular tooth on the anterior margin of the lower side, while the second segments are similarly equipped with a tooth on the outer side. The chelipeds are short and pubescent; there is a prominent spine at the distal superior angle of the ischium, and a tooth near the distal end of the internal margin; five or six teeth along the superior margin of the merus, and one on each side of the distal end of the same segment; the carpus bears a superior tooth near the proximal end, together with three teeth on the distal margin; the chela is short and thick, the hand devoid of teeth or spines; the fingers are very short and thick, meeting one another only at their spoon-shaped denticulated tips; there is a rounded tubercle at the base of the inner margin of the immovable finger; the outer margin of this finger is denticulated. Ambulatory limbs: five to seven spines on the superior and external inferior margin of the meri (those on the superior margin the largest); upper edge of carpus three to four-spined; propodites unarmed; inner margin of dactyli denticulated. Abdomen without spines, somewhat tomentose.

Length, 37 mm.; carapace, 20 mm.; rostrum, 6.5 mm.; breadth of carapace, 12 mm.; length of cheliped, 28 mm.

Station 3393. 1020 fathoms. 3 males, 1 fem. (with *Peltogaster*).

Nearly allied to *M. edwardsii* (Wood-Mason) * of the Bay of Bengal, but easily distinguished from that species by the lateral margins of the carapace, which in Wood-Mason's species are divided into two lobes, whilst in *M. hendersoniana* they are entire.

UROPTYCHUS Hend.

Diptychus A. M. Edw., Bull. Mus. Comp. Zoöl., VIII. 61, 1880 (*nom. præoc*).
Uroptychus Hend., Rep. Challenger Anomura, p. 173, 1888.

Uroptychus nitidus occidentalis Fax.

Plate XXVI., Fig. 1, 1a.

Uroptychus nitidus occidentalis Fax., Bull. Mus. Comp. Zoöl., XXIV. 192, 1893.
Diptychus nitidus, var. *occidentalis* A. M. Edw. et Bouv., Ann. Sci. Nat., Zool., 7ème Sér., XVI. 306, 1894.

Differs from the typical *Uroptychus nitidus* (A. M. Edw.) † as follows: the branchial regions are more swollen, giving to the posterior half of the carapace a more convex lateral outline; the rostrum is shorter, the chelipeds shorter and more robust, the fingers shorter in proportion to the length of the basal part of the propodite; the branchial regions are more distinctly margined. It approaches in some respects *U. uncifer* (A. M. Edw.), in which the rostrum and chelipeds are still shorter. *U. politus* Hend., another closely related form, is distinguished by its short antennal acicle.

Length of body of a female, 29 mm.; length of carapace, 15 mm.; length of rostrum, 4 mm.; breadth of carapace between antero-lateral spines, 5 mm.; breadth across the branchial region, 10 mm.; length of cheliped, 44.5 mm. (merus, 11 mm., carpus, 12.5 mm., chela, 17.5 mm., dactylus, 6 mm.).

Station 3384. 458 fathoms. 2 males, 2 fem. ovig.

Uroptychus pubescens Fax.

Plate XXVI., Fig. 3, 3a, 3b.

Uroptychus pubescens Fax., Bull. Mus. Comp. Zoöl., XXIV. 192, 1893.
Diptychus pubescens A. M. Edw. et Bouv., Ann. Sci. Nat., Zool., 7ème Sér., XVI. 306, 1894.

Carapace, without including rostrum, broader than long, pubescent; a transverse row of spines across the gastric region from one side of the carapace to the other; lateral border of carapace spinose; the anterior margin

* Ann. Mag. Nat. Hist., 6th Ser., VII. 201, 1891.
† Bull. Mus. Comp. Zoöl., VIII. 62, 1880.

has a deep concavity above the eye, outer angle of the concavity armed with a spine. Rostrum one half as long as the rest of the carapace, bent downward a little, acute, with entire setiferous margins. Eye small, not broader than the eye-stalk, with brown pigment. Abdomen naked, smooth, pleuræ subacute. Antennæ equal in length to the carapace with the rostrum; acicle shorter than the peduncle. Chelipeds long, all the joints as far as the fingers spinulose, the spinules with broad bases; propodite not broader than the carpus; carpus equal in length to the basal portion of the propodite; fingers straight, a slight tooth near the base of the dactylus; the tips of the fingers cross. Meri of ambulatory legs minutely spinulose on the superior margin, distal end of propodite spiniferous on the hind margin, whole hind margin of dactylus armed with spines; all the joints of the ambulatory limbs furnished with long setæ.

Length (female), 44 mm.; breadth, 17.5 mm.; length of carapace, 21 mm.; length of rostrum, 7.5 mm.; length of cheliped, 57 mm. (merus, 12 mm., carpus, 15 mm., chela, 24 mm., dactylus, 9.3 mm.).

Station 3354. 322 fathoms. 2 fem. ovig.
" 3355. 182 " 1 fem. ovig.

This species is more nearly related to *U. insignis* Hend. than to any other described species.

Uroptychus bellus Fax.

Plate XXVI., Fig. 2, 2a, 2b.

Uroptychus bellus Fax., Bull. Mus. Comp. Zoöl., XXIV. 193, 1893.
Diptychus bellus A. M. Edw. et Bouv., Ann. Sci. Nat., Zool., 7ème Sér., XVI. 306, 1894.

Carapace broad, branchial regions inflated, upper surface naked, smooth, and polished; the branchio-cardiac lines meet in the median line of the carapace; the anterior margin has a concavity above the eye, forming an orbit with a spinule at its external angle. There is one spine at the antero-lateral angle of the carapace, and ten or eleven on the lateral margin; the lateral spines decrease in size posteriorly. The rostrum is long, tapering, acute at the apex, and concave at the base above. The abdomen is smooth, the pleuræ subacute. The eye-stalks are short and stout, the eye not wider than the peduncle, black. The antennæ are very slender, shorter than the carapace, the acicle considerably shorter than the peduncle. Chelipeds very long, naked except for a few setæ on the fingers, polished; the ischium bears a spine on the superior margin and several others on the

lower side; the merus and carpus are armed with spines arranged in longitudinal rows; there is a row of spines on the upper margin of the propodite (the row is double at the proximal end), another series on the outer face reaching from the proximal end about half way to the distal end, and another still shorter row of more rudimentary spines just outside the latter series; the fingers are separated by a gap; their prehensile edges are denticulate, with one or more prominent teeth near the base of the dactylus. Ambulatory appendages: meri and carpi of the first and second pairs spinulose along the upper edge, these joints being spineless on the third pair. All of the ambulatory appendages are subchelate, the distal end of the propodite being enlarged and furnished with spines against which the spined dactylus closes.

Length (male), 17 mm.; carapace, 10.5 mm.; rostrum, 4.5 mm.; breadth of carapace, 7.7 mm.; cheliped, 31 mm. (merus, 7 mm., carpus, 9 mm., chela, 14 mm., dactylus, 5 mm.).

Station 3354. 322 fathoms. 1 fem. ovig.
" 3355. 182 " 1 male.

Family AXIIDÆ.

AXIUS Leach.

Trans. Linn. Soc. London, XI. 335, 343, 1815.

Axius acutifrons (Bate).

Plate XXVIII., Fig. 2.

Eiconaxius acutifrons Bate, Rep. Challenger Macrura, p. 40, Plate V. Fig. 2, 1888.
Axius acutifrons Fax., Bull. Mus. Comp. Zoöl., XXIV. 193, 1893.

Station 3358. 555 fathoms. 2 males, 4 fem. ovig.
" 3359. 465 " 3 males, 3 fem. (2 ovig.).

The Challenger specimens were taken off Banda, lat. 4° 31′ S., long. 129° 57′ 20″ E., in 360 fathoms.

The females carry about nine eggs, which are large for the size of the animal (1.5 × 1 m.).

Spence Bate established the genus *Eiconaxius* to receive three species from the "Challenger," which differ from *Axius stirhynchus* Leach — the type of the genus *Axius* — in the presence of a long spine (stylocerite) on the second joint of the external antennæ outside of the movable acicle (scapho-

GENERAL CONSIDERATIONS ON THE DISTRIBUTION.

THE route of the "Albatross," as will be seen by reference to the accompanying chart, traverses about twenty-nine degrees of latitude, from 1° S. (Galapagos Islands) to 28° N. (Guaymas, in the Gulf of California). In a longitudinal direction the region explored extends from 78° 34′ 20″ W. (Gulf of Panama) to 110° 53′ 4″ W. (Guaymas). An account of the topography of the region is given by Mr. Agassiz in his general sketch of the expedition.* The bathymetrical range explored is very great, extending as it does from the surface and the shore line to 2232 fathoms.

In order to apprehend the faunal relations of the Crustacea of this region it will be convenient to consider separately the littoral and the deep-sea species. The littoral as distinguished from the deep-sea fauna may be taken to include the animals living between the shore and a depth of 100 to 150 fathoms. But it must be borne in mind that there is no definite line dividing the littoral from the deeper fauna. In a general sense the depth specified may be taken as that above which we find, but in a slight degree at most, those structural modifications which respond to the peculiar conditions obtaining at greater depths.

That the temperature of the sea is the chief factor governing the distribution of marine Crustacea has been recognized by all writers on the subject. In 1838 Milne Edwards† wrote: "l'étude de la distribution géographique des Crustacés fait apercevoir aussi une *coïncidence remarquable entre la température des diverses régions carcinologiques et l'existence ou la prédominance de certaines formes organiques.* Ainsi, quoique les Crustacés des Antilles et des mers de l'Inde soient tous ou presque tous d'espèces différentes, ils ont entre eux une analogie si grande, que les deux faunes offrent le même aspect général et se distinguent facilement de celles appartenant aux régions froides de l'un et de l'autre continent. . . . Les régions tempérées ont aussi entre

* Bull. Mus. Comp. Zoöl., Vol. XXIII., No. 1, with maps, 1892.

† Ann. Sci. Nat., Zool., 2e Sér., X. 156, 157.

elles des points de ressemblance multipliés." In 1852 Dana* published a chart to illustrate the distribution of marine animals. On this chart the waters of the globe are divided into five great circumterrestrial zones, whose potent influence controls the distribution of marine life. The limits of these zones are determined by isocrymal lines, or lines of equal mean temperature of the surface water during the coldest month of the year. The Torrid or Equatorial Zone is bounded north and south by the isocryme of 68° F., — the limit of reef-building corals. The North and South Temperate Zones are included between the isocrymal lines of 68° and 35°, the North and South Frigid or Polar Zones between the isocrymes of 35° and 26°.

The relations existing between littoral Crustacea from similar latitudes around the whole circuit of the globe make it clear that the primary faunal divisions should be drawn with reference to the isocrymal lines. Yet Dana† proceeds to base his fundamental faunal areas or "kingdoms" chiefly on north and south lines running *across* the isocrymes, in accordance with the general trend of the great continental shores. His Arctic and Antarctic kingdoms alone are determined by latitude. Miers,‡ Henderson,§ and other recent carcinologists have followed Dana's method.

But other zoölogists who have treated of the distribution of the littoral marine fauna have based their primary divisions on the isothermal lines. Thus, according to the Danish conchologist Mörch,‖ the marine fauna falls

* United States Exploring Expedition, Vol. XIII., Pt. II., p. 1451.

† *Op. cit.*, pp. 1530, 1554, etc.

‡ Brachyura of the Challenger Expedition, p. xvii, 1886. Dana's and Miers's primary faunal regions may be readily compared as follows: —

Dana. Kingdoms.		Miers. Regions.
Africo-European	Europe. W. Africa.	Atlantic.
Occidental	E. America. W. America	Occidental.
Oriental	E. Africa, Indian Ocean. Pacific coasts and islands, except W. America.	Oriental or Indo-Pacific.
Arctic	Arctic shores, including Norway, Iceland, Greenland, Alaska, etc.	Arctic or Boreal Circumpolar.
Antarctic	Antarctic shores, including So. Patagonia, So. New Zealand, etc.	Antarctic or Austral Circumpolar.

§ Anomura of the Challenger Expedition, p. 197, 1888.

‖ Malakozoolog. Blätter, VI. 104, 1860.

into two great primary divisions, the Polar and the Tropical; the Polar being subdivided into North- and South-Polar and North- and South-Subpolar, the Tropical into Indo- and Atlantico-Tropical and North- and South-Subtropical. A similar mode of division is adopted by Günther * and Gill † in treating of the distribution of shore fishes. Gill in particular protests against making the lay of the continents the prime factor in the distribution of littoral marine animals, re-affirming what had long before been pointed out by Milne Edwards and others: "The tropical faunas are much more closely related to one another than they are to the faunas along the same reach of shore toward the arctic or antarctic regions. This relationship is evinced more or less in every class and branch of animals. . . . Consequently, the marine faunas cannot be at all correlated with the primary [terrestrial or inland] realms or regions of the globe." He then proceeds logically to divide the littoral marine fauna into five primary circumterrestrial realms whose boundaries are determined by the isocrymal lines. These realms are the Arctic, Pararctic or North Temperate, Tropical, Notalian or South Temperate, and Antarctic.

It is true, as Gill well says, that the relations between the littoral marine faunæ in a longitudinal direction are traversed and complicated by relations existing in a latitudinal direction. This must necessarily result from the easy routes of migration afforded by the great coast lines and from the dispersal of the larvæ of tropical species northward and southward by the deflected equatorial currents. But, on the whole, the change of temperature encountered in passing from low to high latitudes has proved a barrier to the spread of tropical littoral types northward — a more effectual barrier, it would seem, than the immense distances between the tropical shores of the different continents have proved to be against the intertropical dispersal of such types around the globe. Every summer myriads of delicate larvæ, belonging to tropical and subtropical genera, such as *Ocypode* and *Calappa*, are borne on the warm bosom of the Gulf Stream to the southern shores of New England, only to perish on the approach of the northern winter. Yet these same genera are represented by flourishing colonies established on tropical shores around the whole girdle of the globe. Geological evidence goes to show that the tropical Atlantic and Pacific were formerly connected over the region now occupied by the Isthmus of Panama, Central America, and parts

* Introduction to the Study of Fishes, p. 259, 1880.

† The Nation, XXV. 43, 1877; Proc. Biolog. Soc. Washington, II. 32–36, 1885.

of Mexico, and that this connection was not completely severed till late in the Tertiary period. It is obvious that the former uninterrupted sweep of the equatorial current from the Atlantic into the Pacific must have served as an important agent in disseminating tropical types around the earth.

Littoral species of the cold and temperate zones have this advantage over tropical types in the matter of distribution on north and south lines: the temperature of the sea rapidly falls in passing from the surface downward, so that even under the equator a temperate degree of heat is found at a moderate depth. Availing themselves of this, many littoral species of the North and South Temperate realms, by moving into the deeper and colder waters have extended their range toward the equator. For example, *Cancer borealis*, whose normal range as a strictly shore species is limited on the south by the New England coast, was found during one of the cruises of the "Blake" in 142 fathoms off the coast of South Carolina, living in a temperature of 56½ F. under a surface temperature of 81°. Eluding in this way the fatal heat of the tropics, certain species of the temperate zone have actually passed under the equator and invaded the opposite hemisphere. *Cancer longipes*, a shore crab of Chile, was dredged by the "Albatross" in the Gulf of Panama at a depth of 210–286 fathoms, above the seventh parallel of north latitude. The bottom temperature here was 46° to 49° F., while the surface temperature was 72°–74°. The extreme surface temperatures at Valparaiso are given as 52° and 62°.* *Platymera gaudichaudii* is another crab long known to naturalists as a native of the shores near Valparaiso. This species also was found by the "Albatross" in the Gulf of Panama, living at a depth of 127 fathoms in a temperature of 56° (surface temperature, 74°). The same species was secured during another cruise of the "Albatross" much further north, off the California coast from the latitude of San Diego to San Francisco. It is of interest to note that near the northern limit it was found even at as slight a depth as 26 fathoms, where it enjoyed the congenial temperature of 58°.

In this way, doubtless, it has come about that many littoral genera (e. g. *Cancer* and *Lithodes*) of the Arctic and North Temperate regions are represented on the shores of corresponding latitudes in the southern hemisphere, albeit they are unknown from the vast stretch of intervening coast.

This extension of the range of Arctic and Temperate littoral animals toward the equator in the cold off-shore waters finds a close parallel in the distribution of land animals. I refer to the well known influence which alti-

* The means of the coldest and warmest thirty consecutive days of the year.

tude, with its accompanying low temperature, exerts in extending the southern limit of a northern fauna.

The western coast of Central America and Mexico from Panama to Guaymas — the region explored by the "Albatross" in 1891 — forms a small part — the so-called Panama Province — of the great Tropical carcinological Realm. The immediate origin and special relations of this fauna remain to be considered.

As soon as the shore Crustacea of the Panama Province came to be known with any degree of fulness, chiefly through the publications of William Stimpson, it appeared that they belonged, with few exceptions, to genera living on the Atlantic side of the continent, in the Gulf of Mexico and the Caribbean Sea. It also appeared that although but few identical species inhabited the two coasts,* yet a very large number of the Panamian species were represented by corresponding, closely related species in the Caribbean Sea. In many cases these "representative" species on the two sides of the continent are barely distinguishable, and, were it not for the continental barrier separating the seas inhabited by them, they would be deemed but varieties or geographical races of one species.

I have brought together in the following list some of the similar littoral species of the Panamian and Caribbean Provinces. Cosmopolitan species are of course omitted.†

Pacific Coast.	Atlantic Coast.
Leptopodia debilis.	Leptopodia sagittaria.
Podochela vestita.	Podochela riisei.
Anasimus rostratus.	Anasimus fugax.
Collodes granosus.	Collodes trispinosus.
" tenuirostris.	
Batrachonotus nicholsi.	Batrachonotus fragosus.
Euprognatha granulata.	Euprognatha rastellifera.
Sphenocarcinus agassizi.	Sphenocarcinus corrosus.
Epialtus sulcirostris.	Epialtus affinis.
Tyche lamellifrons.	Tyche emarginata.

* The following Decapods, in addition to certain species of world-wide range, have been recorded from the Panamian and West Indian sides:

Microphrys weddellii, Acanthonyx petiverii, Carcinus mænas, Cronius ruber, Achelous spinimanus, Gelasimus maracoani, G. heterocheles, G. vocator, G. stenodactylus, Geograpsus lividus, Ocypode arenaria, Aratus pisoni, Goniopsis cruentata, Hippa emerita, Petrolisthes armatus, Alpheus minor, A. heterocheles. The species of *Gelasimus* and *Alpheus* are given on Kingsley's authority. Both of these genera need careful revision.

† A few species are included which are not *very* closely related, but which are *the only species of the genus known, e. g.*, the two species of *Sphenocarcinus*. Such cases point in the same direction as the rest, *i. e.* to the West Indian origin of the Panamian littoral fauna.

Pacific Coast.	Atlantic Coast.
Herbstia camptacantha.	Herbstia depressa.
Pelia pacifica.	Pelia mutica.
Libinia macdonaldi.	Libinia spinimana.
Pericera fossata.	Pericera trispinosa.
" triangulata.	" spinosissima.
Othonia sexdentata. }	Othonia lherminieri.
" quinquedentata. }	
Thoe sulcata. }	Thoe puella.
" erosa. }	
Mithrax armatus.	Mithrax spinosissimus.
" sinensis. }	" hispidus.
" tuberculatus. }	
Lambrus hassleri.	Lambrus pourtalesii.
Solenolambrus arcuatus.	Solenolambrus typicus.
Mesorrhœa gilli.	Mesorrhœa sexspinosa.
Heterocrypta macrobrachia.	{ Heterocrypta granulata.
	{ " sp. non descr.
Actæa sulcata.	Actæa nodosa.
" dovii.	" setigera.
Glyptoxanthus labyrinthicus.	Glyptoxanthus erosus.
Lophactæa rotundata.	Lophactæa lobata.
Xantho stimpsoni.	Xantho denticulatus.
Panopeus validus.	Panopeus herbstii.
" latus.	" xanthiformis.
Menippe obtusa. }	Menippe mercenaria.
" frontalis. }	
Leptodius occidentalis.	Leptodius floridanus.
Ozius perlatus.	Ozius reticulatus.
Heteractæa lunata.	Heteractæa ceratopus.
Pilumnus xantusii.	Pilumnus aculeatus.
" limosus.	" gemmatus.
Eriphia squamata.	Eriphia gonagra.
Arenæus mexicanus.	Arenæus cribrarius.
Neptunus iridescens.	Neptunus spinicarpus.
Achelous affinis.	Achelous depressifrons.
Callinectes toxotes. }	{ Callinectes bocourti.
" bellicosus. }	{ " ornatus.
" arcuatus. }	{ " tumidus.
	{ " danæ.
Speocarcinus granulimanus.	Speocarcinus carolinensis.
Gelasimus gracilis.	Gelasimus pugnax.
Calappa convexa.	Calappa galloides.
Æthusa lata.	Æthusa microphthalma.
Uhlias ellipticus.	Uhlias limbatus.
Ranilia angustata.	Ranilia muricata.
Raninops fornicata.	{ Raninops constricta.
	{ " stimpsoni.
Cymopolia tuberculata.	Cymopolia dilatata.
" zonata.	" dentata.

Pacific Coast.	Atlantic Coast.
Hypoconcha panamensis.	Hypoconcha sabulosa.
	" arcuata.
Lepidopa myops.	Lepidopa scutellata.
Clibanarius panamensis.	Clibanarius vittatus.
Paguristes degueti.	Paguristes depressus.
	" sericeus.
Paguristes fecundus.	Paguristes lymani.
Pylopagurus longimanus.	Pylopagurus ungulatus.
" affinis.	
" hirtimanus.	" rosaceus.
Spiropagurus occidentalis.	Spiropagurus iris.
Petrolisthes occidentalis.	Petrolisthes sexspinosus.
Sicyonia affinis.	Sicyonia edwardsii.
Lysiosquilla desaussurei.	Lysiosquilla scabricauda.
Squilla panamensis.	Squilla intermedia.
" biformis.	

But few characteristically Indo-Pacific genera are found in the Panamian Province. An *Æthra* from the western coast of Mexico has been described by S. I. Smith as a new species by the name of *Æ. scutata*, but A. Milne Edwards regards it as a mere variety of the Indo-Pacific *Æ. scruposa*. *Daira americana* Stimps., a species closely related to the Indo-Pacific *D. perlata* (Herbst), inhabits the western coast of Central America and Mexico. Four species of *Trapezia* and one species of *Quadrella* have also been found on the same coast.* Of the two known species of *Chorilibinia*, one comes from Northern Australia and New Guinea, the other from the Gulf of California. One species of *Carpilodes* (*C. cinctimanus*), a genus rather characteristic of the Indo-Pacific region, is recorded from Cape St. Lucas.† Still, the number of peculiarly Indo-Pacific genera is so small as barely to give a perceptible tinge to the Panamian fauna. The great sea-distances separating the tropical Indo-Pacific Province from the Panamian, together with the adverse equatorial current which sets against the richer fauna of the East, have allowed a marked differentiation to come about between these two provinces of the great Tropical Realm. On the other hand, the small number of genera peculiar to the Panama fauna, and the large number, not only of West In-

* *Trapezia rufopunctata* (Herbst), an Indo-Pacific species, recorded from the island of Socorro; *T. cymodoce* (Herbst), also an Indo-Pacific species, from Panama and Acapulco; *T. formosa* Smith, from Panama; *T. nigrofusca* Stimps., from Cape St. Lucas; *Quadrella nitida* Smith, from Panama. Two species of the eastern genus *Myra*, from the Gulf of California, have been recently described by Miss M. J. Rathbun (Proc. U. S. Nat. Mus., XVI. 255, 256, 1893). But this genus is hardly separable from the American genus *Persephona*.

† *Remipes testudinarius*, although it belongs to a *genus* of circumterranean distribution, belongs in the category of *species* which have reached the west shore of tropical America from the Indo-Pacific region.

dian genera but also of species closely allied to those of the West Indies, point to a common origin of these two faunæ in the great Caribbæo-Mexican Gulf which formerly opened freely into the Pacific over the region now occupied by Central America and Mexico.* This communication between the Caribbean Sea and the Pacific was not barred at the Isthmus of Darien apparently before the Miocene.†

The relationship between the littoral faunæ of the Atlantic and Pacific coasts of tropical America has often been pointed out by writers on the different classes of marine animals. Even before geological evidence was available a former water-way across the Isthmus of Darien was invoked to explain the existence of identical or analogous species on the opposite shores.

In 1856 Philip P. Carpenter‡ made a comparison between the littoral Mollusca of the Atlantic and Pacific shores of tropical America, and listed as common to both shores 35 identical species, and 34 species likely to prove identical; together with 67 Pacific species represented in the West Indies by closely allied or analogous species. He also pointed out the general dissimilarity of the Panamian and Indo-Pacific Molluscan faunæ. On comparing the marine Mollusca of Panama with those of the West Indies, Mörch§ concluded that the Panama Province, although geographically a part of the Pacific, yet faunally belonged to the tropical Atlantic, its affinities with the Indo-Pacific region being comparatively remote.

Later conchologists, by nicer discrimination, have very much reduced the number of *identical* species, but have not thereby effaced the relationship between the two faunæ. Even Fischer,‖ who believes that the affinity between the faunæ of the opposite sides of the Isthmus is much more remote than has been maintained by many writers, admits the striking distinctness of the Panama fauna from the Indo-Pacific.

Of the 193 kinds of Central American shore Fishes known to Dr. Günther** in 1869, 59 (or 30½ p. c.) were found on both the east and west coasts. In a later work†† the same author asserts that the genera of Fishes are with

* See A. Agassiz, Mem. Mus. Comp. Zoöl., X., No. 1, p. 82, 1883; Bull. Mus. Comp. Zoöl., XIV. 112, 1888.

† See W. M. Gabb, Proc. Amer. Philosoph. Soc., XII. 571, 572, 1872, and Dall and Harris, Bull. U. S. Geolog. Surv., No. 84, p. 151, 1892.

‡ Rep. Brit. Assoc. Adv. Sci. for 1856, pp. 362 *et seqq.*, 1857.

§ Beiträge zur Molluskenfauna Central-Amerika's, von O. A. L. Mörch. Malakozoolog. Blätter, herausgeg. v. Menke u. Pfeiffer, VI. 107, 1860.

‖ Manuel de Conchyliologie, p. 167, 1881.

** Trans. Zoölog. Soc. London, VI. 397, 1869.

†† Introduction to the Study of Fishes, pp. 279, 280, 1880.

scarcely any exception identical on the two sides of Central America, and that one half of the species are common to both coasts. D. S. Jordan* considers the assumption of complete identity to be erroneous in 30 out of Günther's 59 cases, so reducing the percentage to 15. Of 407 species of Fishes known in 1885 to inhabit the Pacific coast between Cape St. Lucas and Panama, only 71 species or 17½ p. c. are considered by Jordan to be common to both the Atlantic and Pacific coasts. He therefore concludes that "the two faunæ show no greater resemblances than the similarity of physical conditions on the two sides would lead us to expect" without resorting to the hypothesis of a recent communication between the two oceans. Many of the species found on both coasts according to Jordan often ascend rivers and may have been diffused by crossing from marsh to marsh during the rainy season.

In determining the genetic relationship between two faunæ one must take into account not merely the species that are absolutely indistinguishable to the discriminating eye of a modern systematist but also the number of common genera and the number of closely allied or representative species. The observations of Jordan and other recent ichthyologists have very much increased the percentage of representative species from the two coasts of Central America, at the expense of the identical ones. For it may be assumed that the Caribbean and Panamian Fishes considered conspecific by Dr. Günther are at any rate closely allied. This degree of divergence between the faunæ of the two coasts is only what one might expect to find, if the passage through the Isthmus of Panama has been closed, as seems probable, since the early Miocene.

The belief that the resemblance between the Panamian and Caribbean faunæ is due to the intercommunication of the tropical Atlantic and Pacific within comparatively late geological times does not rest upon a hypothetical basis, if we can rely upon the observations of the late W. M. Gabb,† who spent three years in the exploration of San Domingo. This geologist found in the San Domingo Miocene 217 extinct, and 97 still living species of Mollusca, the still surviving forms existing on both sides of Central America, which barrier is capped by Miocene rocks. Fifteen of the 97 surviving species are now restricted to the Panama Province, having disappeared from the Caribbean waters since the Miocene period.

* Proc. U. S. Nat. Mus., VIII. 394, 1885. Cf. also Evermann and Jenkins, Proc. U. S. Nat. Mus., XIV. 123 *et seqq.*, 1891.

† See Proc. Amer. Philosoph. Soc., XII. 571, 1872.

According to A. Agassiz* the littoral Echinoid fauna of the Panama district is a mixed one, including generic elements from the adjoining districts. *But the strictly Panamian species are with few exceptions representatives of the West Indian types.* In a later work† the same author says that the principal differences in the Echinoid fauna on the two sides of the Isthmus are due to the immigration of true Atlantic types into the West Indian faunal region during the Tertiary and Post-Tertiary periods, after the Gulf of Mexico and the Caribbean Sea ceased to be in freer communication with the Pacific than with the Atlantic.

The total dissimilarity of the Coral fauna on the opposite sides of the Isthmus cannot be ignored.‡ It may be explained in part by the extreme sensitiveness of the reef-building species, such as flourish in the Caribbean Sea, to physical conditions. Mr. Agassiz§ tells us that there could be no more striking contrast in topography than that between the Caribbean and the sea on the western side of Central America, with its abrupt continental slope and silt-covered floor. To the enormous amount of silt that covers the ocean bottom, Agassiz attributes the absence of reef-building corals on the west coast, while Dana and others have ascribed it to the cold currents from the north and south that wash these shores, lowering the surface temperature at the Galapagos in the month of November, it is said, to 62° F. The affinity between the *Miocene* West Indian Corals and the recent species of the Pacific, which has been pointed out by Duncan‖ shows that the present dissimilarity is a result of the exclusion of the Pacific from the Caribbean Sea.

Below the littoral zone there lies a belt, extending say from 150 to 500 fathoms, which forms a sort of debatable ground, invaded on the one hand by littoral types from above, and on the other by characteristic deep-sea forms from below. Mingled with these are certain genera whose evolution finds its fullest expression in this intermediate zone. In illustration: *Cancer longipes* and *Pleuroncodes monodon* are shallow-water species of the coast of Chile which by descending into the cold waters of the intermediate belt have been enabled to extend their range into the heart of the tropics. *Paralomis* is a genus of probable Patagonian origin which in a similar way has worked northward in the cold waters of this intermediate bathy-

* Mem. Mus. Comp. Zoöl., III. 221, 1872. † Mem. Mus. Comp. Zoöl., X., No. 1, p. 79, 1883.
‡ See Verrill, in Proc. Boston Soc. Nat. Hist., X. 323, 1866.
§ Bull. Mus. Comp. Zoöl., XXIII. 9, 1892.
‖ Quarterly Journ. Geolog. Soc. London, XIX. 406–458, 1863; XX. 20–44, 1864.

metrical belt. *Lithodes*, a shallow-water form in the cold seas of both the Northern and Southern Hemisphere, is found in the tropics only at considerable depths. *Munida*, too, is a type of world-wide distribution in comparatively shallow waters of the North and South Temperate regions. But it reaches its maximum development in moderately deep water (100–300 fathoms) within the tropics, and one species (*Munida stimpsoni*) has been found in the West Indian region at so great a depth as 1105 fathoms.* *Xanthodes*, *Ebalia*, *Solenocera*, and *Sicyonia*, are littoral or sublittoral genera of cosmopolitan range in the warmer seas of the globe. *Cymopolia* is also a genus of extended geographical range, with a vertical distribution from the shore to 298 fathoms. *Catapagurus* has been hitherto known from the east coast of North America, 50–300 fathoms, and from the Arafura Sea and the Feejee Islands, 28 fathoms; the "Albatross" species has most affinity with that from the Arafura Sea. *Æthusa* and *Pasiphaeia* are cosmopolitan genera with a bathymetrical range extending from the littoral belt and the surface to 1000 fathoms. *Anamathia*, *Uroptychus*, *Iconaxius*, and *Aristæus* have their fullest development in the intermediate zone between 150 and 500 fathoms. They are all genera of world-wide range, unless it be *Iconaxius*, which has hitherto been found only on the east and west sides of the Pacific. The following genera represented in the material collected by the "Albatross" at a depth less than 500 fathoms may be considered as deep-water types which overlap the limit of the intermediate belt: *Munidopsis*, *Polycheles*, *Glyphocrangon*, *Heterocarpus*, *Nematocarcinus*, *Acanthephyra*, *Benthesicymus*, and *Gnathophausia*.

The following list indicates the genera found below the 500 fathom line; those whose range extended beyond 1000 fathoms are printed in italics: —

Trachycarcinus.	*Eryonicus.*	Peneus (1 species).
Æthusina.	Sclerocrangon.	*Peneopsis.*
Leptolithodes.	*Pontophilus.*	*Haliporus.*
Lithodes	Paracrangon.	*Hemipeneus.*
Parapagurus.	*Glyphocrangon.*	*Benthesicymus.*
Galacantha.	*Heterocarpus.*	*Gennadas.*
Munidopsis.	Pandalopsis.	Sergestes ?
Axius (Iconaxius)	*Nematocarcinus.*	*Gnathophausia.*
Calastacus.	*Acanthephyra.*	*Eucopia.*
Nephropsis.	*Hymenodora.*	Petalophthalmus.
Willemoesia.	*Notostomus.*	*Scolophthalmus.*
Polycheles.	*Pasiphaeia ?*	Ceratomysis.

* As a result, chiefly, of the dredging expeditions of the last twenty years, the number of known species of *Munida* has been raised from six to about forty-five.

An analysis of this list discloses the enormous — often cosmopolitan — distribution of deep-sea types and their lack of special affinity with the nearest littoral fauna. Only four new genera were found among the Stalk-eyed Crustacea taken at a greater depth than 500 fathoms, viz. *Trachycarcinus*, *Calastacus*, *Scolophthalmus*, and *Ceratomysis*. Of these, *Trachycarcinus* (a Corystoid crab from 546–695 fathoms) is represented in deep water in the Caribbean Sea by an undescribed species which is probably congeneric, and by *Trichopeltarion* (151 fathoms). Both of these genera are closely related to, and perhaps derived from, *Hypopeltarium*, a shallow water form found on the shore of South America from La Plata around Patagonia to Chile. *Calastacus* is allied to *Calocaris* of the North Atlantic, 150–400 fathoms. *Scolophthalmus*, a deep-sea Schizopod, is probably a near relative of *Hansenomysis* from off the west coast of Greenland, and it is worthy of note that both *Scolophthalmus* and *Ceratomysis* confess by their structure their kinship with *Boreomysis*, a genus which reaches its highest development near the arctic and antarctic regions.

Iconaxius has been previously known from remote parts of the Pacific, — near the Celebes and Kermadec Islands. The only other known species of *Paracrangon* inhabits Puget Sound and the seas near Japan. *Sclerocrangon* is without doubt a genus of boreal origin. It is represented in high northern latitudes by circumpolar littoral species, and on both sides of the Atlantic by deep-water species that range as far south as 31° 57′ N. (*S. agassizii*). One of the "Albatross" west coast species, *S. procax*, extends the range of this genus southward in deep water to within 4° 3′ of the equator (Station 3380, 899 fathoms, bottom temperature 37° F.). The genus *Pandalopsis* is represented in the "Albatross" collection by the same species that was discovered by the "Challenger" off Monte Video. *Petalophthalmus* was known, prior to the "Albatross" Expedition, only through the unique specimen obtained by the "Challenger" Expedition from a great depth in the tropical Atlantic. Like *Scolophthalmus* and *Ceratomysis*, it is related to *Boreomysis*. All the other genera included in the above list may be said to have a world-wide distribution.

That the truly deep-sea Crustacean fauna of the Panama region has no special affinity with the littoral fauna of the same region may perhaps be more clearly shown by placing in two columns the distribution of the Panamian species found below 500 fathoms, or the habitat of representative species, when such are known.

PANAMIAN.	
Trachycarcinus corallinus (546–695 fms.).	Trachycarcinus sp. non descr. Antillean Sea.
Æthusina gracilipes (885–1823 fms.).	Philippines, Arafura Sea, Banda Sea (700–1425 fms.).
" challengeri (2232 fms.).	Japan Seas (1875 fms.).
" smithiana (134–899 fms.).	Æthusina abyssicola. E. coast North America (1497–2221 fms.).
Leptolithodes asper (695 fms.).	L. multispinus. British Columbia, Japan (?–876 fms.).
" longipes (770 fms.).	
Lithodes diomedeæ? juv. (660–1010 fms.).	L. diomedeæ. Off coast of Chile. L. grimaldii. No. Atlantic (410–1458 fms.). L. agassizii. Off coast of Carolina (465–850 fms.).
Parapagurus pilosimanus abyssorum (770–1823 fms.).	Bay of Biscay, Bermudas, Sierra Leone, Tristan d'Acunha, Patagonia, Valparaiso, Banda Sea, Philippines, Papua, Japan, Bay of Bengal, Arabian Sea (740–1997 fms.).
Galacantha rostrata (1175–1360 fms.).	E. coast Europe, West Indies, Juan Fernandez, Banda, Bay of Bengal (G. areolata) (1098–1591 fms.).
" diomedeæ (770–1877 fms.).	Galacantha spinosa. West Indies (333 fms.).
Munidopsis bairdii (1772 fms.).	E. coast United States (1497–1742 fms.).
" ciliata (695–1270 fms.).	M. ciliata. Bay of Bengal, Arru Is., between Papua and Admiralty Is. (800–1310 fms.).
" vicina (1672–1793 fms.).	M. nitida. Caribbean Sea (769 fms.).
" subsquamosa (1471–1672 fms.).	Japan Seas, Bay of Bengal (var. pallida) (1803–1875 fms.).
" subsquamosa aculeata (1793 fms.).	Between Marion I. and the Crozets; W. Patagonia (1375–1450 fms.). M. crassa. E. coast United States (1742–2620 fms.).
Munidopsis villosa (511 fms.).	M. abbreviata. Caribbean Sea (502–734 fms.).
" aspera (134–782 fms.).	Near Patagonia (245 fms.).
" carinipes (695 fms.).	M. longimana. West Indies (372–502 fms.). M. brevimana. West Indies (200 fms.). M. cylindrophthalma. Bay of Bengal (188–220 fms.).
" latirostris (153, 1772 fms.).	Between Papua and Admiralty Is. (1070 fms.).
" hendersoniana (1020 fms.).	M. edwardsii. Bay of Bengal (1310 fms.).
Axius (Iconaxius) acutifrons (465–555 fms.).	Off Banda (360 fms.).
Nephropsis occidentalis (660–676 fms.).	Closely allied species in E. and W. Atlantic, off Arru Is., Bay of Bengal, Arabian Sea (188–922 fms.).
Willemoesia inornata (1322–1823 fms.).	W. leptodactyla. N. and S. mid Atlantic; Mediterranean Sea; off S.W. South America (1300–2000 fms.). W. forceps. West Indies (1920 fms.).

PANAMIAN.

Polycheles nanus (899–1270 fms.).	Atlantic coast United States (705–1917 fms.).
" sculptus pacificus (511–1270 fms.).	P. sculptus. W. Atlantic (464–1400 fms.).
Eryonicus cæcus (400–1832 fms.).	E. cæcus. Off Canary Is. (1620 fms.).
" spinulosus (384 fms.).	E. sp. Bay of Bengal (690–920 fms.).
Sclerocrangon atrox (660–676 fms.).	S. ferox. Arctic Ocean and high North Atlantic from Nova Zembla to Baffin's Bay (shore to 459 fms.).
	S. salebrosa. Kamtchatka (shallow water.).
" procax (660–905 fms.).	S. agassizii. E. and W. Atlantic (263–959 fms.).
Pontophilus occidentalis (978–2232 fms.).	P. abyssi. E. coast North America; Bay of Bengal (1917–2021 fms.).
Glyphocrangon nobilis (770–1360 fms.).	Near Dominica, W. I. (1131 fms.).
	G. acuminata. Feejee Is. (1350 fms.).
Heterocarpus hostilis (695–1020 fms.).	H. alphonsi. Philippines; Japan; Bay of Bengal; Arabian Sea (345–740 fms.).
" affinis (660–680 fms.).	
Pandalopsis ampla (660–676 fms.).	Off Monte Video (600 fms.).
Nematocarcinus ensifer (660–1879 fms.).	East coast North America (588–2033 fms.).
Acanthephyra agassizii (1573–1832 fms.).	A. agassizii. E. coast North America (105–2949 fms.).
	A. purpurea. E. Atlantic (1000 fms.).
	A. sanguinea. Bay of Bengal; Arabian Sea (490–1748 fms.).
" approxima (384–1168 fms.).	Patagonia (400 fms.).
" curtirostris (458–1772 fms.).	Bay of Bengal; Arabian Sea (840–1043 fms.).
" brevirostris (1740 fms.).	E. coast United States (1395–2949 fms.).
Hymenodora glacialis (905–1832 fms.).	North Atlantic, S. to 37° 12′ 20″ (E. coast U. S.) (452–2949 fms.).
Notostomus westergreni (1740 fms.).	N. patentissimus. S. of Philippines (2150 fms.).
Pasiphaeia americana (259–551 fms.).	P. cristata. Feejee Is. (315 fms.).
" princeps (1132 fms.).	E. coast United States (444–1342 fms.).
" acutifrons (384–551 fms.).	Patagonia; Japan (245–775 fms.).
Haliporus nereus (695–1793 fms.).	H. lævis. S. W. of Sierra Leone; off Manila (1050–2500 fms.).
Hemipeneus spinidorsalis (1201–1823 fms.).	So. Atlantic, near Tristan d'Acunha; Philippines (1900–2050 fms.).
" triton (1672–1823 fms.).	H. carpenteri. Bay of Bengal; Arabian Sea (1091–1644 fms.).
Benthesicymus altus (1360–2232 fms.).	Tristan d'Acunha; off Feejee Is.; off Kermadec Is.; Japan; Philippines; between Papua and Australia (345–1900 fms.).
Gennadas sp. (570–1740 fms.).	G. parvus. Cosmopolitan (346–3050 fms.).
Sergestes inous (899 fms.).	S. mollis. E. coast United States; Arabian Sea (373–2949 fms.).
" bisulcatus (242–1793 fms.).	Arabian Sea; Bay of Bengal (738–840 fms.).
Gnathophausia zoea (384–551 fms.).	Bay of Biscay; North and Tropical Atlantic; Pacific, north of Kermadec Is. (600–1850 fms.).

PANAMIAN.	
Gnathophausia willemoesii (493–1270 fms.).	G. willemoesii. S. of Amboina in Banda Sea (1425 fms.). G. sarsii. Bay of Bengal (102 fms.).
" brevispinis (551–1471 fms.).	Bay of Bengal (690–1748 fms.).
Eucopia australis (551–1770 fms.).	North and Tropical Atlantic; Southern Ocean; Antarctic Ocean; Japan; Bay of Bengal; Gulf of Manaar (350–2500 fms.).
Petalophthalmus pacificus (700 fms.).	P. armiger. Tropical mid Atlantic (2500 fms.).

A study of the deep-sea Crustacea thus leads to the conclusion that this fauna is one of cosmopolitan range, indivisible into subordinate local provinces like those of the littoral and terrestrial faunæ. This is what one would expect from the uniformity of conditions prevailing at great depths and from the enormous length of time that has elapsed since modern types of marine Invertebrata came into existence. We have seen not only that many of the denizens of the cold waters of the intermediate zone, even within the tropics, are emigrants from the shallow water of cold and cold-temperate latitudes, but also that very many of the peculiarly deep-sea types betray their kinship with boreal genera. This, in the absence of much light from paleontology in this particular group of animals, may afford us the clew to the origin of a large part of the abyssal Crustacean fauna. Rarely, as in the case of the recent *Eryontidæ*, do we find a deep-sea type that vividly recalls an ancient form. In this case, so good an authority as Boas thinks that the modern deep-water *Polycheles* is identical with the Jurassic *Eryon*. It is of interest to note that in the same beds at Solenhofen — beds of undoubted shallow-water origin — we find with *Eryon* another singularly antiquated type in *Limulus*. But the surviving descendants of *Limulus* are pre-eminently littoral. It is manifestly illogical to assume, as some have done, that because a certain form is now restricted to deep water the rocks in which it occurs as a fossil were deposited at a similar depth. The surviving representatives of an ancient shallow-water type may be littoral, as in the case of *Limulus*, or they may be found only in deep water, like the recent *Eryontidæ*. Some unquestionably bottom-living species at the present day have a vertical distribution of 2000 fathoms. For instance, *Parapagurus abyssorum* ranges from 250 to 2221 fathoms,* and Dall † states that certain species of Mollusca

* Not taking into account the "Challenger" record of this species in 45 fathoms off Patagonia (Henderson, Rep. Challenger Anomura, p. 89, 1888).

† Bull. Mus. Comp. Zoöl., XII. 186, 1886.

on the coast of Florida extend from a few fathoms off shore to 2000 fathoms. Considerations like these will put one on his guard against such an assumption as that above alluded to. Pourtalès was surprised at the bulk and massive type of the West Indian Tertiary simple corals as compared with their modern representatives which he dredged in the Caribbean Sea. But this difference is explicable if we suppose that the ancient forms were littoral. Under the enormous pressure which exists in deep water, great size is possible only when accompanied by a soft and freely permeable texture. The calcareous shells and corals from deep water are generally small, or if large, extremely thin and fragile. The deep-sea Crustacea, as a rule, lack the rigid calcareous coat which protects their littoral relatives. Species living under a pressure of a ton or more to the square inch are often so limp and delicate that it is difficult to secure a perfect specimen. By casting away their armor, their battle with the abyss was won.

The small number of ancient types of Crustacea preserved in the great depths of the ocean is not a subject for wonder if we bear in mind the fact that most of the fossil Crustacea known to us are probably littoral, or from the present point of view, shallow-water forms. The changes in environment to be met and overcome by a highly specialized littoral species in adapting itself to life at great depths are presumably as great, and lead to as much structural modification as those encountered by the littoral descendants of ancient species through the vicissitudes of the shores. As a concrete example, I will instance the family Galateidæ. This family has a very extensive vertical distribution, being represented at all depths from the littoral zone to below 2000 fathoms. But this great distance is apportioned in a rough way among the different genera of the family. In the shallower waters from the shore to 25 fathoms the genus *Galatea* prevails, in the deeper, but not abyssal belt *Munida* comes to the front, while in the greater depths below 500 fathoms the family is represented chiefly by the blind genera *Galacantha* and *Munidopsis*. Now MM. Milne Edwards and Bouvier * have shown, in their interesting memoir on this group, that as we pass from the shallow-water *Galatea*, through *Munida*, to the deep-sea genera *Galacantha* and *Munidopsis*, we depart further and further from the more primitive, generalized, or Macruran type.

In some instances the more primitive types of Crustacea flourish in the

* Considérations Générales sur la Famille des Galathéidés. Par MM. A. Milne Edwards et E. L. Bouvier. Ann. Sci. Nat., Zool., 7ème Sér., XVI. 315–317, 1894.

sublittoral or intermediate depths, while the most highly specialized forms are more characteristic of the very shallow waters. Such is the case with the Paguridæ.*

Doubtless in certain groups of lowly organized animals many species cast in the antique mould survive in the abyssal depths of the ocean. But in highly specialized groups, like the Stalk-eyed Crustacea, — beings endowed with visual and respiratory organs of a very perfect grade, — the peculiar conditions that surround the dwellers of the deep work great structural changes. Correlated with the retrogression of the visual organs, marked changes take place affecting the antennæ and anterior parts of the body generally. The purity of the water in these still regions often leads to a more or less complete disappearance of the epipods or "gill-scrapers."

So it comes about that the Crustacea living at a great depth are apt to be rather specialized types, — further removed from the primitive ancestral stock than are the allied species of the shore. Taking the animal kingdom as a whole, it is probable that the archaic forms now extant in the shallow waters of the land or coast, or in the moderate depths below the strictly littoral zone, far outnumber those surviving in the extreme depths of the sea. *Heterodonta*, the Ganoid fishes, *Limulus*, *Pollicipes*, *Trigonia*, and *Lingula* are all peculiar to shoal water. So are the Unionidæ of the rivers and ponds. *Nautilus* and *Pleurotomaria* come from very moderate depths. The Brachiopods, distributed from the shore-line to 2945 fathoms, attain their maximum development in from 50 to 250 fathoms. The wonderful Crinoid fields, — those lily beds of the Caribbean Sea, — lie at a depth of but 50 to 200 fathoms beneath the surface.

Only in a very broad and general sense may the deep-sea Crustacea, taken as a whole, be called antique types, inasmuch as they are to a very great degree members of the Anomuran or Macruran series, — low in the scale of classification, and in so far more primitive forms. Only four species (representing two genera) of Brachyura were discovered by the "Albatross" below 500 fathoms,† and these low in the Brachyuran scale. As bearing on the suggestion of the boreal origin of the deep-sea Crustacea, it may be observed that the Brachyura, that great group which scarcely tinges the

* Milne Edwards and Bouvier, in Ann. Sci. Nat., Zool., 7 me Sér., XIII. 195, 1892; Mem. Mus. Comp. Zoöl., Vol. XIV., No. 3, p. 9, 1893.

† In the vast amount of material obtained by the "Challenger" during the circumnavigation of the globe only four species (belonging to three genera) of Brachyura came from below 500 fathoms. Two of these are the same as two of the four species secured by the "Albatross" below the 500 fathom line.

complexion of the deep-sea fauna, attain their maximum development within the tropics.

So few pelagic or surface species are included in this Report, that a discussion of the distribution of the pelagic fauna would be out of place here. The experiments in towing at various depths with the self-closing Tanner net proved beyond question that the pelagic fauna may sink during the heat of the day, or under other adverse conditions of the surface, to a depth of 100 to 250 fathoms.*

With regard to the vertical distribution of the species that come up in the dredge or trawl, it may be taken for granted that the ambulatory forms, whose structure fits them only for life on the ocean floor, really come from the bottom. But many natatory species are also captured when dredging at great depths. Such are the swimming prawns belonging to the family Hoplophoridæ, certain Pasiphaeiidæ, Peneidæ, and Sergestidæ, and the deep-sea Schizopods. It is evident that these may never have come from the bottom, but that they may have entered the open trawl on its way up to the surface. The absence or rarity of some of these forms in collections made at or near the surface, taken in connection with structure and color of the animals themselves, signifies that they normally dwell at a great depth. The experiments with the Tanner net towed at great depths, within 100 fathoms or so of the bottom, are of great interest in this connection. At Hydr. Station 2619, the net was towed for sixteen minutes at a depth of 1000 fathoms (100–482 fathoms above the bottom). A specimen of *Eucopia* and a violet colored Amphipod came up in the lower part of the net, which had been closed at 1000 fathoms. At Hydr. Station 2627 (1832 fathoms) the net was towed at 1740–1770 fathoms for twenty minutes, but nothing was captured in the closed part of the net. In the upper part of the net, which came up open all the way from 1740 fathoms to the surface, were four specimens of *Eucopia*. A similar trial at Station 3436 failed through the water shoaling and the net dragging the bottom. At Station 2637 (Gulf of California, 773 fathoms) the net was towed at 70 fathoms above the bottom, but in this case the net came up open to the surface, bringing with it two deep-sea Schizopods, — *Eucopia* and the eyeless *Petalophthalmus*. Again, at Station 2638, in the Gulf of California, the net was towed at a depth vary-

* See A. Agassiz in Bull. Mus. Comp. Zoöl., XXIII. 48–56, 1892, and Ortmann in Bull. Mus. Comp. Zoöl., XXV. 108–110, 1894.

ing from 500 to 570 fathoms, where the soundings indicated a depth of 622 fathoms. A red, deep-sea Peneid, belonging to the genus *Gennadas* was found in the lower, closed part of the net.*

There can be no doubt that the deep-sea natatory Crustacea occasionally come to, or very near to, the surface. The first known specimen of *Hymenodora glacialis*, a species whose rudimentary eyes and whose structure point to the depths as its normal dwelling-place, was taken at the surface, off the east coast of Greenland. An immature specimen of *Acanthephyra agassizii* was caught at the surface, in a dip-net, during the cruise of the "Albatross" off the east coast of the United States in 1884. This specimen was kept alive for half an hour before it was put into alcohol.† A female of the nearly related, if not identical, species, *A. purpurea*, was captured during the "National" Expedition, swimming at a depth of less than 200 fathoms. Spence Bate records a specimen of *Gennadas* secured at the surface on the voyage of the "Challenger." *Amalopeneus*, a genus identical with, or at any rate most closely allied to, *Gennadas*, was found during the "National" Expedition at a depth of less than 200 fathoms. Yet the same thing was captured in the closing-net between 500 and 570 fathoms (bottom 622 fathoms) during the "Albatross" Expedition of 1891, and between 650 and 750 fathoms during the "National" Expedition. The genus *Eucopia* was first made known to science through a specimen recovered from the stomach of a penguin killed in the Antarctic Sea. This specimen was presumably captured by the bird in comparatively shallow water. According to Mr. Agassiz's notes made on board the "Albatross," the same Schizopod was captured in the open part of the Tanner tow-net between the surface and 300 fathoms at Station 3414 (2432 fathoms). Another individual, as we have seen above, was taken in the closed portion of the net at a depth of 1000 fathoms.

Spence Bate suggested that some of the free-swimming Crustacea of the deep sea may approach the surface to spawn, — a plausible theory if one bears in mind the sensitiveness of young animals to cold. As the bottom Crustacea of the deep sea may be supposed, from their structure and affinities, to have originated directly from littoral ancestors, so the deep-sea swimming forms have probably come from pelagic or surface species. It

* At Challenger Exped. Station 267 (2700 fathoms), in the mid North Pacific, a specimen of *Gennadas* was captured in the open tow-net which had only been lowered to within 700 fathoms of the bottom.

† See S. I. Smith, in Ann. Rep. U. S. Fish Comm. for 1885, p. 667, 1886.

may well be that after these types had become acclimated to the depths, their young still found in the ancestral surface life the conditions most favorable for their development. The toad still goes to the water to spawn, the land-crab goes to the sea. The journey of a swimming prawn from a depth of 1000 fathoms or more to the surface to spawn does not impress one as more remarkable than the periodic passage of anadromous fishes from the sea to fresh waters in their solicitude for the welfare of their young. The advantage gained for the race, too, through the wide dispersal of pelagic larvæ by the ocean currents is obvious.

Most of the Stalk-eyed Crustacea, as is well known, protect their eggs for a longer or shorter period after they are laid, either carrying them under the tail, or, as in the Schizopoda, brooding them in a special pouch beneath the breast. In many of the deep-sea species the eggs attain an enormous size before they hatch. From analogy with certain land and fresh-water species, we infer that in these cases the young quits the egg, or, which is the same thing, leaves the mother in an advanced stage of development, ready to lead a life similar to that of its parents. But it is a remarkable fact that none of the deep-sea swimming forms belonging to the family Peneidæ are ever found carrying their eggs. The natural inference from this is that the young must be quickly hatched, in a very immature state, best fitted for surface life, like the larvæ of the littoral species belonging to the same family. This certainly adds weight to Spence Bate's suggestion concerning the occasional occurrence of such forms at the surface. It is also worthy of note in this connection, that *Acanthephyra agassizii*, one of the Hoplophoridæ that has been taken at the surface, has eggs of normal size.

LIST OF SPECIES ARRANGED ACCORDING TO GEOGRAPHICAL REGIONS.*

Gulf of Panama (Stations 3381–3397; 56–1832 fathoms).

Cancer longipes.
Xanthodes sulcatus.
Panopeus latus.
Achelous affinis.
Platymera gaudichaudii.
Æthusa ciliatifrons.
Paralomis diomedeæ.
Lithodes panamensis.
Pylopagurus affinis.
Parapagurus pilosimanus abyssorum.
Pleuroncodes monodon?
Munida obesa.
Munida propinqua.
Munida gracilipes.
Galacantha diomedeæ.
Munidopsis bairdii.
Munidopsis ciliata.
Munidopsis vicina.
Munidopsis subsquamosa aculeata.
Munidopsis agassizii.
Munidopsis villosa.
Munidopsis sericea.
Munidopsis crinita.
Munidopsis tanneri.
Munidopsis hamata.
Munidopsis latirostris.
Munidopsis hendersoniana.
Uroptychus nitidus occidentalis.
Willemoesia inornata.
Polycheles nanus.
Polycheles sculptus pacificus.
Eryonicus cæcus?
Pontophilus occidentalis.
Glyphocrangon alata.
Glyphocrangon nobilis?
Glyphocrangon sicaria.
Heterocarpus vicarius.
Heterocarpus hostilis.
Nematocarcinus ensifer.
Nematocarcinus agassizii.
Acanthephyra agassizii?
Acanthephyra approxima?
Acanthephyra cristata.
Acanthephyra curtirostris (incl. var. γ).
Acanthephyra cucullata.
Hymenodora glacialis.
Pasiphaeia americana.
Pasiphaeia magna.
Sicyonia picta.
Solenocera agassizii.
Peneopsis diomedeæ.
Haliporus nereus.
Hemipeneus triton.
Benthesicymus altus.
Benthesicymus tanneri.
Sergestes bisulcatus.
Gnathophausia willemoesii.
Eucopia sculpticauda.
Squilla biformis.

Off Mariato Point (Stations 3353–3359; 182–782 fathoms).

Maiopsis panamensis.
Xanthodes sulcatus.
Trachycarcinus corallinus.
Ebalia sp.
Cymopolia tuberculata.
Glyptolithodes cristatipes.
Leptolithodes asper.
Catapagurus diomedeæ.
Munida obesa.
Galacantha diomedeæ.
Munidopsis ciliata.
Munidopsis aspera.
Munidopsis carinipes.
Munidopsis inermis.
Uroptychus pubescens.
Uroptychus bellus.
Axius acutifrons.
Axius crista-galli.

* Littoral and surface species are not included in this list.

Polycheles tanneri.
Polycheles sculptus pacificus.
Panulirus sp.
Glyphocrangon spinulosa.
Heterocarpus hostilis.
Nematocarcinus agassizii.
Acanthephyra curtirostris.
Sicyonia picta.
Peneopsis diomedeæ.
Haliporus nereus.
Benthesicymus tanneri.
Ceratomysis spinosa.

Off Galera Point (Stations 3398, 3399; 1573 and 1740 fathoms).

Æthusina gracilipes?
Willemoesia inornata.
Pontophilus occidentalis.
Nematocarcinus ensifer.
Acanthephyra agassizii?
Acanthephyra brevirostris.
Hymenodora glacialis.
Notostomus westergreni.
Haliporus nereus.
Hemipeneus spinidorsalis.
Benthesicymus altus.
Gennadas sp.
Eucopia australis.

Off Malpelo Island (Stations 3377–3380; 52–899 fathoms).

Achelous affinis.
Æthusina gracilipes?
Æthusina smithiana.
Cymopolia fragilis.
Spiropagurus occidentalis.
Paguristes fecundus.
Parapagurus pilosimanus abyssorum.
Munida refulgens.
Polycheles nanus.
Polycheles granulatus.
Eryonicus cæcus?
Sclerocrangon procax.
Heterocarpus hostilis.
Nematocarcinus agassizii.
Sicyonia affinis.
Benthesicymus tanneri.
Sergestes inous.
Eucopia australis.

Between Mariato Point and Cocos Island (Stations 3360–3362; 1175–1672 fathoms)

Æthusina gracilipes?
Parapagurus pilosimanus abyssorum.
Galacantha rostrata.
Munidopsis vicina.
Munidopsis subsquamosa.
Polycheles nanus.
Pontophilus occidentalis.
Acanthephyra cristata.
Acanthephyra curtirostris.
Hemipeneus triton.
Benthesicymus altus.
Benthesicymus tanneri.
Gnathophausia brevispinis.

Off Cocos Island (Stations 3363–3372; 52–1067 fathoms).

Eupronatha granulata.
Sphenocarcinus agassizi.
Lambrus hassleri.
Panopeus tanneri.
Achelous spinimanus.
Æthusa lata.
Æthusina smithiana.
Cymopolia fragilis.
Raninops fornicata.
Leptolithodes longipes.
Lithodes diomedeæ?
Cancellus tanneri.
Eupagurus californiensis.
Pylopagurus longimanus.
Pylopagurus hirtimanus.
Spiropagurus occidentalis.
Parapagurus pilosimanus abyssorum.
Munida refulgens.
Munida microphthalma?
Galacantha diomedeæ.
Munidopsis ciliata.
Munidopsis aspera.
Pontophilus occidentalis.
Glyphocrangon nobilis?
Heterocarpus hostilis.
Nematocarcinus ensifer.
Nematocarcinus agassizii.
Notostomus fragilis.
Sicyonia affinis.
Peneus balboæ.
Haliporus nereus.
Benthesicymus tanneri.

On course from Cocos Island to Malpelo Island (Stations 3373–3376; 1132–1877 fathoms).

Æthusina gracilipes?
Parapagurus pilosimanus abyssorum.
Galacantha diomedeæ.
Willemoesia inornata.
Eryonicus cæcus?
Glyphocrangon nobilis?
Nematocarcinus ensifer.
Acanthephyra curtirostris.
Pasiphaeia princeps.
Hemipeneus spinidorsalis.
Hemipeneus triton.
Benthesicymus altus.
Benthesicymus tanneri.
Gnathophausia brevispinis.

Between Galera Point and Galapagos Islands (Station 3400; 1322 fathoms).

Æthusina gracilipes?
Parapagurus pilosimanus abyssorum.
Galacantha rostrata.
Willemoesia inornata.
Polycheles nanus.
Glyphocrangon nobilis?
Nematocarcinus ensifer.
Haliporus nereus.
Hemipeneus spinidorsalis.
Benthesicymus tanneri.
Gnathophausia brevispinis.
Scolophthalmus lucifugus.

Galapagos Islands (Stations 3401–3411; 53–885 and 1189 fathoms).

Anamathia occidentalis.
Panopeus tanneri.
Æthusina gracilipes?
Lithodes diomedeæ?
Parapagurus pilosimanus abyssorum.
Munida propinqua.
Galacantha diomedeæ.
Munidopsis margarita.
Munidopsis ornata.
Munidopsis aspera.
Polycheles tanneri.
Eryonicus spinulosus.
Glyphocrangon loricata.
Glyphocrangon nobilis?
Nematocarcinus ensifer.
Nematocarcinus agassizii.
Acanthephyra approxima?
Pasiphaeia americana.
Pasiphaeia acutifrons?
Haliporus nereus.
Aristæus occidentalis.
Benthesicymus tanneri.
Sergestes bisulcatus.
Gnathophausia zoea.
Gnathophausia brevispinis.
Eucopia australis.
Eucopia sculpticauda.

Between Galapagos Islands and Acapulco (Stations 3413–3415; 1360–2232 fathoms).

Æthusina gracilipes?
Æthusina challengeri?
Parapagurus pilosimanus abyssorum.
Galacantha rostrata.
Pontophilus occidentalis.
Glyphocrangon nobilis?
Nematocarcinus ensifer.
Acanthephyra curtirostris, var. *β*.
Haliporus nereus.
Haliporus doris.
Haliporus thetis.
Hemipeneus spinidorsalis.
Benthesicymus altus.
Eucopia sculpticauda.

Off Acapulco (Stations 3416–3423; 94–772 fathoms).

Trachycarcinus corallinus.
Lithodes diomedeæ?
Pleuroncodes monodon?
Galacantha diomedeæ parvispina.
Munidopsis hystrix.
Calastacus stilirostris.
Nephropsis occidentalis.
Polycheles sculptus pacificus.
Sclerocrangon atrox.
Sclerocrangon procax.
Glyphocrangon alata.
Glyphocrangon spinulosa.

Glyphocrangon nobilis?
Heterocarpus affinis.
Pandalopsis ampla.
Nematocarcinus ensifer.
Nematocarcinus agassizii.
Acanthephyra curtirostris, var. β.
Benthesicymus tanneri.
Gnathophausia willemoesii.

Near Las Tres Marias (Stations 3424–3428; 80–680 fathoms).

Lambrus hassleri.
Osachila lata.
Lithodes sp.
Munida refulgens.
Galacantha diomedeæ parvispina.
Munidopsis hystrix.
Munidopsis scabra.
Munidopsis quadrata.
Munidopsis depressa.
Nephropsis occidentalis.
Polycheles sculptus pacificus.
Sclerocrangon atrox.
Paracrangon areolata.
Glyphocrangon spinulosa.
Heterocarpus affinis.
Pandalopsis ampla.
Nematocarcinus ensifer.
Benthesicymus tanneri.
Gnathophausia willemoesii.

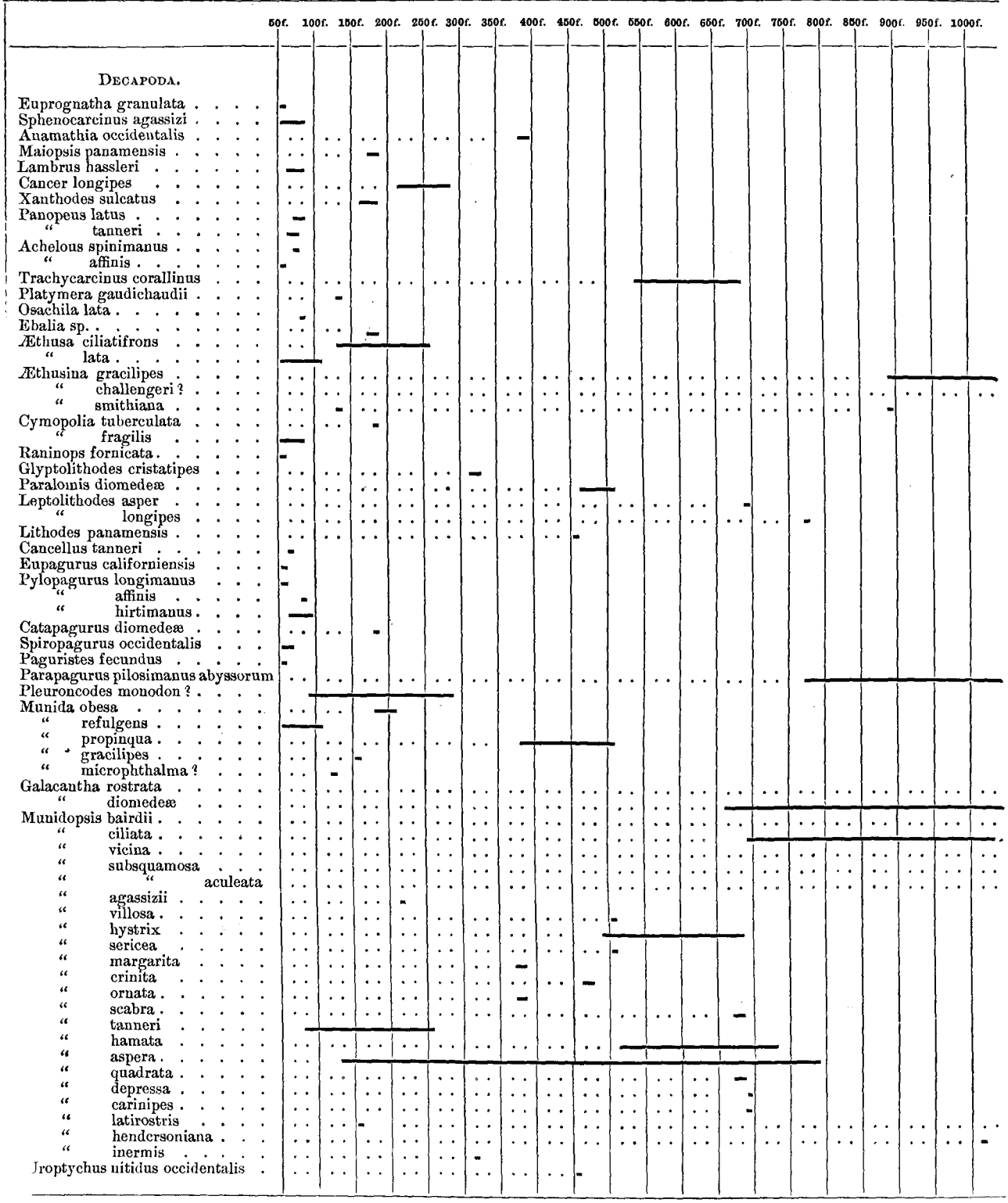
Off Mazatlan (Stations 3429, 3430; 852 and 919 fathoms).

Parapagurus pilosimanus abyssorum.
Galacantha diomedeæ.
Nematocarcinus ensifer.
Acanthephyra curtirostris, var. γ.

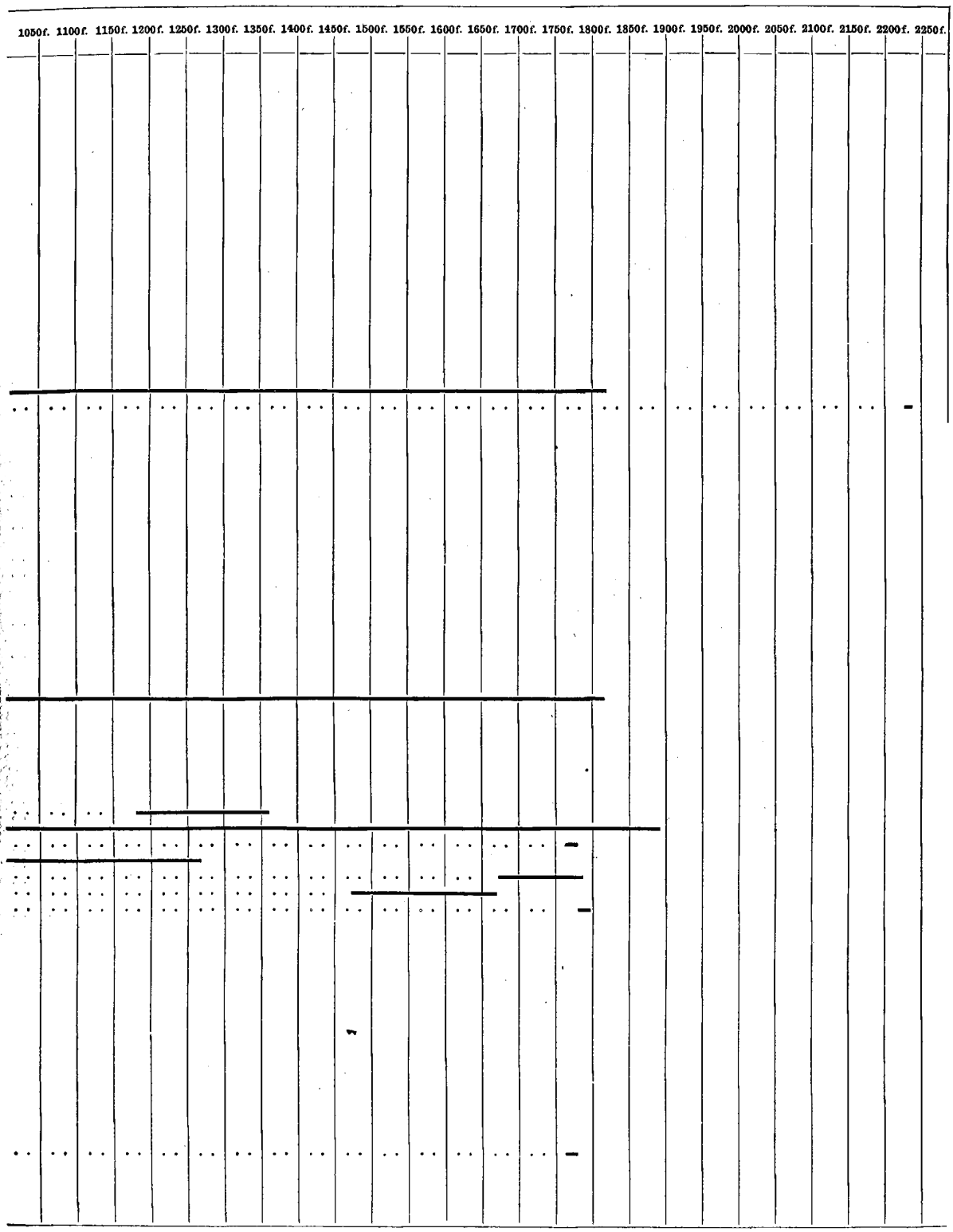
Gulf of California (Stations 3431–3437; 628–1588 fathoms)

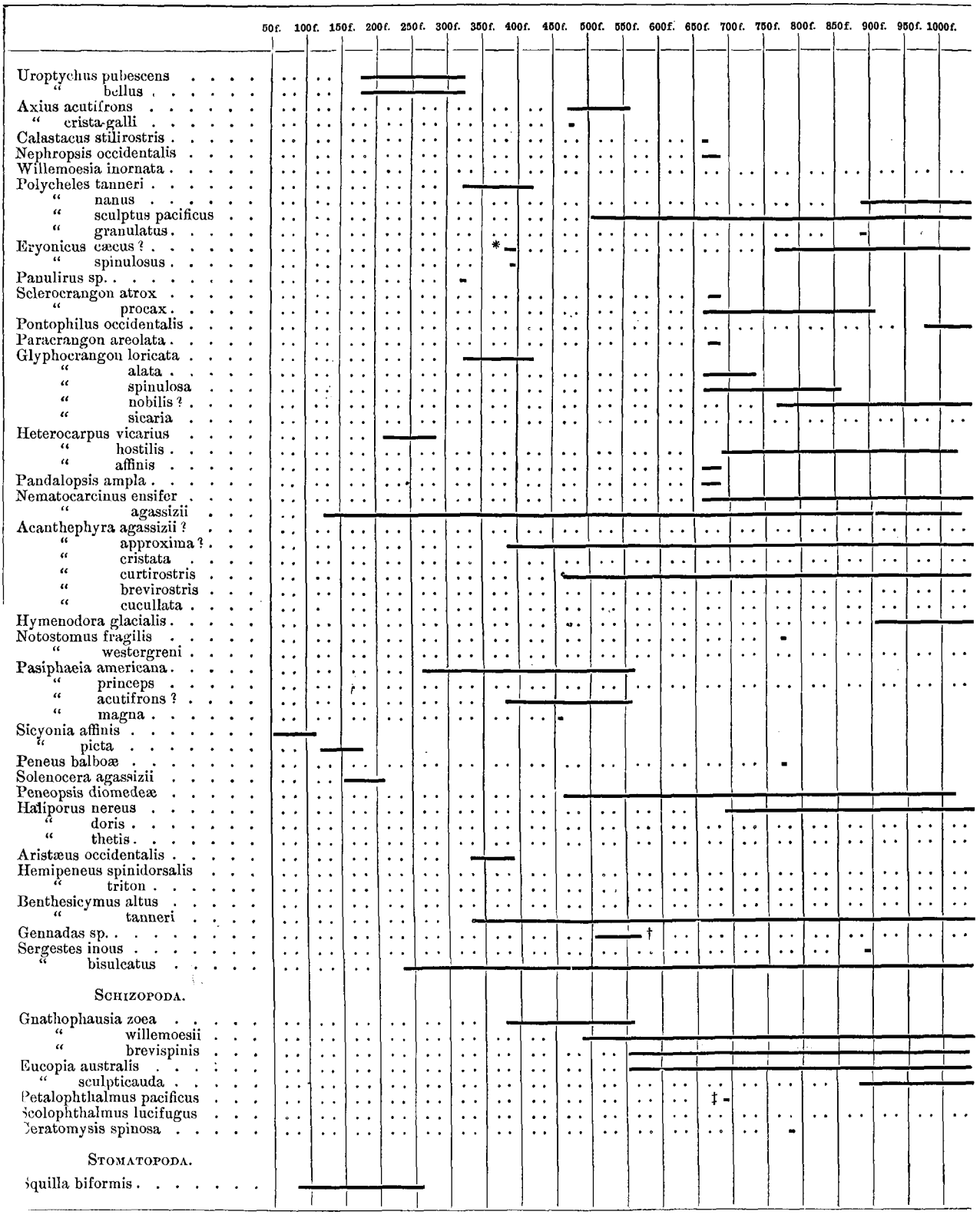
Parapagurus pilosimanus abyssorum.
Galacantha diomedeæ parvispina.
Sclerocrangon procax.
Glyphocrangon spinulosa.
Glyphocrangon nobilis?
Nematocarcinus ensifer.
Acanthephyra curtirostris, var^{tes} α, β, γ.
Hymenodora glacialis.
Benthesicymus tanneri.
Gennadas sp.
Sergestes bisulcatus.
Eucopia australis.
Petalophthalmus pacificus.

NOTE. — Strictly littoral and surface species are omitted. It should be observed that the free-swimming species, most of which occur merely indicate the soundings at the stations where these forms were captured. See page 248.

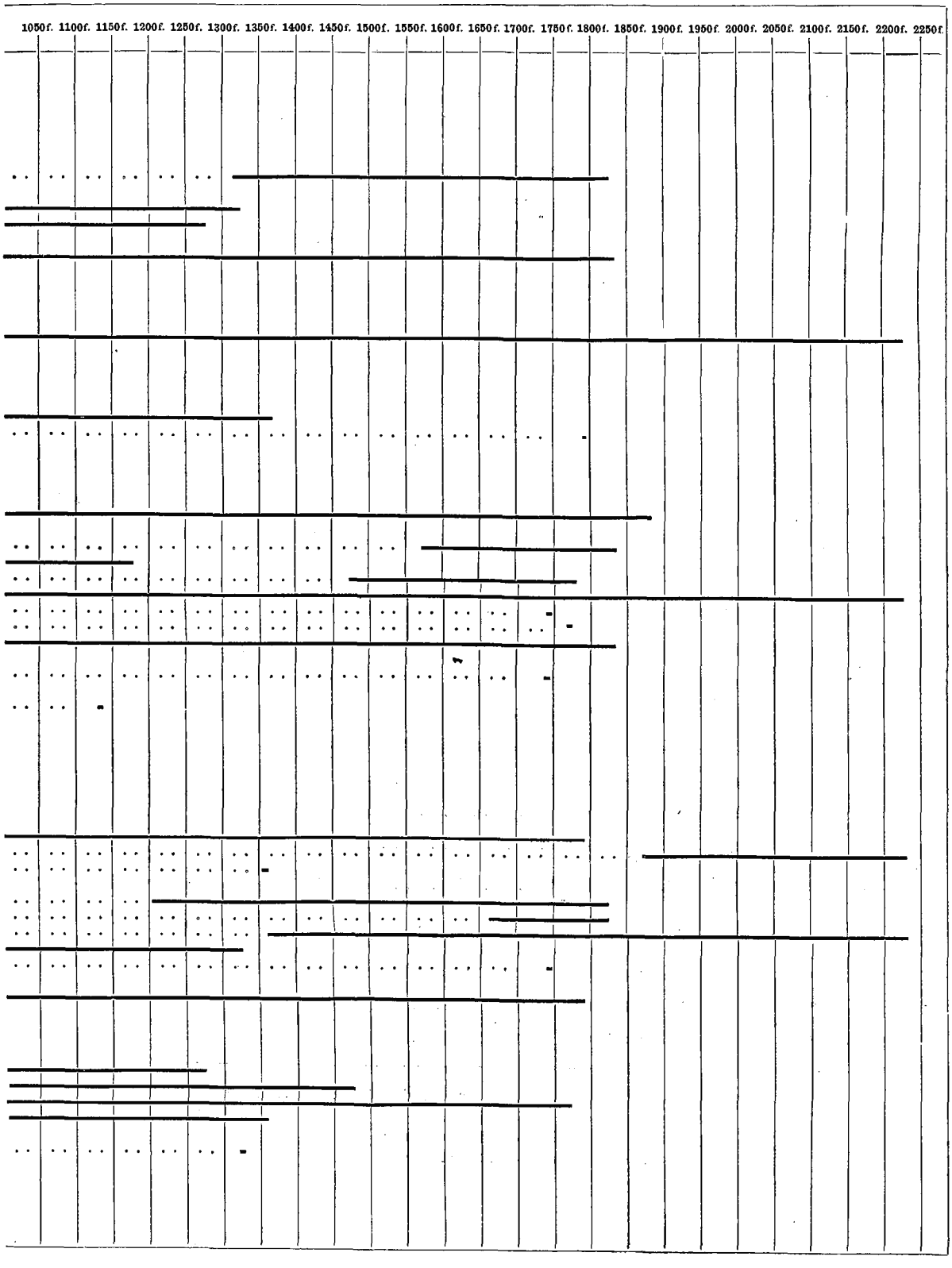


toward the end of the table, may have entered the trawl during its passage up to the surface. In such cases, the distribution lines





* Tanner tow-net, 400 fathoms to surface. † Submarine tow-net, 500–570 fathoms. ‡ Submarine tow-net, 700 fathoms to surface.


1050f. 1100f. 1150f. 1200f. 1250f. 1300f. 1350f. 1400f. 1450f. 1500f. 1550f. 1600f. 1650f. 1700f. 1750f. 1800f. 1850f. 1900f. 1950f. 2000f. 2050f. 2100f. 2150f. 2200f. 2250f.

RECORD OF SUBMARINE TOW-NET STATIONS OF THE UNITED STATES FISH COMMISSION STEAMER "ALBATROSS."*

MARCH AND APRIL, 1891.

Serial Number.	Date.	Time.	Position. Latitude North.	Position. Longitude West.	Temperatures. Surface.	Temperatures. Bottom.	Depth in Fathoms.	Character of Bottom.	Depth at which towed, in Fathoms.	Time in Minutes.	Remarks.
	1891.	h. m.	° ′ ″	° ′ ″	°	°					
3382 Dr.	March 7	8 50 A.M.	6 21 0	80 41 0	75	35.8	1793	gn. M.	200	15	
"	" 7	9 53 A.M.	6 21 0	80 41 0	75	35.8	1793	gn. M.	200		Hauled up straight from 200 fathoms in 10 minutes; from 100 fathoms in about 5 minutes. About 60 miles from the 100 fathom line.
"	" 7	10 23 A.M.	6 21 0	80 41 0	75	35.8	1793	gn. M.	100		
3388 Dr.	" 9	10 31 A.M.	7 6 0	79 48 0	73	36.2	1168	gn. glob. Oz.	400	17	15 miles from 100 fathom line, and 25 miles from nearest land.
2619 Hyd.	" 11	8 25 A.M.	7 31 0	78 42 30	68	36.5	1100	gn. glob. Oz.	300	19	
"	" 11	9 44 A.M.	7 31 0	78 42 30	68	36.5	1100	gn. glob. Oz.	1000 1482 †	16	Drifted into 1482 fathoms.
2627 Hyd.	" 25	6 49 A.M.	0 36 0	82 45 0	81	36.0	1832	gy. glob. Oz.	1770 1739 †	20	
			South.								
2628 Hyd.	" 26	9 14 A.M.	0 13 0	84 52 0	81	..	..	.....	204	20	Towed awhile from 200 fathoms to surface, to fill upper part of net. About 250 miles from the Galapagos.
			North.								
3414 Dr.	April 8	6 57 A.M.	10 14 0	96 28 0	82	35.8	2232	gn. M.	100	20	350 miles from land.
"	" 8	7 47 A.M.	10 14 0	96 28 0	82	35.8	2232	gn. M.	200	10	
"	" 8	8 49 A.M.	10 14 0	96 28 0	82	35.8	2232	gn. M.	300	20	
"	" 8	10 30 A.M.	10 14 0	96 28 0	82	35.8	2232	gn. M.	300	15	
——	" 9	10 4 A.M.	12 34 0	97 21 0	82	..	..	.....	175	8	About 300 miles S. E. of Acapulco. Depth.‡
——	" 9	8 3 P.M.	13 33 30	97 57 30	83	..	..	.....	175	10	About 250 miles S. E. of Acapulco. Depth.‡
——	" 11	8 45 A.M.	16 32 0	99 42 0	80	..	..	.....	300	20	About 30 miles S. E. of Acapulco. Depth.§
——	" 16	10 10 A.M.	17 39 30	102 11 30	76	..	..	.....	175	15	About 120 miles N.W. of Acapulco. Depth over 2,000 fathoms.
3436 Dr.	" 22	1 22 P.M.	27 3 40	110 53 40	72	37.2	905	bn. M. bk. Sp.	800	15	Surface about 75 miles S. W. of Guaymas, half-way across Gulf of California.
2637 Hyd.	" 22	7 21 P.M.	27 20 0	110 54 0	71	38.0	773	bn. M. bk. Sp.	700	15	About 50 miles S. W. of Guaymas.
3437 Dr.	" 23	5 31 A.M.	27 39 40	111 0 30	70	40.0	628	bn. M. bk. Sp.	600	15	Shoaled water and dragged on bottom.
2638 Hyd.	" 23	7 26 A.M.	27 38 0	111 4 0	72	39.2	622	bn. M. bk. Sp.	500 570 †	15	

* Tanner tow-net at all Stations except Station 3382, March 7.

† Depth varying between these points.

‡ Between two Stations, over 2,000 fathoms.

§ Between two Stations, about 500 fathoms.

RECORD OF DREDGING AND TRAWLING STATIONS OF THE UNITED STATES FISH COMMISSION STEAMER "ALBATROSS."

Serial Number.	Date.	Time.	Position.		Temperatures.		Depth in Fathoms.	Character of Bottom.	Remarks.
			Latitude North.	Longitude West.	Surface.	Bottom.			
	1891.	h. m.	° ′ ″	° ′ ″	°	°			
	Feb. 22	8 0 P.M.	. . . .	. . . . .	. .	. .	. .	. . . . .	
3353	" 23	8 56 A.M.	7 6 15	80 34 0	73	39.0	695	gn. M.	Surface tow-net.
3354	" 23	1 25 P.M.	7 9 45	80 50 0	78	46.0	322	gn. M.	
3355	" 23	3 1 P.M.	7 12 20	80 55 0	81	54.1	182	bk. G. Sh.	
3356	" 23	7 30 P.M.	7 9 30	81 8 30	83	40.1	546	sft. bl. M.	Surface tow-net. 15 miles from Mariato Point.
3357	" 24	6 17 A.M.	6 35 0	81 44 0	83	38.5	782	gn. S.	Surface tow-net.
3358	" 24	11 38 A.M.	6 30 0	81 44 0	83	40.2	555	gn. S.	
3359	" 24	2 4 P.M.	6 22 20	81 52 0	83	42.0	465	rky.	
3360	" 24	5 20 P.M.	6 17 0	82 5 0	83	36 4	1672	fne. bk. dk. gn. S.	Surface tow-net.
3361	" 25	7 33 A.M.	6 10 0	83 6 0	82	36.6	1471	gn. Oz.	
3362	" 26	7 20 A.M.	5 56 0	85 10 30	84	36.8	1175	gn. M. S. rky.	Intermediate net of Chun and Petersen.
3363	" 26	4 37 P.M.	5 43 0	85 50 0	83	37.5	978	wh. glob. Oz.	Surface tow-net.
3364	" 27	6 58 A.M.	5 30 0	86 8 30	81	38.0	902	yl. glob. Oz.	
3365	" 27	1 30 P.M.	5 31 0	86 31 0	85	37.0	1010	yl. glob. Oz.	Surface tow-net.
3366	" 27	8 4 P.M.	5 30 0	86 45 0	84	37.0	1067	yl. glob. Oz.	
3367	" 28	6 38 A.M	5 31 30	86 52 30	82	57.1	100	rky.	
3368	" 28	7 21 A.M.	5 32 45	86 54 30	82	58.4	66	rky.	Surface tow-net.
3369	" 28	8 7 A.M.	5 32 45	86 55 20	82	62.2	52	Nullipore or rky.	
3370	" 28	10 3 A.M.	5 36 40	86 56 50	84	54 8	134	rks. & S.	At Cocos Island. Surface tow-net at night.
3371	March 1	7 49 A.M.	5 26 20	86 55 0	82	39.0	770	glob. Oz.	
3372	" 1	5 51 P.M.	4 49 0	86 11 20	84	38.8	761	gy. glob. Oz.	8 P. M. Surface tow-net.
3373	" 2	10 33 A.M.	4 2 0	84 58 0	82	36.6	1877	br. M. bk. Sp.	
3374	" 3	10 35 A.M.	2 35 0	83 53 0	80	36.4	1823	gn. Oz.	
3375	" 4	6 36 A.M.	2 34 0	82 29 0	77	36.6	1201	gy. glob. Oz.	Surface tow-net.
3376	" 4	4 27 P M.	3 9 0	82 8 0	78	36.3	1132	gy. glob. Oz.	
3377	" 5	8 38 A.M.	3 56 0	81 40 15	77	38.0	764	M.	
3378	" 5	11 45 A.M.	3 58 20	81 36 0	78	55.9	112	brk. sh.	
3379	" 5	2 15 P.M.	3 59 40	81 35 0	78	. .	52	rks.	
3380	" 5	4 51 P.M.	4 3 0	81 31 0	79	37.2	899	rks.	
3381	" 6	8 38 A.M.	4 56 0	80 52 30	77	35.8	1772	gn. M.	
3382	" 7	10 46 A.M.	6 21 0	80 41 0	75	35.8	1793	gn. M.	Submarine tow-net. 8:30 P.M., surface tow-net.
3383	" 8	6 51 A.M.	7 21 0	79 2 0	74	36.0	1832	gn. glob. Oz.	
3384	" 8	1 20 P.M.	7 31 30	79 14 0	74	42.0	458	gn. S.	
3385	" 8	3 7 P.M.	7 32 36	79 16 0	72	45.9	286	gn. M.	
3386	" 8	4 54 P.M.	7 33 12	79 17 15	73	48.0	242	fne. gy. S.	
3387	" 8	7 21 P.M.	7 40 0	79 17 50	74	56.2	127	fne. gy. S.	Surface tow-net.
3388	" 9	6 41 A.M.	7 6 0	79 48 0	73	36.2	1168	gn. glob. Oz.	Submarine tow-net.
3389	" 9	2 10 P.M.	7 16 45	79 56 30	74	48.8	210	gn. M.	
3390	" 9	4 25 P.M.	7 26 10	79 53 50	74	62.6	56	fne. gy. S. G.	
3391	" 9	7 15 P.M.	7 33 40	79 43 20	73	55.8	153	gn. M.	
3392	" 10	6 30 A.M.	7 5 30	79 40 0	73	36 4	1270	hard.	Rhabdamina bottom.
3393	" 10	1 21 P.M.	7 15 0	79 36 0	74	36.8	1020	gn. M.	
3394	" 10	5 43 P.M.	7 21 0	79 35 0	73	41.8	511	dk. gn. M.	
3395	" 11	2 20 P.M.	7 30 36	78 39 0	70	38.5	730	rky.	
3396	" 11	5 15 P.M.	7 32 0	78 36 30	70	47.4	259	hrd. gy. M. S.	

RECORD OF DREDGING AND TRAWLING STATIONS OF THE UNITED STATES FISH COMMISSION STEAMER "ALBATROSS." — *Continued.*

Serial Number.	Date.	Time.	Position.		Temperatures.		Depth in Fathoms.	Character of Bottom.	Remarks.
			Latitude North.	Longitude West.	Surface.	Bottom.			
	1891.	h. m.	° ′ ″	° ′ ″	°	°			
3397	March 11	6 32 P.M.	7 33 0	78 34 20	71	57.3	85	stf. gn. M. brk.	Surface tow-net.
3398	" 23	3 16 P.M.	1 7 0	80 21 0	84	36.0	1573	gn. Oz.	Surface tow-net, off Galera Point.
3399	" 24	6 37 A.M.	1 7 0	81 4 0	80	36.0	1740	gn. Oz.	Surface tow-net.
			South.						
3400	" 27	6 10 A.M.	0 36 0	86 46 0	81	36.0	1322	lt. gy. glob. Oz.	Surface tow-net.
3401	" 28	4 45 A.M.	0 59 0	88 58 30	82	43.8	395	glob. Oz.	
3402	" 28	7 13 A.M.	0 57 30	89 3 30	82	42.3	421	R. glob. Oz.	
3403	" 28	10 19 A.M.	0 58 30	89 17 0	82	43.3	384	fne. gy. S. bk. Sp.	
3404	" 28	1 16 P.M.	1 3 0	89 28 0	83	43.2	385	R.	Tangles.
3405	" 28	3 42 P.M.	0 57 0	89 38 0	83	60.0	53	P. Co. Sh.	
3406	April 3	6 47 A.M.	0 16 0	90 21 30	81	41.3	551	R.	
3407	" 3	10 48 A.M.	0 4 0	90 24 30	81	37.2	885	glob. Oz.	Tangles.
			North.						
3408	" 3	4 7 P.M.	0 12 30	90 32 30	83	39.5	684	glob. Oz.	Tangles.
3409	" 3	7 24 P.M.	0 18 40	90 34 0	82	42.3	327	bk. S.	Tangles. Surface tow-net. Off Bindloe Island, 4 miles west.
3410	" 3	8 48 P.M.	0 19 0	90 34 0	82	44.2	331	bk. S.	
3411	" 4	7 35 A.M.	0 54 0	91 9 0	82	36.2	1189	yl. glob. Oz.	
3412	" 4	6 11 P.M.	1 23 0	91 43 0	82	38.0	918	R.	9 P. M., surface tow-net, 5 miles off Wenman Islands.
3413	" 5	8 34 A.M.	2 34 0	92 6 0	82	36.0	1360	glob. Oz. dk. Sp.	At noon, surface tow-net.
3414	" 8	11 14 A.M.	10 14 0	96 28 0	82	35.8	2232	gn. M.	Submarine tow-net and surface tow-net.
3415	" 10	9 39 A.M.	14 46 0	98 40 0	83	36.0	1879	br. M. glob. Oz.	
3416	" 11	9 46 A.M.	16 32 30	99 42 40	81	40.5	419	fne. br. M.	
3417	" 11	11 44 A.M.	16 32 0	99 48 0	82	40.6	493	gn. M.	
3418	" 11	2 57 A.M.	16 33 0	99 52 30	82	39 0	660	br. S. bk. Sp.	
3419	" 11	5 59 P.M.	16 34 30	100 3 0	81	39.0	772	gn. M. bk. Sp.	Surface tow-net.
3420	" 12	7 48 A.M.	16 46 0	100 8 20	82	39.6	664	dk. gn. M.	
3421	" 12	11 32 A.M.	16 47 20	100 0 10	82	42.9	338	dk. gn. M.	
3422	" 12	12 35 P.M.	16 47 30	99 59 30	83	53 5	141	gn. M.	
3423	" 12	1 31 P.M.	16 47 30	99 59 20	83	56.0	94	gn. M.	
3424	" 18	11 18 A.M.	21 15 0	106 23 0	76	38.0	676	gy. S. bk. Sp. glob.	
3425	" 18	2 14 P.M.	21 19 0	106 24 0	76	39.0	680	gn. M. & S.	
3426	" 18	3 45 P.M.	21 21 0	106 25 0	76	51.2	146	rky.	
3427	" 18	4 3 P.M.	21 22 15	106 25 0	75	51.2	80	rky.	
3428	" 18	6 40 P.M.	21 36 30	106 25 0	76	48.1	238	dk. gy. S. glob.	
3429	" 19	5 39 A.M.	22 30 30	107 1 0	73	37 0	919	gn. M. glob. Oz.	
3430	" 19	3 27 P.M.	23 16 0	107 31 0	73	37.9	852	bk. S.	
3431	" 20	6 33 A.M.	23 59 0	108 40 0	70	37.0	995	lt. bro. M. glob.	
3432	" 20	2 38 P.M.	24 22 30	109 3 20	70	37.8	1421	br. M. bk. Sp.	
3433	" 21	6 34 A.M.	25 26 15	109 48 0	69	36 5	1218	br. M. bk. Sp.	Surface tow-net.
3434	" 21	10 14 A.M.	25 29 30	109 48 0	70	36 4	1588	br. M. bk. Sp.	
3435	" 22	8 56 A.M.	26 48 0	110 45 20	70	37.3	859	br. M. bk. Sp.	
3436	" 22	3 10 P.M.	27 34 0	110 53 40	72	37.2	905	br. M. bk. Sp.	Submarine tow-net and surface tow-net.
3437	" 23	5 4 A.M.	. . . .	. . . . .	70	40.0	628	br. M. bk. Sp.	Submarine tow-net dragged on the bottom. About 50 miles south of Guaymas.

EXPLANATION OF THE PLATES.

PLATE A.

Fig. 1.	*Trachycarcinus corallinus* FAX.	Male. Natural size. Station 3418. Colored from life.
" 1[a].	" " "	Male, denuded. Natural size. Station 3356.
" 1[b].	" " "	Oral and antennal region. Enlarged.
" 1[c].	" " "	Sternal region of male. Enlarged.
" 1[d].	" " "	Abdomen of male. Enlarged.
" 1[e].	" " "	Lesser cheliped of male. Enlarged.
" 1[f].	" " "	Abdomen of an ovigerous female. × 2. Station 3356.

PLATE B.

Fig. 1.	*Galacantha rostrata* A. M. EDW.	Natural size. Colored from life.
" 1[a].	" " "	Lateral view of carapace. Natural size.
" 2.	*Eryonicus cæcus* BATE ?	Male. Enlarged. Station 3375. Colored from life.

PLATE C.

Fig. 1.	*Polycheles sculptus pacificus* FAX.	Natural size. Colored from life.
" 1[a].	" " " "	First, second, and third abdominal somites, viewed from the side.
" 2.	*Polycheles sculptus* SMITH.	First, second, and third abdominal somites, viewed from the side. "Blake" Station 326, off east coast of United States.

PLATE D.

Fig. 1.	*Nephropsis occidentalis* FAX.	Male. Natural size. Station 3418. Colored from life.
" 1[a].	" " "	Carapace from above.
" 1[b].	" " "	Swimmeret.
" 2.	*Pontophilus occidentalis* FAX.	Nat. size. Station 3382. Colored from life.
" 2[a].	" " "	Carapace, lateral view.
" 2[b].	" " "	First abdominal appendage.
" 2[c].	" " "	Second abdominal appendage.
" 2[d].	" " "	Third abdominal appendage.

PLATE E.

Fig. 1.	*Gnathophyllum panamense* Fax.	Female. × 2½. Colored from life.
" 1ª.	" " "	Lateral view. More highly magnified.
" 1ᵇ.	" " "	Anterior part, from above. Still more enlarged.
" 1ᶜ.	" " "	End of the abdomen and posterior pair of abdominal appendages. Enlarged.
" 1ᵈ.	" " "	Rostrum in profile. Enlarged.
" 1ᵉ.	" " "	External maxilliped. Enlarged.

PLATE F.

Fig. 1.	*Notostomus westergreni* Fax.	Male. Natural size. Station 3399. Colored from life.
" 1ª.	" " "	Anterior part of the carapace seen in profile. Enlarged.
" 1ᵇ.	" " "	Eye-stalk and eye. Enlarged.
" 1ᶜ.	" " "	Right antennal scale. Enlarged.
" 1ᵈ.	" " "	Telson and posterior pair of abdominal appendages. Slightly enlarged.

PLATE G.

Fig. 1.	*Peneopsis diomedeæ* Fax.	Female. Natural size. Colored from life.
" 1ª.	" " "	Antennal scale.
" 1ᵇ.	" " "	First abdominal appendage of female.
" 1ᶜ.	" " "	Petasma of male.
" 1ᵈ.	" " "	Swimmeret.

PLATE H.

Fig. 1.	*Benthesicymus tanneri* Fax.	Male. Natural size. Station 3435. Colored from life.
" 1ª.	" " "	Carapace in profile. Natural size.
" 1ᵇ.	" " "	Sternum of the female. Enlarged. Station 3435.
" 1ᶜ.	" " "	First pair of abdominal limbs and petasma of male. Enlarged. Station 3435.
" 1ᵈ.	" " "	Right first abdominal appendage of the female, outer side. Enlarged. Station 3435.
" 1ᵉ.	" " "	Distal end of third maxilliped of male, first form. Enlarged. Station 3435.
" 1ᶠ.	" " "	Distal end of third maxilliped of male, second form. Enlarged. Station 3410.

PLATE XV.

Fig. 1.	*Petrolisthes agassizii* Fax.	Male. Enlarged.
" 1a.	" " "	Right external maxilliped.
" 2.	*Pachycheles panamensis* Fax.	Female. Enlarged.
" 2a.	" " "	Left external maxilliped.
" 3.	*Pleuroncodes monodon* M. Edw. ?	Male. × 1⅙.
" 3a.	" " "	Left chela, outer face.
" 3b.	" " "	Antennule.
" 3c.	" " "	External maxilliped.

PLATE XVI.

Fig. 1.	*Munida obesa* Fax.	Male. × 1½.
" 1a.	" " "	External maxilliped.
" 2.	*Munida gracilipes* Fax.	Much enlarged.
" 2a.	" " "	Chela.
" 2b.	" " "	External maxilliped.

PLATE XVII.

Fig. 1.	*Munida refulgens* Fax.	Male. Nat. size.

PLATE XVIII.

Fig. 1.	*Munida propinqua* Fax.	Male. Somewhat enlarged.
" 1a.	" " "	External maxilliped.
" 2.	*Munidopsis vicina* Fax.	Female. Much enlarged.
" 2a.	" " "	Cheliped.
" 3.	*Munidopsis ciliata* W.-M.	Male. Sixth abdominal somite, telson, and last pair of appendages, much enlarged. Station 3353.
" 4.	*Munidopsis agassizii* Fax.	Female. Much enlarged.
" 4a.	" " "	Chela. More highly magnified.

PLATE XIX.

Fig. 1.	*Munidopsis hystrix* Fax.	Enlarged.
" 1a.	" " "	Chela.
" 2.	*Munidopsis villosa* Fax.	Male. Enlarged.
" 3.	*Munidopsis sericea* Fax.	Male. Enlarged.
" 3a.	" " "	External maxilliped.

PLATE XX.

Fig. 1.	*Munidopsis ornata* Fax.	Male. Enlarged.
1a.	" " "	External maxilliped, viewed from below.
" 2.	*Munidopsis margarita* Fax.	Enlarged.
" 3.	*Munidopsis crinita* Fax.	Female. Highly magnified.
" 3a.	" " "	External maxilliped.

PLATE XXI.

Fig. 1. *Munidopsis scabra* FAX. Enlarged.
" 1a. " " " External maxilliped.
" 2. *Munidopsis hamata* FAX. Enlarged.
" 2a. " " " External maxilliped.
" 2a. " " " Side view.

PLATE XXII.

Fig. 1. *Munidopsis tanneri* FAX. Enlarged.
" 1a. " " " External maxilliped.
" 2. *Munidopsis depressa* FAX. Male. Enlarged.
" 2a. " " " External maxilliped.
" 2b. " " " Side view.

PLATE XXIII.

Fig. 1. *Munidopsis quadrata* FAX. Male. Enlarged.
" 1a. " " " Side view.
" 1b. " " " External maxilliped.
" 1c. " " " Female. Enlarged.
" 2. *Munidopsis inermis* FAX. Male. Much enlarged.
" 2a. " " " Carapace in profile.

PLATE XXIV.

Fig. 1. *Munidopsis carinipes* FAX. Enlarged.
" 1a. " " " External maxilliped.
" 1b. " " " Side view.
" 2. *Munidopsis hendersoniana* FAX. Female. Enlarged.
" 2a. " " " External maxilliped.
" 2b. " " " Anterior part, in profile.
" 2c. " " " Cheliped.

PLATE XXV.

Fig. 1. *Galacantha diomedeæ* FAX. Male. Somewhat enlarged.
" 1a. " " " Carapace in profile.
" 1b. " " " Sixth abdominal somite, telson, and last pair of appendages of female.
" 1c. " " " External maxilliped.
" 1d. " " " Antennule.
" 1e. " " " End of one of the posterior thoracic appendages. Much enlarged.
" 2. *Galacantha diomedeæ*, var. *parvispina* FAX. Profile of carapace.

PLATE XXVI.

Fig. 1. *Uroptychus nitidus occidentalis* FAX. Female. Enlarged.
" 1a. " " " " End of abdomen.
" 2. *Uroptychus bellus* FAX. Male. Enlarged.
" 2a. " " " Antennule.
" 2b. " " " External maxilliped.

Fig. 3. *Uroptychus pubescens* FAX. Female. Enlarged.
" 3ª. " " " Antennule.
" 3ᵇ. " " " External maxilliped.

PLATE XXVII.

Fig. 1. *Calastacus stilirostris* FAX. Male. Enlarged.
" 1ª. " " " Front and rostrum from above.
" 1ᵇ. " " " Swimmeret.
" 1ᶜ. " " " Antenna of the second pair.
" 1ᵈ. " " " First abdominal appendage of the male.
" 1ᵉ. " " " Second abdominal appendage of the male.
" 1ᶠ. " " " Third abdominal appendage of the male.
" 2. *Calocaris macandreæ* BELL. North Atlantic. Antenna of the second pair, viewed from above.
" 2ª. " " " Antenna of the second pair, viewed from the side.

PLATE XXVIII.

Fig. 1. *Axius crista-galli* FAX. Female. Enlarged.
" 1ª. " " " Anterior part, viewed from above.
" 1ᵇ. " " " Rostrum in profile.
" 1ᶜ. " " " Swimmeret.
" 1ᵈ. " " " Antenna of the second pair.
" 1ᵉ. " " " Leg of fourth pair, male.
" 1ᶠ. " " " Leg of fifth pair, male.
" 1ᵍ. " " " First abdominal appendage, female.
" 1ʰ. " " " Second abdominal appendage.
" 2. *Axius acutifrons* (BATE). Female. Cheliped.

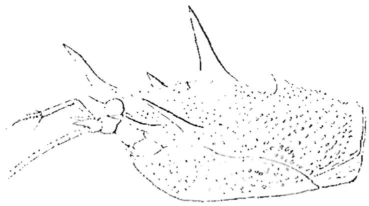
PLATE XXIX.

Fig. 1. *Eryonicus spinulosus* FAX. Dorsal view. Enlarged.
" 1ª. " " " Lateral view. Enlarged.
" 2. *Eryonicus cœcus* BATE? Mandible. Adult male. Station 3375.
" 2ª. " " " First maxilla, adult male.
" 2ᵇ. " " " Second maxilla, adult male.
" 2ᶜ. " " " First maxilliped, adult male.
" 2ᵈ. " " " Second maxilliped, adult male.
" 2ᵉ. " " " Third maxilliped, adult male. a, epipod.
" 2ᶠ. " " " Swimmeret, adult male.

PLATE XXX.

Fig. 1. *Eryonicus cœcus* BATE? Front and oral region, adult male. Station 3375. a, ophthalmic lobe. a', papilla of ophthalmic lobe. β, first antenna. γ, proximal segment of second antenna. γ', phymacerite. γ'', scaphocerite, or scale of second antenna. γ''', fourth, or distal segment of antennal peduncle. δ, mandible. δ', distal segment of mandibular palp. ϵ, mouth. ζ, labrum. η, posterior wall of mouth. ϑ, metastoma.

1a



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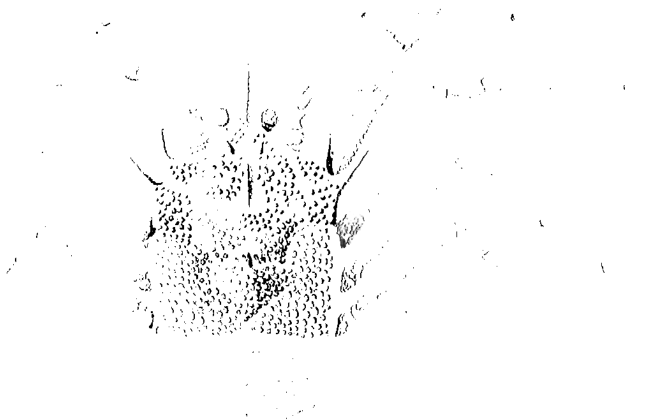

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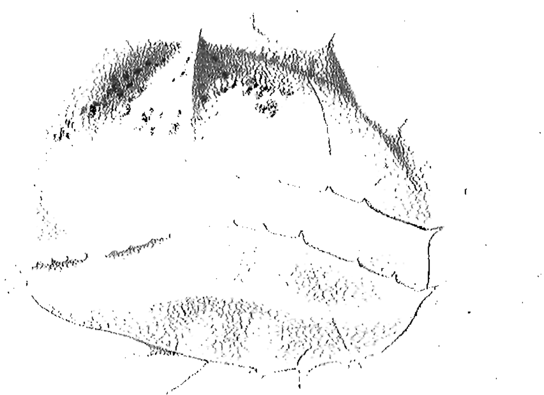

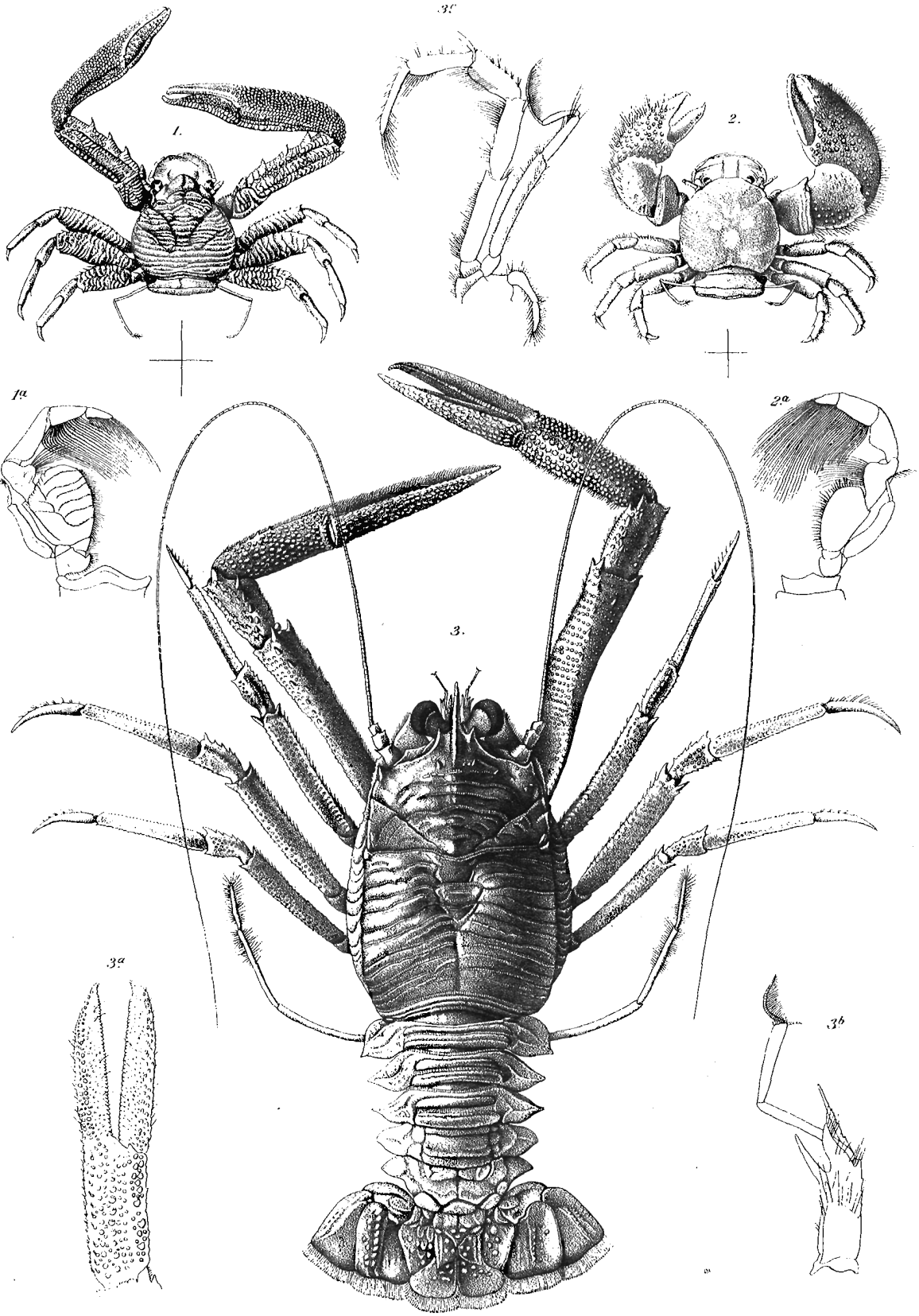

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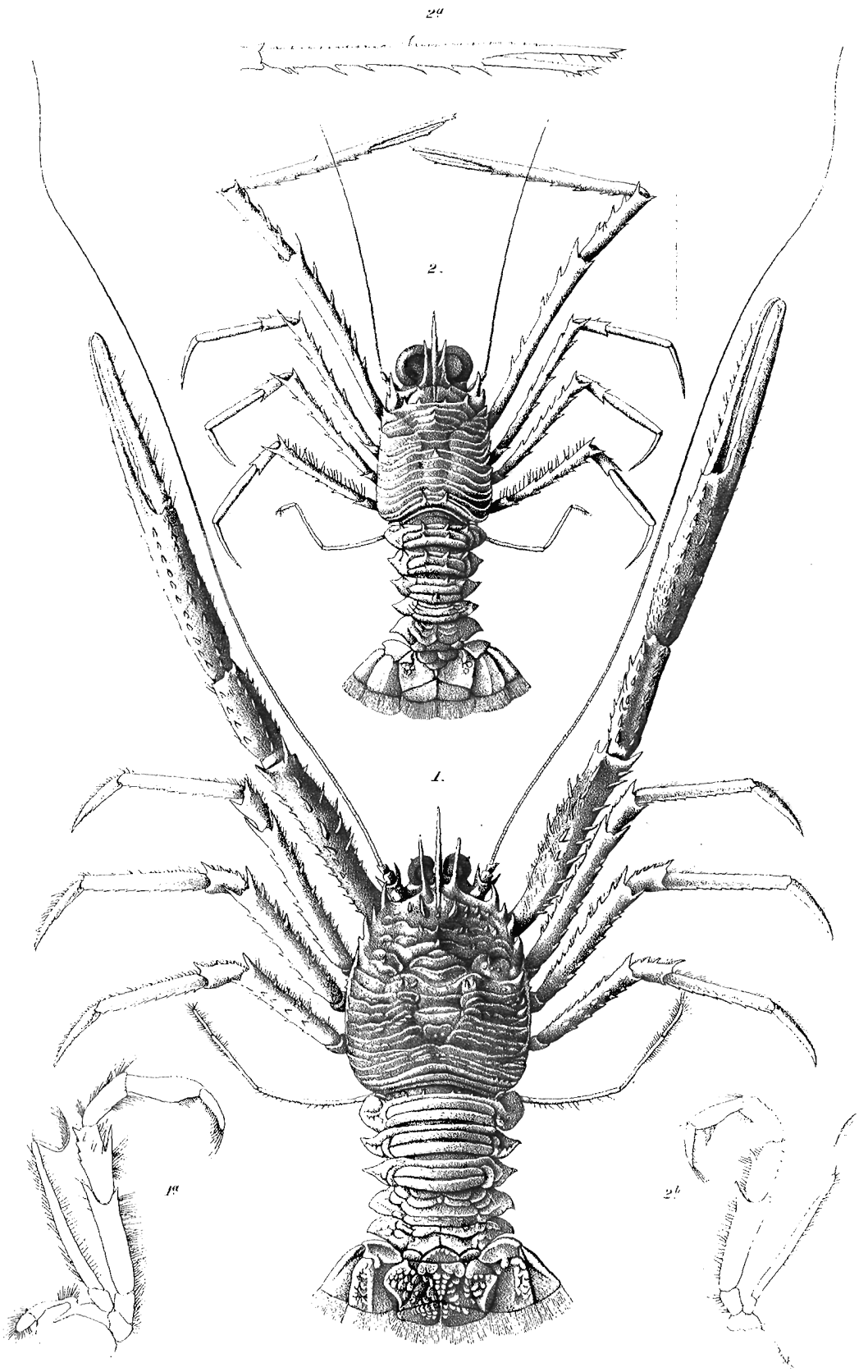
3. PLEURONCODES MONODON?



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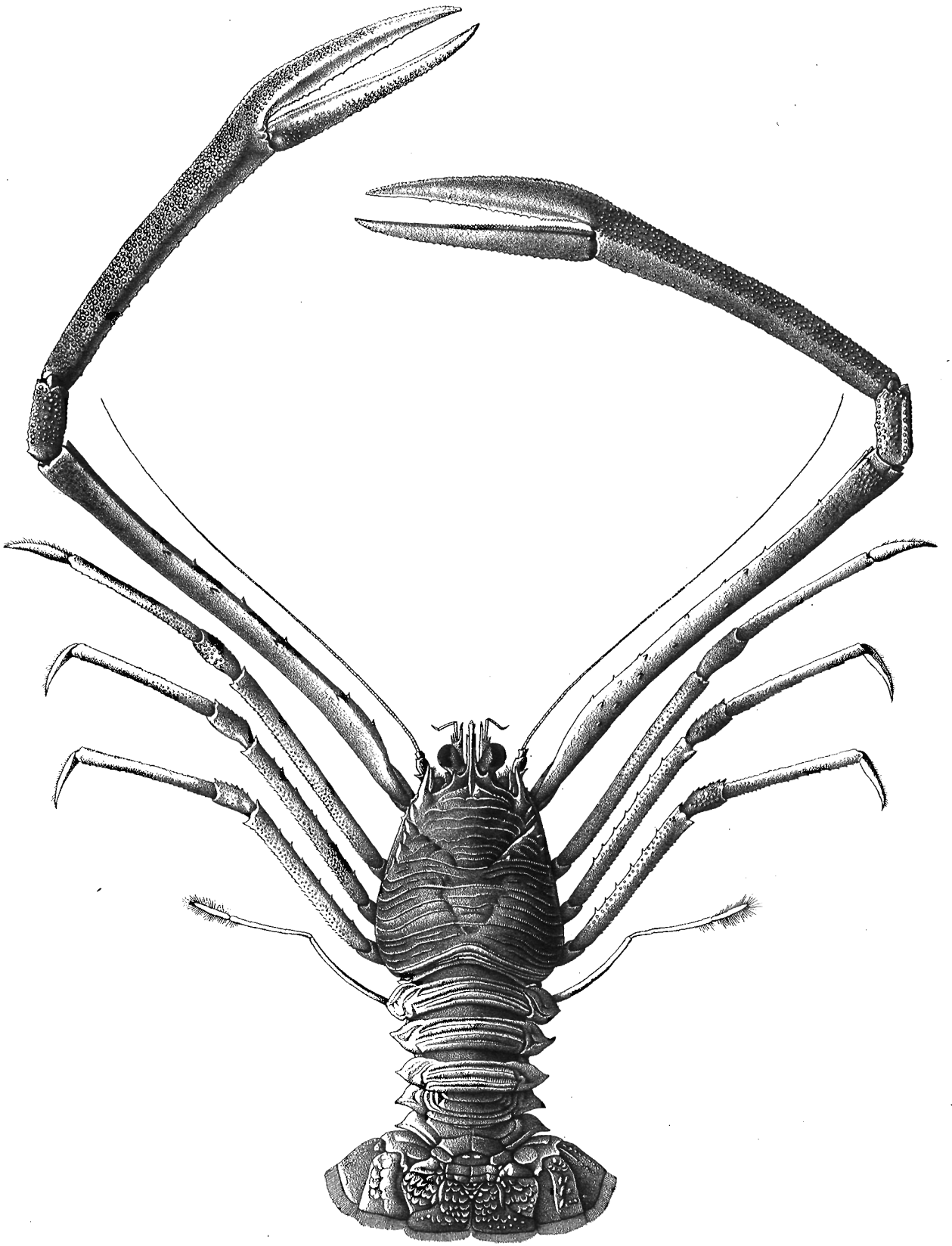
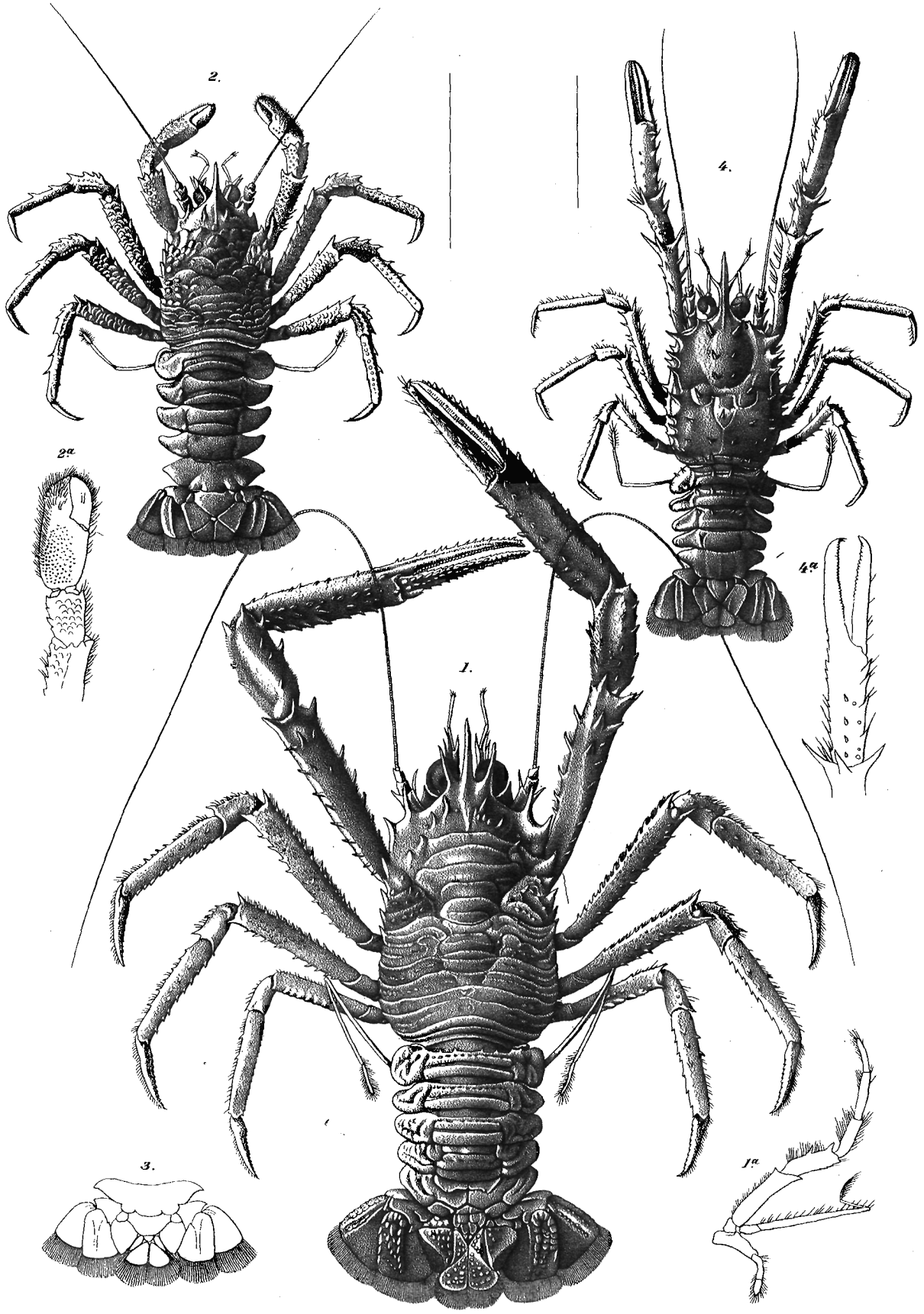


A.M.Westergren, del. B.Meisel, lith.

MUNIDA REFULGENS.



A.M. Westergren, del.

D. Meixel, lith.

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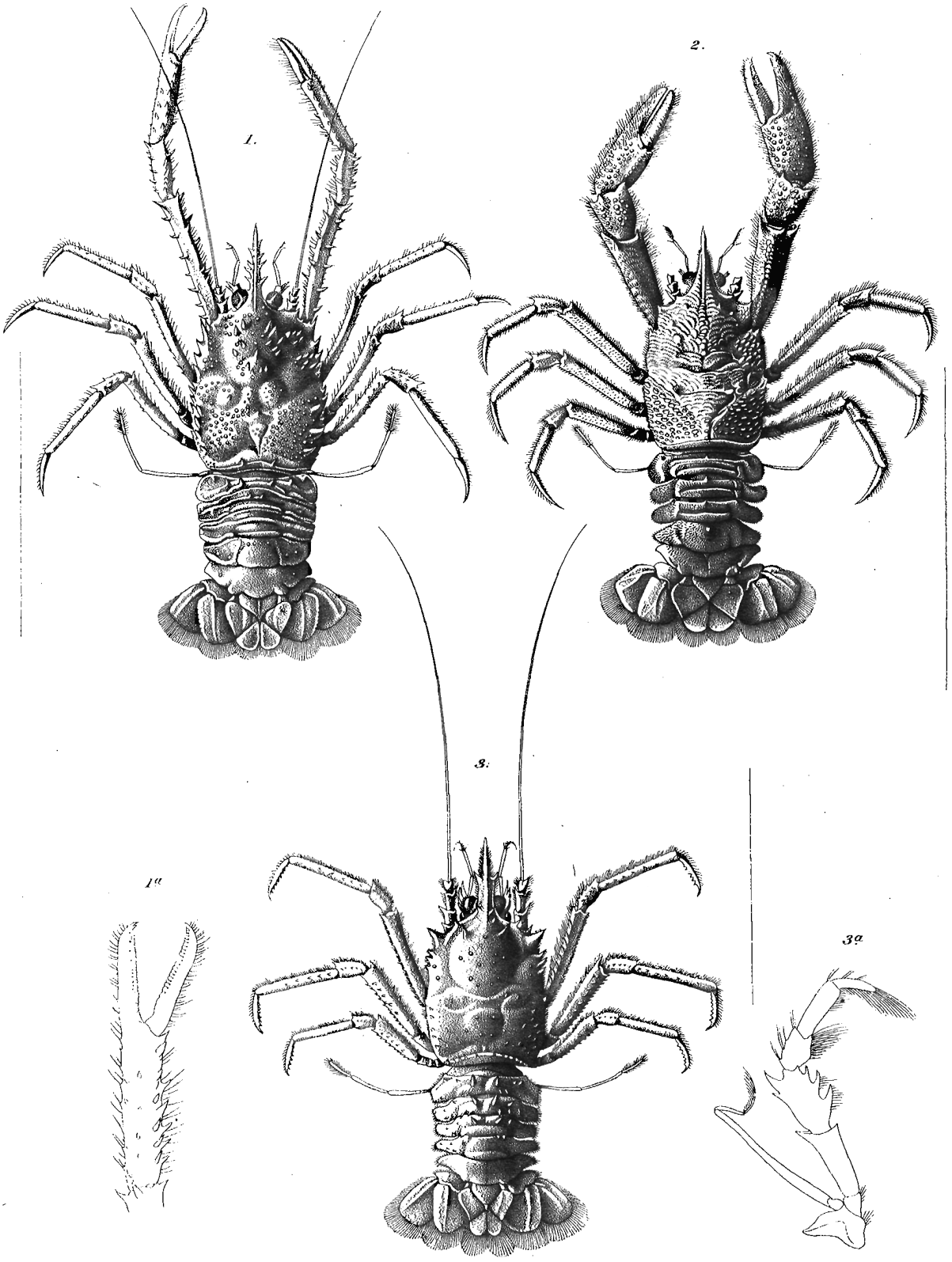
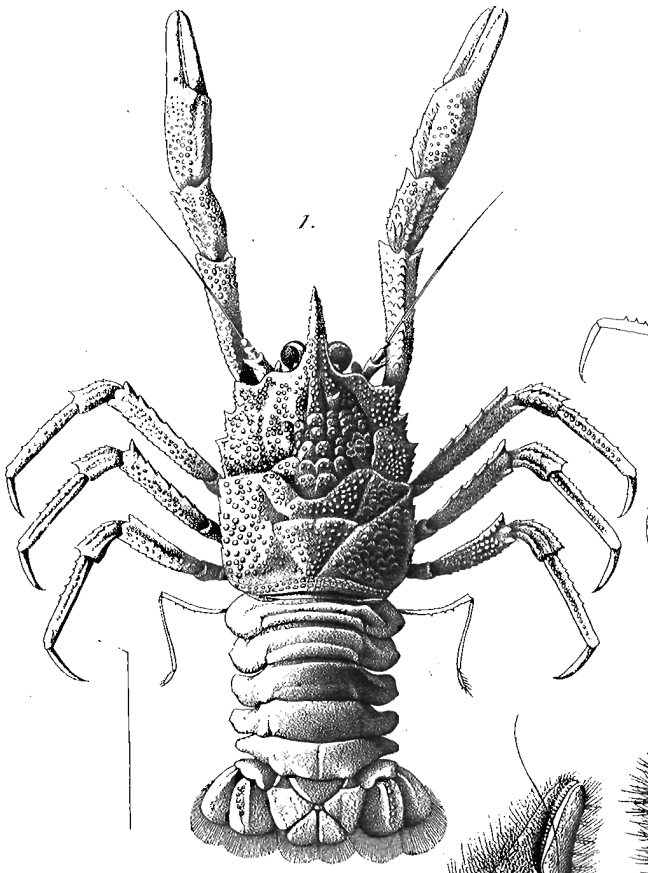
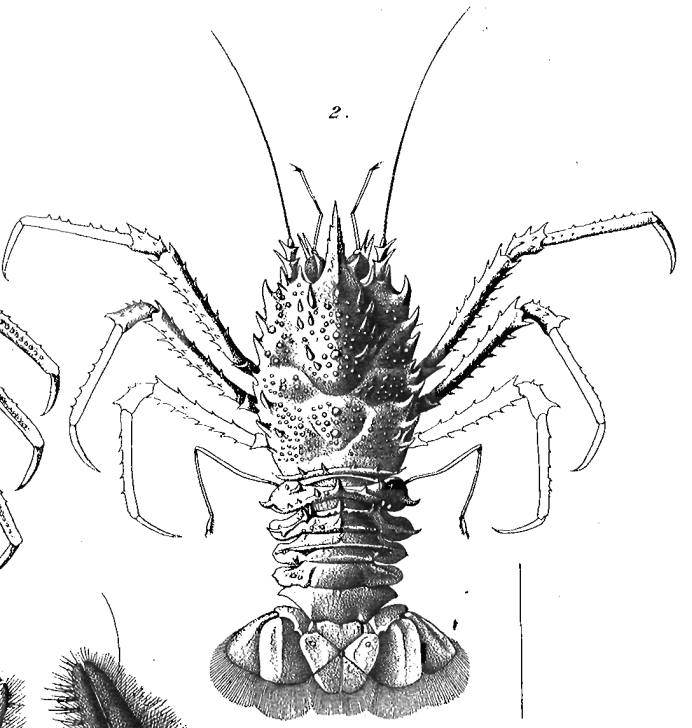
3. MUNIDOPSIS CILIATA. 4. MUNIDOPSIS AGASSIZII.

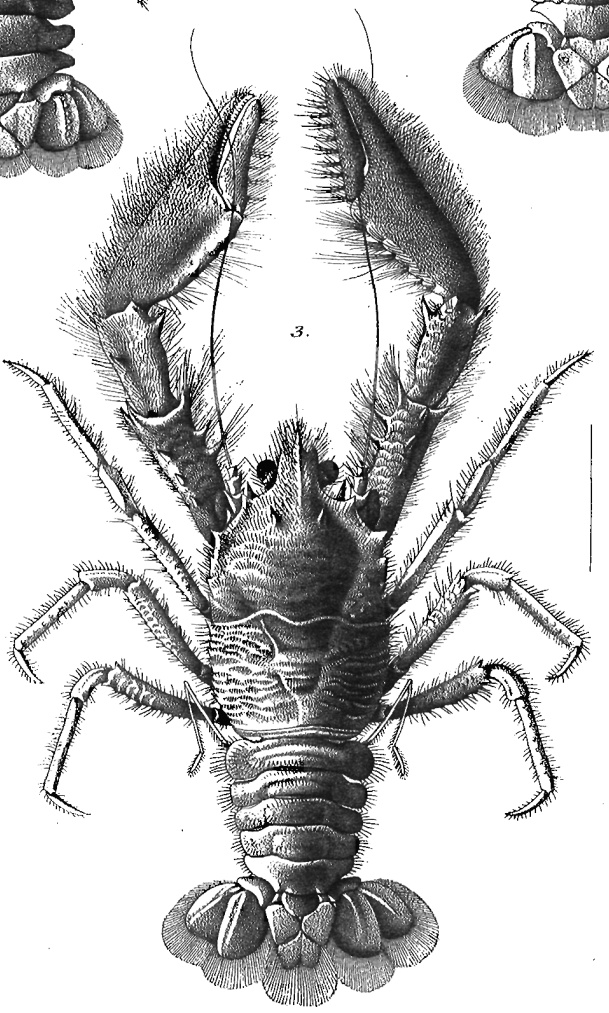


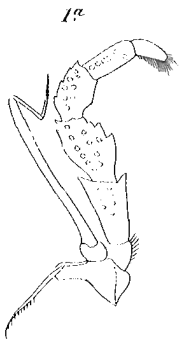
A.M. Westergren, del. B. Meisel, lith.

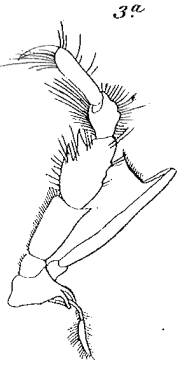
1. MUNIDOPSIS HYSTRIX 2. MUNIDOPSIS VILLOSA.
3. MUNIDOPSIS SERICEA.







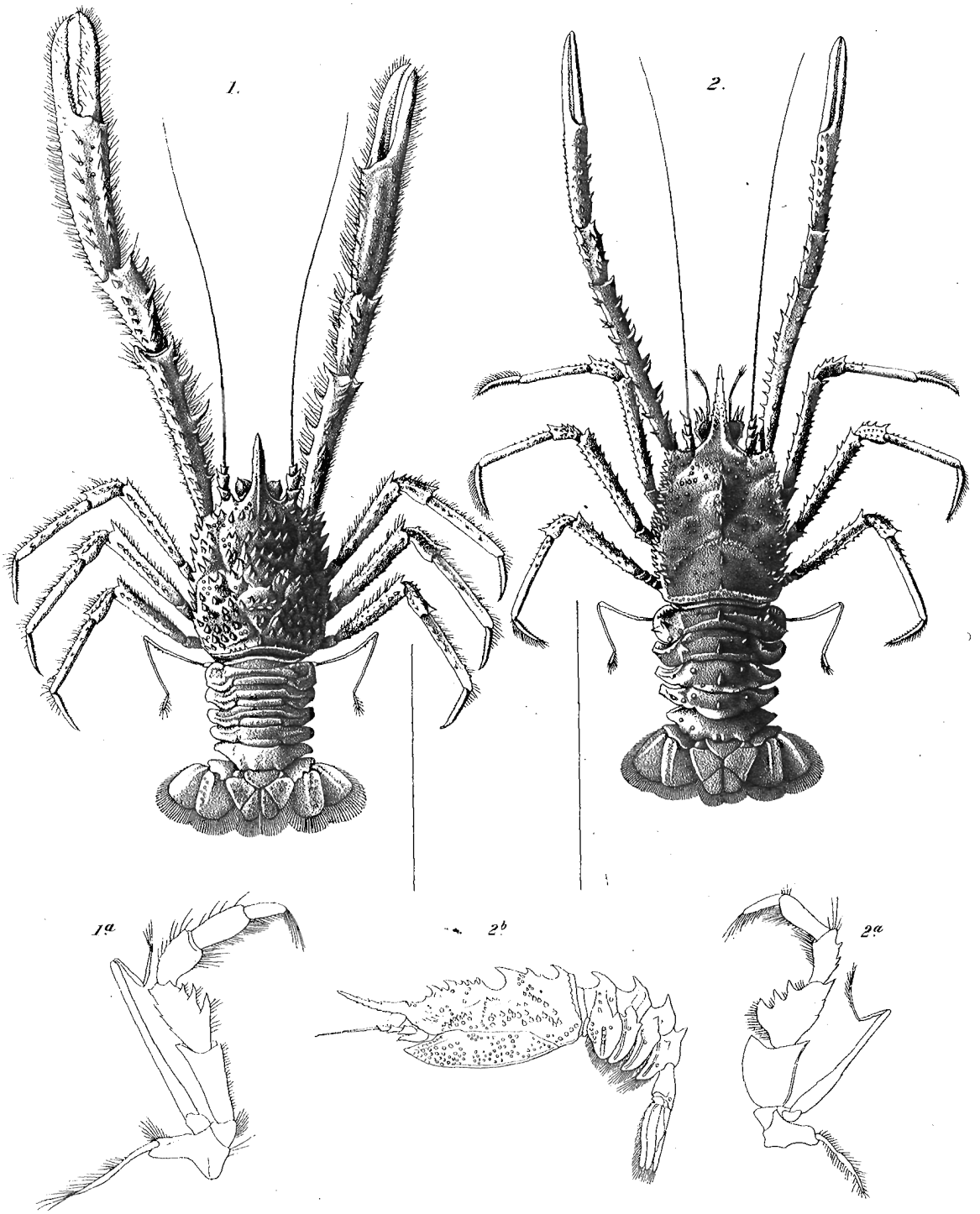




A.M. Westergren, del

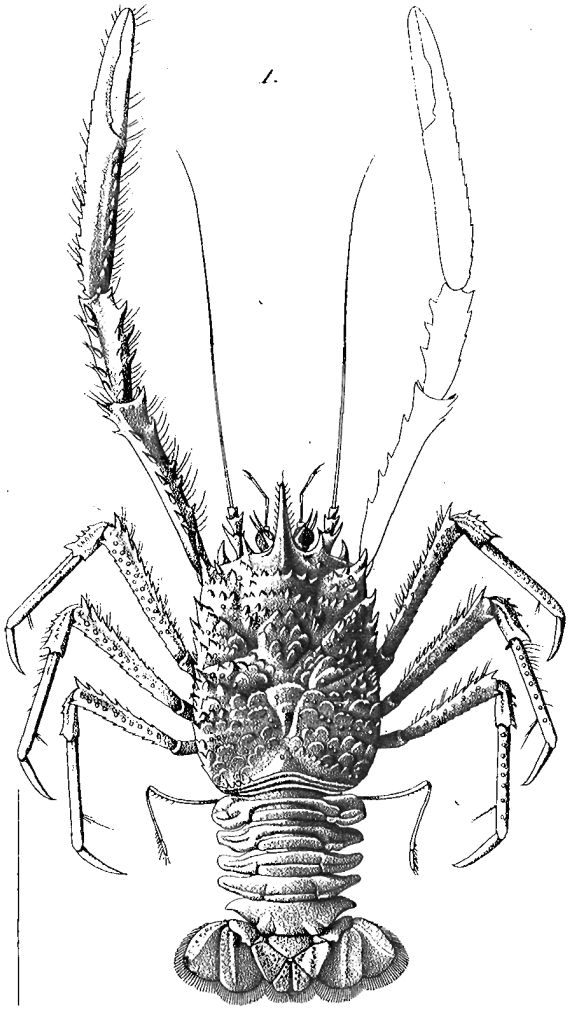
B. Meisel, lith.

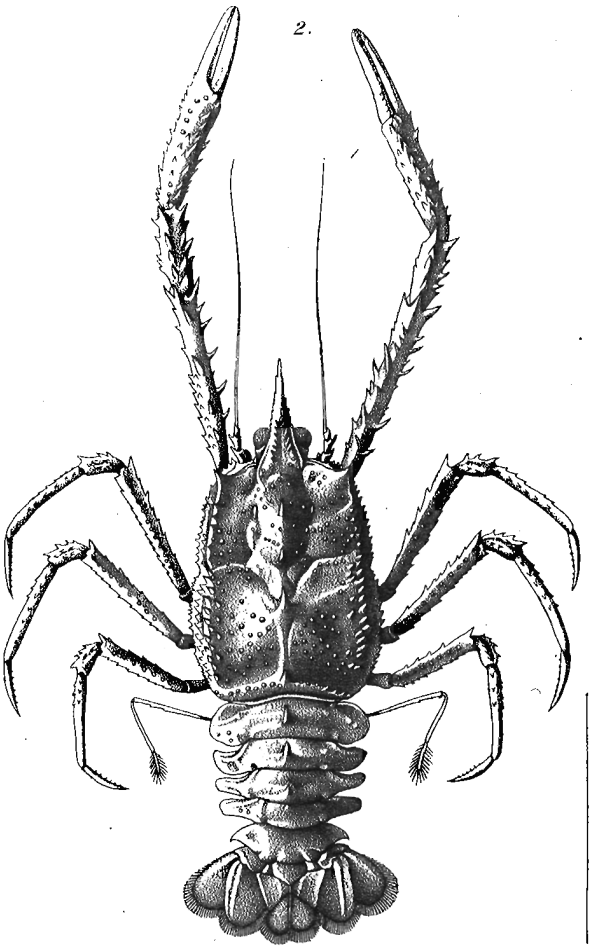
1. MUNIDOPSIS ORNATA. 2. MUNIDOPSIS MARGARITA.
3. MUNIDOPSIS CRINITA

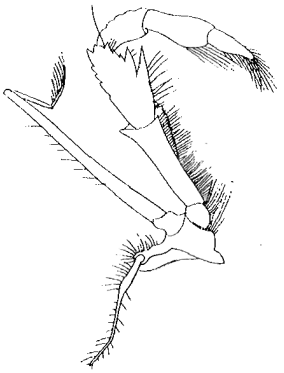


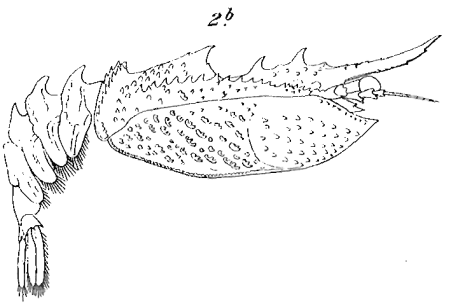
A.M. Westergren, del. B. Meisel, lith.

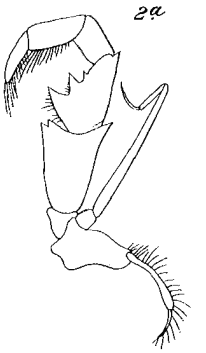
1. MUNIDOPSIS SCABRA. 2. MUNIDOPSIS HAMATA.





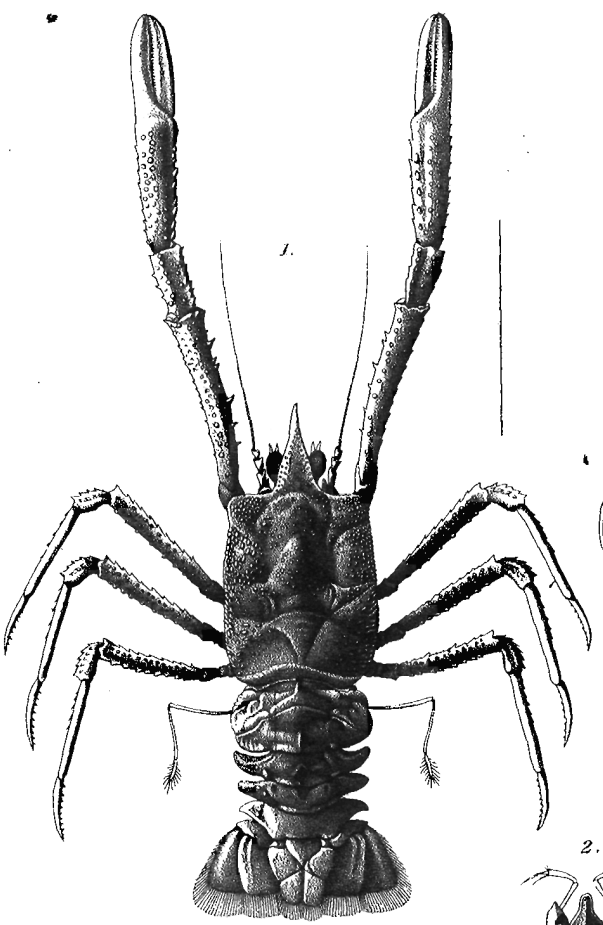


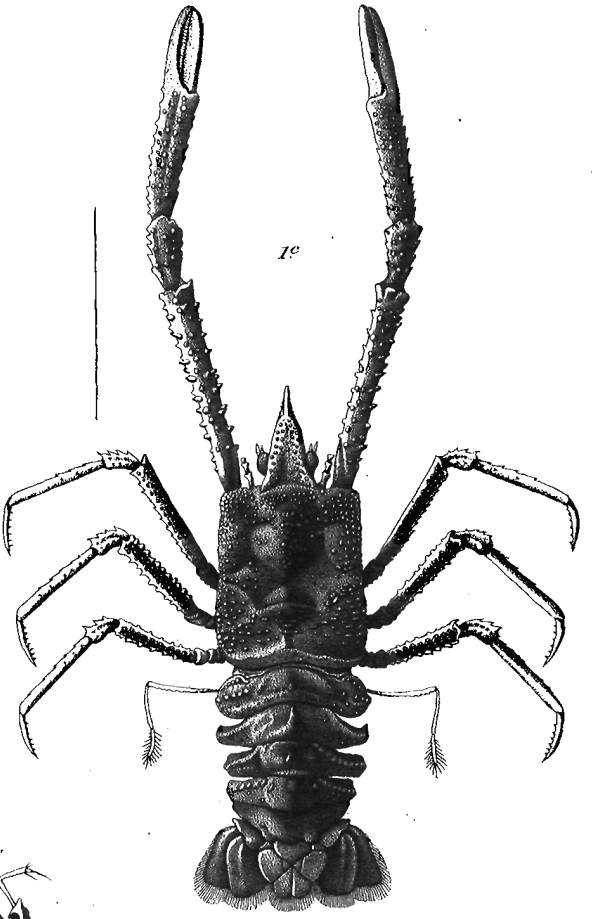


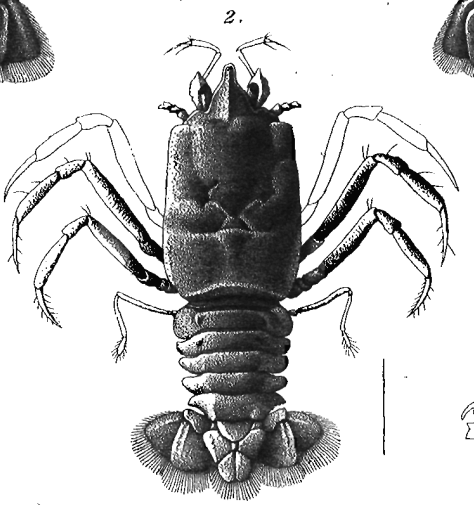


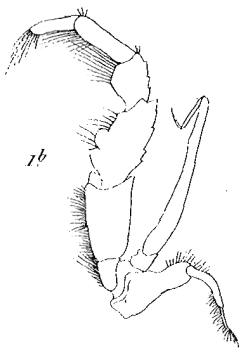
A.M.Westergren, del. B.Meisel, lith.

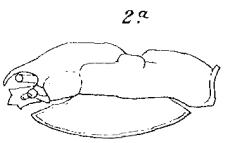
1. MUNIDOPSIS TANNERI. 2. MUNIDOPSIS DEPRESSA.

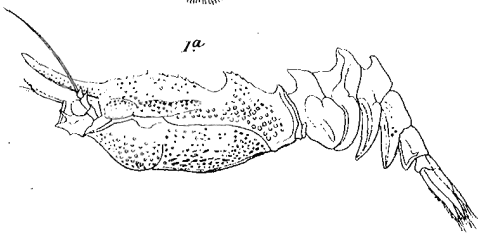






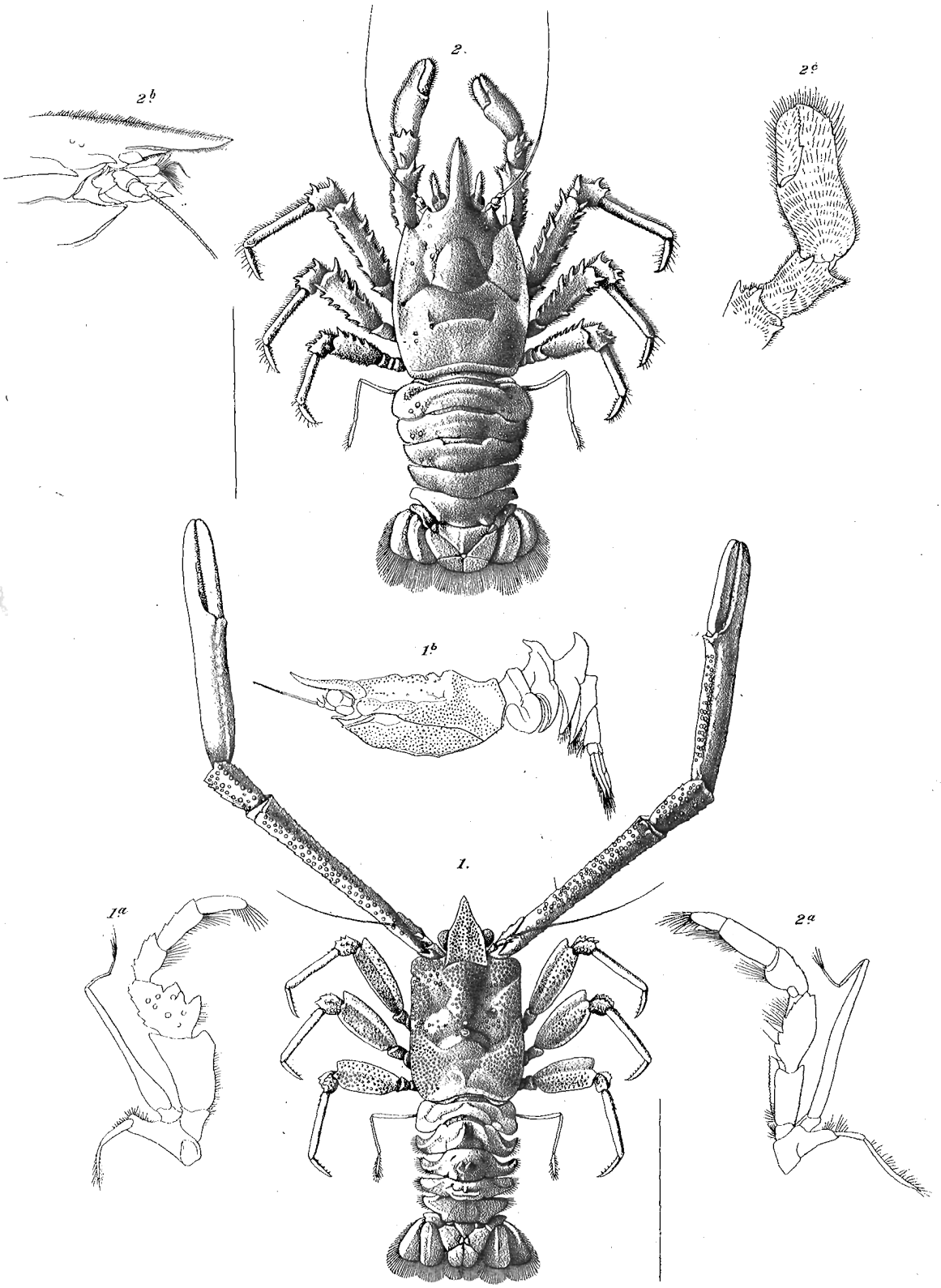






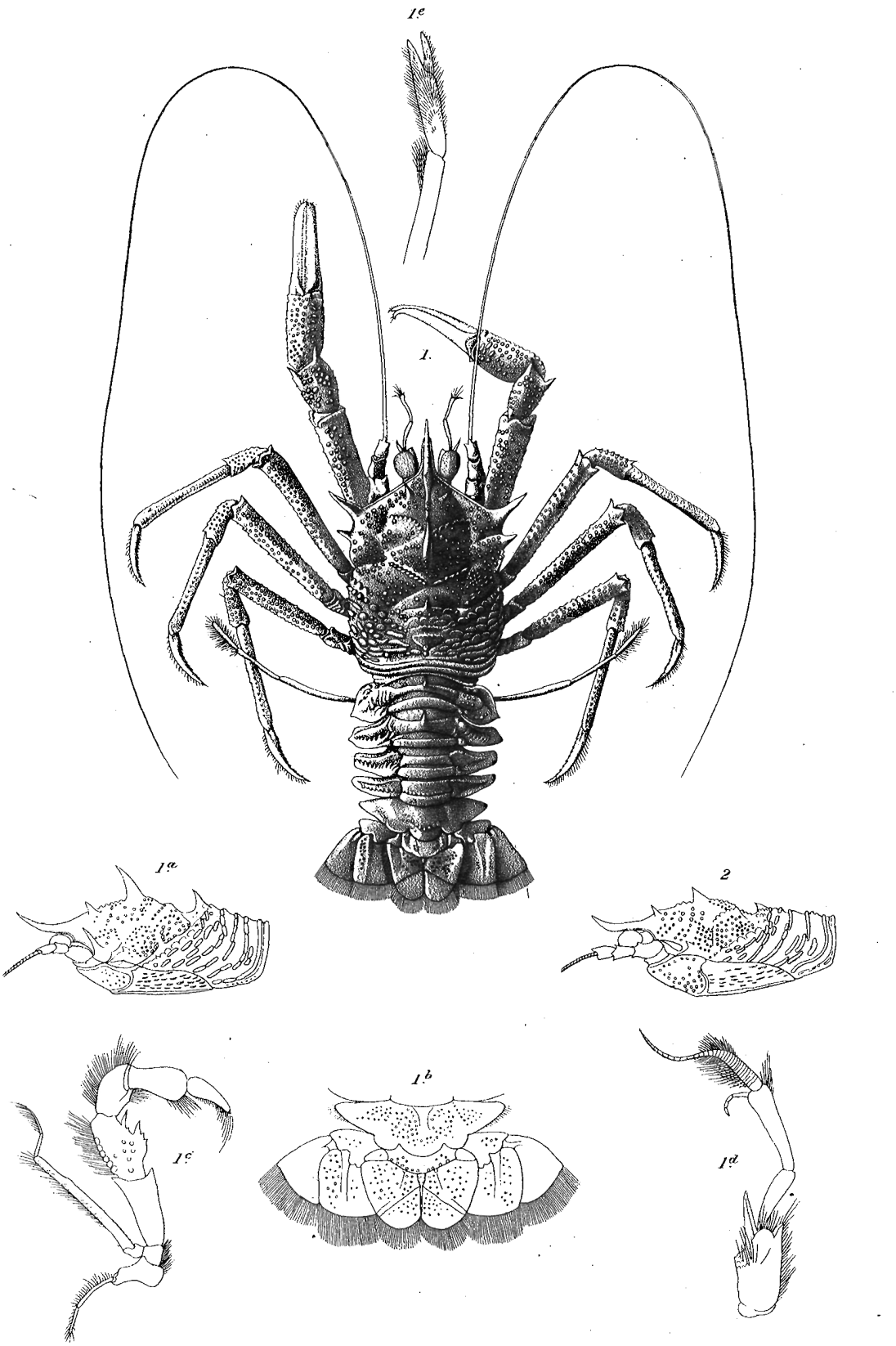
A.M.Westergren, del B.Meisel, lith

1. MUNIDOPSIS QUADRATA. 2. MUNIDOPSIS INERMIS.



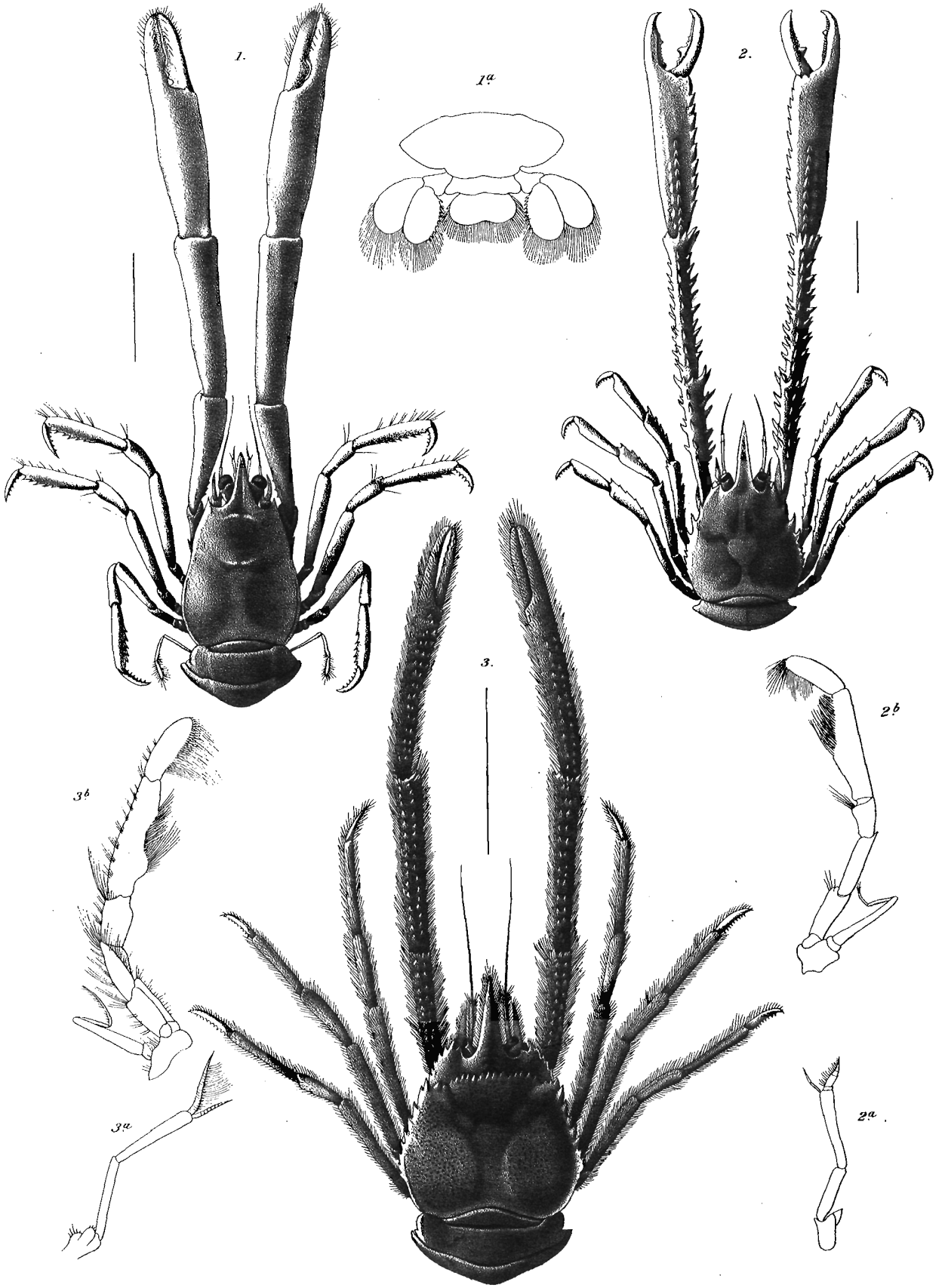
A.M.Westergren, del. B.Meisel, lith.

1 MUNIDOPSIS CARINIPES. 2. MUNIDOPSIS HENDERSONIANA.



A.M. Westergren, del. B. Meisel, lith.

1. GALACANTHA DIOMEDEÆ. 2. GALACANTHA DIOMEDEÆ VAR. PARVISPINA.



1 UROPTYCHUS NITIDUS OCCIDENTALIS. 2 UROPTYCHUS BELLUS.
3. UROPTYCHUS PUBESCENS.