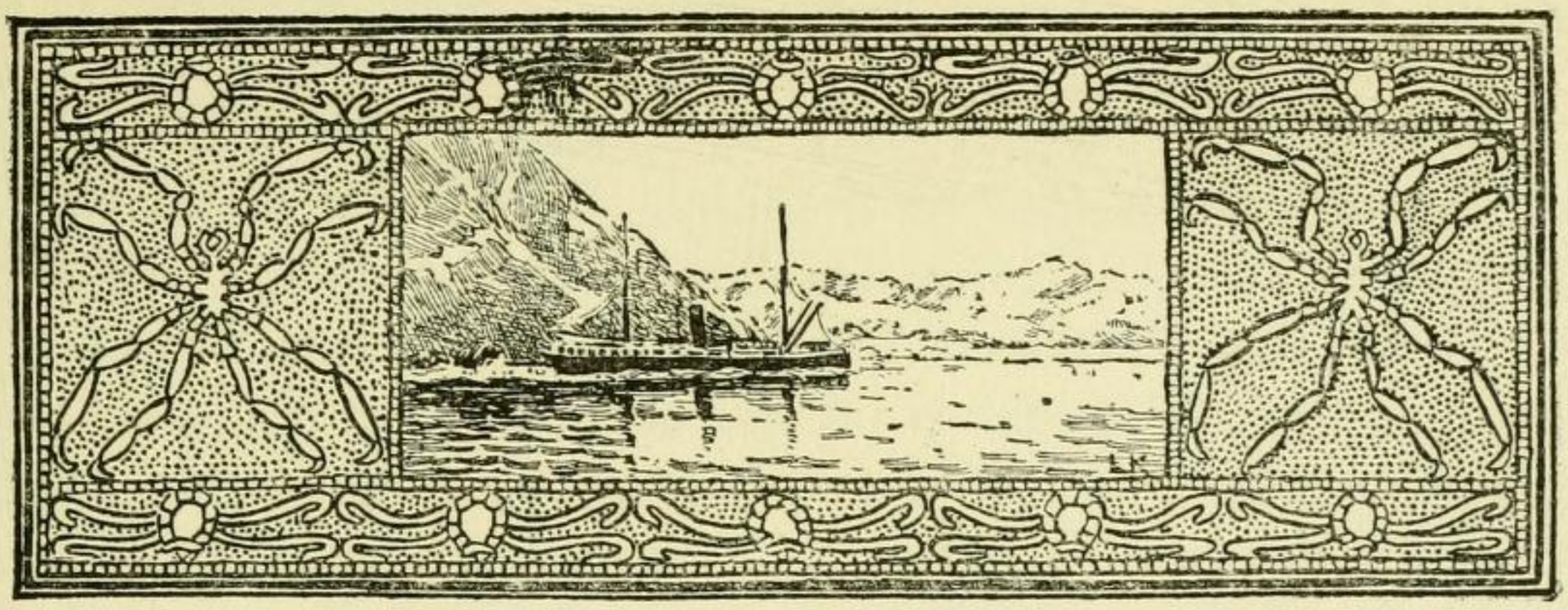
PYCNOGONIDA OF THE WEST COAST OF NORTH AMERICA



PYCNOGONIDA OF THE WEST COAST OF NORTH AMERICA

BY LEON J. COLE

CONTENTS.

INTRODUCTION.

THE Pycnogonida collected by the Harriman Alaska Expedition form the basis of the material described in the following pages. They were obtained by those members of the party who devoted their attention to the invertebrate forms, Professor W. E. Ritter, Dr. W. R. Coe, and Professor Trevor Kincaid; I have also to thank Professor Kincaid for several specimens collected by him upon a previous trip to the Pribilof Islands, in 1897. In addition to the above, the Pycnogonida in the collection of the University of California, from various places along the California coast, were placed at my disposal. Finally several lots, also from California, were turned over to me by Dr. S. J. Holmes, to whom I am indebted for many courtesies. I have been generously permitted to include descriptions of all these forms, so that, with the exception of two previous notes, each describing a new species, of which one is included in the present collections, all that has been written on the littoral Pycnogonida of the west coast of North America will be found in this paper.

Of the two species previously described from the Pacific coast the first was established by Stimpson ('64) from a single specimen, which he called *Ammothea longicaudata*, collected in Puget Sound by the Northwest Boundary Commission. Stimpson's description of the species is preliminary and indeterminate; the fuller description and figures were never published. In 1892 Ives ('92) described a species of *Pycnogonum* from San Diego, California, which he named *Pycnogonum stearnsi*, after the collector. These constitute the references to the shore forms on the Pacific coast of North America. Schimkewitsch ('93) has described the deep-sea specimens collected by the *Albatross* in the Gulf of California and to the southward, none of which was taken in less than 660 fathoms of water, and in a previous paper (Schimkewitsch, '89) he describes the collections of the *Vettor Pisani*, a part of which were made in the Gulf of Panama and at various places along the coast of South America. On the Atlantic coast of North America the chief systematic work has been done by Wilson ('78[a], '78[b], '80, and '81).

The collections here reported comprise altogether 108 specimens, of which 42 are adult males, 39 adult females, and 27 immature specimens. These represent 13 species, included in 9 genera. Specimens of all these species have been deposited in the Museum of the University of California, including the type specimens of those species which are here described for the first time. Duplicates, so far as possible, will be deposited in the United States National Museum.

GEOGRAPHICAL DISTRIBUTION.

The available data are so meager that no very general conclusions can be drawn respecting the distribution of Pycnogonida on the Pacific coast. It may be worth while, however, to consider the question briefly, and to compare the results with what is known of the distribution of other groups in that region. The accompanying table shows graphically the distribution of the Pycnogonida known from the west coast, including the species reported from Puget Sound, which may possibly be synonymous with one of the species of *Ammothea* reported from Alaska.

TABLE SHOWING DISTRIBUTION OF PYCNOGONIDA ON THE WEST COAST OF NORTH AMERICA.

	St. Paul Island, Pribilof Group, Bering Sea.	Dutch Harbor, Unalaska.	Popof Island, Shumagin Group, Alaska.	Orca, Prince William Sound, Alaska.	Puget Sound, Washington.	Shelter Cove, Humboldt Co., Calif.	"Northern California."	Dillon's Beach, Sonoma Co., Calif.	Lands End, San Francisco Co., Calif.	Oakland Creek, Alameda Co., Calif.	San Pedro Point, San Mateo Co., Calif.	Pacific Grove, Monterey Co., Calif.	San Diego, Calif.
Ammothea pribilofensis	x												
Ammothea latifrons	x	x											
Phoxichilidium femoratum		x	x	x									
Ammothea alaskensis			x	x									
Ammothea longicaudata					x								
Pycnogonum stearnsi						x		x			x	x	
Ammothella tuberculata							x	x					
Lecythorhynchus marginatus								x			x	x	
Halosoma viridintestinalis								x					
Ammothea gracilipes									x	x			
Clotenia occidentalis												x	
Anoplodactylus erectus													x
Ammothella spinifera													x
Tanystylum intermedium													x

In the table the localities are arranged in order from the north and west toward the east and south, from Bering Sea to southern California. The species are similarly arranged in the order of their first occurrence in the list of localities. It will be noticed that there is a great gap in the series of localities extending the whole distance from Prince William Sound, Alaska, to northern California, except for the single record of Stimpson at Puget Sound. This gap is indicated in the table by double lines.

It seems at first surprising that more of the species are not identical with North Atlantic forms; but when it is taken into account that only four species have been found to the northward on the Pacific side, and that one of these, *Phoxichilidium femoratum* Rathke, is circumpolar, being found also on the coasts of northern Europe, the proportion does not appear so small. Furthermore, two other of the four species, *Ammothea latifrons* and *Ammothea alaskensis*, correspond fairly closely to the European forms *Ammothea echinata* (Hodge) and *Ammothea lævis* (Hodge) respectively, and it is not unlikely that they have been differentiated from common circumpolar types.

In discussing the distribution of the Hydroids collected by the Harriman Alaska Expedition, Nutting (:01) takes exception to the definition of the Pacific faunal areas made by Dall ('76) in 'An Introductory Note to the Report on Alaskan Hydroids, by Mr. Clark.' Dall extended what he called the *Oregonian Fauna* from Monterey to the Shumagin Islands; Nutting would not extend this southern fauna farther northward than about the region of Puget Sound. Then, instead of a break at the Shumagin Islands with a distinct fauna beyond (called the *Aleutian* by Dall), the results of further research would seem to show that from Puget Sound to the Aleutian Islands the fauna is fairly continuous and homogeneous, and to this Nutting has applied the name *Alaskan Fauna*. Reasoning from the close relation existing between Pycnogonida and Hydroid colonies, the former being so often found with and perhaps obtaining their food from the latter, and the larvæ, in some cases at least, being known to be parasitic upon the Hydroids, either living within the gastral cavity (Dohrn, '81, p. 76) or attached to the outside with the proboscis buried in the body of the host (von Lendenfeld, '83), it would not be at all

surprising if a correlation were found in their distribution. In this connection the results presented in the table may have some bearing on the question of a line of demarcation at the Shumagin Islands. The evidence does not favor such a distinction, for it will be noticed that of the two forms obtained at Orca, both are found at Popof Island, and one of them at Unalaska, still farther west.

As might perhaps be expected, all the species from California are different from those found in Alaska; but in determining the position of the dividing line between the two faunas the data at hand give no help, although, as Nutting supposes, it is not at all unlikely that the line is not far to the southward of Puget Sound.

The fauna of the California coast is in some respects strikingly like that of the Gulf of Naples. For instance, two representatives of the genus *Ammothella* are found along the coast of that State, and none to the northward, while of the other four species which apparently belong to this genus (see p. 273), but which have heretofore been referred to the unrestricted genus *Ammothea*, three are recorded from Naples by Dohrn ('81), and one from the Bermudas by Verrill (:00). The genus *Clotenia* is known only from the original species, *C. conirostris* Dohrn, from Naples, and *C. occidentalis* from Pacific Grove, California. This similarity in the faunas of the two places is probably brought about merely by the similarity in temperature rather than by any direct faunal relation, as a similarity can be found between the forms occurring on the coast of California and those of any place having much the same thermal conditions. For example, the two previously known species of *Lecythorhynchus* have been recorded only from Japan, where the conditions are much the same as on the California coast.

CLASSIFICATION AND TERMINOLOGY.

The classification of the Pycnogonida is at best very unsettled. The group as a whole is remarkably homogeneous, the classification depending for the most part upon such characters as the development or non-development, or the loss in adult life, of certain of the anterior appendages. Other differences are often

correlated with these, giving some justification for the groupings, but it is not at all improbable that widely separated forms are in this way often put together; conversely, specimens of the same species but of different ages have sometimes been placed even in different families.[1] Like my predecessors, however, for want of a better standard, I have retained those groupings which seemed most convenient.

In the matter of the terminology of parts I have, with a few exceptions, followed that given by Meinert ('99) in the 'Pycnogonida of the Danish Ingolf-Expedition,' which in turn differs little from that used by Sars ('91, and previous papers). In using this system rather than the more non-committal nomenclature of Dohrn, I have been influenced by two considerations. In the first place, these names, or names much like them, have been on the whole more generally employed in works on Pycnogonida. Secondly, the Pycnogonida form such a highly specialized and well differentiated group that terms similar to those used for other classes of Arthropoda can be employed without necessarily implying that the parts so designated are homologous, but merely analogous in position, shape, or use. Furthermore, the tendency of recent writers has been to use special names for parts, rather than more general appellations, and it is of the utmost importance that some system should be uniformly established.

In the following pages the word 'body' is used as a general term to include the proboscis, caudal segment, and lateral processes, while 'trunk' has for convenience been restricted to only the main portion of the body, the proboscis, caudal segment, and lateral processes being excluded. Instead of 'ovigerous leg' the word 'oviger' has been employed, and simply 'leg' is made to take the place of the cumbersome phrase 'ambulatory leg,' as there is no danger of confusion. When the tarsal joints and the claw are spoken of as a whole, that portion of the leg is called the 'foot'; and when the ventral margin of the second tarsal joint is differentiated, the basal expansion is spoken of as the 'heel,' and the

[1] Thus Wilson ('80), before it was recognized that *Achelia* included merely the adults of those forms placed in the genus *Ammothea*, put *Ammothea* in the family Nymphonidæ, while *Achelia* was classed along with *Tanystylum* in a family which he called the Achelidæ.

remainder of the surface as the 'sole.' In describing the joints of the palpi and ovigera the abbreviations *j*.1, *j*.2, etc., are often used, and similarly the joints of the legs are abbreviated to *c*.1, *c*.2, *c*.3 for the first, second, and third coxal joints, *f*. for femoral, etc., when the meaning cannot be mistaken. In speaking of the dimensions of a joint, 'length' is always in the direction of the axis of the appendage, 'breadth' at right angles to it, regardless of the proportions of the two. The same rule also holds true for the parts of the body, 'length' being in the direction of the axis of the animal; but when the lateral process alone is spoken of, it has the same long axis as the leg. In general, proportionate measurements are used in preference to absolute, as it is thought they will prove more practicable in determining species. Measurements of the length of the whole animal, or 'body,' as it is usually called, are taken from the tip of the proboscis to the tip of the caudal segment. When possible the specimen is flattened out so that the proboscis projects straight forward and the caudal segment straight backward in order to get this measurement, and when this is not possible it is approximated as nearly as can be. Extent is another measurement which it is difficult to obtain with any degree of accuracy. When practicable I have done this by extending the specimen as fully as possible and measuring directly —usually from the tip of the second leg of one side to the tip of the third leg of the other. For one reason or another this can not always be done conveniently, and in such cases it is often necessary to get the leg measurement joint by joint, and to determine the total extent approximately in this way. Such a degree of accuracy is generally not necessary in determining the absolute size of the species, but is often of much importance in order to get proportion of extent to length, and to other dimensions, in the same specimen. Most authors give measurements for at least length and extent, but as they seldom state just how they are made, they can be used only with considerable caution.

The following comparative table of terms used by several of the more recent authors may be of service in comparing descriptions. A much more complete synonymy will be found in Meinert's report ('99).

COMPARATIVE TABLE OF TERMS USED BY VARIOUS AUTHORS IN DESCRIBING PYCNOGONIDS.

This Paper.	Meinert, '99.	Sars, '91.	Hoek, '81a.	Dohrn, '81.	Wilson, '80.
first trunk segment	first segment of trunk (*segmentum corporis primum*)	cephalic segment	cephalothoracic segment	vorderes Segment	oculiferous segment
neck	neck (*collum*)	neck	.....	.....	neck
second trunk segment	second segment of trunk (*segmentum corporis secundum*)	second trunk segment	first true thoracic segment	zweite Segment	(second segment)
third trunk segment	third segment of trunk (*segmentum corporis tertium*)	third trunk segment	.....	dritte Segment	(third segment)
fourth trunk segment	fourth segment of trunk (*segmentum corporis quartum*)	last trunk segment	.....	letzte Segment	posterior segment
lateral process	lateral process (*processus corporis lateralis*)	lateral process	lateral process	seitliche Fortsatz	lateral process
caudal segment	caudal segment (*segmentum caudale*)	caudal segment	abdomen	Hinterleib	abdomen
eye tubercle	oculiferous tubercle (*tuber oculare*)	oculiferous tubercle	oculiferous tubercle	Augenhügel	oculiferous tubercle
eyes	eyes	corneæ	eyes	Augen	eyes
proboscis	proboscis (*rostrum*)	proboscis	proboscis	Schnabel	rostrum
cheliforus	cheliforus (*cheliforus*)	cheliforus	mandible	Extremität I	antenna
scape	scape (*scapus*)	scape	basal joint of mandible	erste Glied	basal joint
chela	chela, or hand (*chela*)	chela, or hand	second joint	zweite Glied	chela
palm	palm (*palma*)	palm	.....	.....	} second joint
immovable finger	immovable finger (*acumen v. digitus immobilis*)	immovable finger	} pincers	Scheere	
movable finger	movable finger (*pollex v. digitus mobilis*)	movable finger			dactylus
palp	palp (*palpus v. pes palpiformis*)	palpus	palp	Extremität II	palp

oviger	ovigerous leg (*pes ovifer*)	false leg	ovigerous leg	Extremität III	accessory leg
terminal part of the oviger	terminal part of the ovigerous leg (*pars terminalis pedis oviferi*)	terminal part of false leg	.....	.....	.....
egg-mass	egg-globe (*globus ovorum*)	egg-globe	egg-mass, or egg-packet	Eiersack	egg-mass
leg	ambulatory leg (*pes ambulatorius*)	ambulatory leg	leg	Extremitäten IV–VII	leg
first coxal joint (*c.*1)	first coxal joint (*articulus coxalis primus*)	first coxal joint	first joint of leg	Glied 1	basal joint
second coxal joint (*c.*2)	second coxal joint (*articulus coxalis secundus*).	second coxal joint	second joint of leg	Glied 2	second joint
third coxal joint (*c.*3)	third coxal joint (*articulus coxalis tertius*)	third coxal joint	third joint of leg	Glied 3	third joint
femoral joint (*f.*)	femoral joint (*femur*)	femoral joint	fourth joint of leg	Glied 4	fourth joint
first tibial joint (*t.*1)	first tibial joint (*articulus tibialis prior*)	first tibial joint	fifth joint of leg	Glied 5	fifth joint
second tibial joint (*t.*2)	second tibial joint (*articulus tibialis alter*)	second tibial joint	sixth joint of leg	Glied 6	sixth joint
first tarsal joint (*ts.*1)	first tarsal joint (*articulus tarsalis prior*)	tarsus	first tarsal joint	Glied 7	tarsus
second tarsal joint (*ts.*2)	second tarsal joint (*articulus tarsalis alter*)	propodus	second tarsal joint	Tarsus	propodus
heel	.....	'lamellar expansion'	.....	Hacke	.....
sole	.....	.....	.....	Sohle	.....
claw, or terminal claw (*cl.*)	claw (*unguis*)	terminal claw	claw	Kralle	dactylus
auxiliary claws (*aux. cl.*)	auxiliary claws (*unguiculi auxiliaris*)	auxiliary claws	auxiliary claws	Nebenkrallen	auxiliary claws

KEY TO THE SPECIES

The following key is adapted only to the species of Pycnogonida described in this paper, and is applicable only to adult forms. If a chelate specimen not positively known to be adult cannot be identified by it, the specimen may be an immature individual and can perhaps be traced by considering it under A, forms with "Chelifori present, not chelate in adult."

A. Chelifori present, not chelate in adult; palpi present; ovigera 10-jointed, present in both sexes (*Ammotheidæ*).

B. Body rather elongate, distinctly segmented; lateral processes well separated; chelifori 1-jointed; palpi 9-jointed (*Lecythorhynchus*).

C. Proboscis subcylindrical or elliptical, constricted in its middle third . . . . . *Lecythorhynchus marginatus*, p. 260

B′. Body more or less disciform; segmentation often indistinct; lateral processes approximated.

C. Chelifori 2- or 3-jointed; palpi 8- or 9-jointed.

D. Chelifori 2-jointed; palpi 8-jointed (*Ammothea*).

E. Chelifori more than half as long as proboscis; caudal segment reaching at least to middle of second coxal joint of fourth pair of legs . . . . *Ammothea latifrons*, p. 263

E′. Chelifori less than half as long as proboscis.

F. Proboscis narrow, fusiform; forms less than 4 mm. in length and 20 mm. in extent.

G. Protuberance on dorsal side of first coxal joint about half as long as the joint; genital protuberance in male of about the same length.

Ammothea alaskensis, p. 266

G′. Protuberance on dorsal side of first coxal joint fully three fourths as long as the joint; genital protuberance in ♂ only about half as long as protuberance on first coxal joint . . *Ammothea gracilipes*, p. 269

F′. Proboscis broadly clavate, truncate at the apex; forms over 4 mm. in length and 20 mm. in extent.

Ammothea pribilofensis, p. 270

D′. Chelifori 3-jointed; palpi 9-jointed (*Ammothella*).

E. Eye tubercle low, rounded; first 2 or 3 trunk segments with a conical tubercle dorsally near the posterior border.

Ammothella tuberculata, p. 273

E′. Eye tubercle tall, slender; caudal segment slender, curved, elevated, spinose; first and second trunk segments with a pair of spines dorsally near the posterior border.

Ammothella spinifera, p. 275

C′. Chelifori usually 1-, sometimes 2-jointed; palpi 6- or 7-jointed. (*Tanystylum*).

D. Chelifori 2-jointed . . . . *Tanystylum intermedium*, p. 278
C″. Chelifori 1-jointed; palpi 4-jointed; body very much shortened (*Clotenia*) . . . . . *C. occidentalis*, p. 281
A′. Chelifori present, chelate; palpi absent; ovigera present in the male only, 5- or 6-jointed (*PHOXICHILIDIIDÆ*).
B. First trunk segment produced very little, or not at all, anteriorly beyond base of proboscis; lateral processes well separated; ovigera 5-jointed (*Phoxichilidium*) . . . *P. femoratum*, p. 283
B′. First trunk segment projecting somewhat anteriorly beyond base of proboscis; body concentrated, lateral processes closely approximated (*Halosoma*) . . . . . *H. viridintestinalis*, p. 286
B″. First trunk segment projecting well beyond base of proboscis, forming a slender neck; body elongate, lateral processes well separated; ovigera 6-jointed (*Anoplodactylus*).
C. Caudal segment directed upward . *Anoplodactylus erectus*, p. 289
A″. Chelifori and palpi both absent; ovigera present in the male only (*PYCNOGONIDÆ*).
B. Ovigera 9- or 10-jointed (*Pycnogonum*).
C. Ovigera 10-jointed . . . . . *Pycnogonum stearnsi*, p. 292

SYSTEMATIC DISCUSSION OF SPECIES.

PYCNOGONIDA.

Family *ACHELIDÆ*.

Chelifori present, chelate in larva but not in adult; palpi present; ovigera 10-jointed, present in both sexes.

Genus **Lecythorhynchus** Böhm ('79b).

Corniger BÖHM, **'79a**, p. 186.

Trunk rather stout, sutures well defined; lateral processes rather short, well separated. Caudal segment moderately long, pointed upward. Eye tubercle slightly anterior to middle of first segment, pointed. Proboscis comparatively long, approximately cylindrical. Chelifori either 1-jointed (mere knobs) or 2-jointed.[1] Palpi long, 9-jointed. Ovigera 10-jointed. Legs moderately long and stout; first tarsal joint very small; second tarsal joint stout, curved; claw strong; auxiliary claws large.

Remarks.—Böhm first named this genus *Corniger*, but later, finding that name untenable,[2] changed it to the present one. Besides the species here described, the genus at present includes only the two species recorded by Böhm, both of which came from Japan.

1 In *Lecythorhynchus armatus* Böhm.

2 " Da die Bezeichnung *Corniger* indess bereits für eine Fischgattung vergeben ist, so mag dieselbe durch *Lecythorhynchus* ersetzt werden."—Böhm ('79b).

LECYTHORHYNCHUS MARGINATUS sp. nov.

Plate XI, figs. 1–2; plate XV, figs. 1–8.

Type.— ♂, University of California, No. 19,501, San Pedro Point, California; ♀, University of California, No. 19,502, Dillon's Beach, California.

Trunk rather stout, second segment broadest; sutures well defined; lateral processes squarish, shorter than breadth of trunk segment; the first pair projecting forward at an angle of about 45°, the second at a lesser angle, third pair projecting somewhat backward, and fourth pair still more so. There is in some cases an indication of a slight chitinous ridge on the mid-dorsal line of the lateral processes.

Caudal segment comparatively long, about equal to second joint of palp, nearly vertical, subconical, with a small nodular projection on the anterior side at the apex; anal opening just posterior to this projection.

Eye tubercle small, pointed, placed rather nearer to the bases of the chelifori than to the posterior border of the segment. Eyes dark, comparatively large, crowded.

Proboscis nearly as long as trunk, projecting obliquely downward, subcylindrical or elliptical, but constricted in the middle third, thus appearing somewhat swollen both behind and ahead of the middle; tapering gradually in the distal fourth to the rounded extremity.

Chelifori short and rudimentary, thumb-like, simple, parallel or nearly so.

Palpi arising nearly lateral to the chelifori, overreaching the proboscis by about half its length. Nine-jointed: *j.*1 short, square; *j.*2 three or four times as long; *j.*3 short again like *j.*1, lying at middle of proboscis; *j.*4 equal to *j.*2; *jj.*5, 6, 7, 8, and 9 all short and rounded, altogether about equal in length to the two preceding joints; *j.*5 slightly projecting. The palpi usually make a zigzag line due to a sharp bending downward at the third joint and a bend forward again at the fifth. There are a few small spines on the palpi, especially on the fifth and succeeding joints.

Ovigera somewhat different in structure as well as in size in the two sexes. In the male they are about equal in length, when straightened out, to the length of the whole animal. First joint comparatively short and broad; *j.*2 about twice as long, more slender; third as long as first, slender like second; fourth and fifth about equal to second; sixth shorter; seventh small, rounded, armed with a group of small backwardly pointing spines; *jj.*8, 9, and 10 successively smaller and in line, but *j.*8 proceeds from the side of *j.*7, thus forming a sharp angle at this place. These joints also have a few very small spines. The appendage as a whole is sigmoid-

ally curved. The ovigera of the female are noticeably smaller than those of the male; the first three joints are somewhat similar, but the fourth is shorter in proportion, and from this point to and including the tenth they decrease more or less regularly in size. The eighth, ninth, and tenth follow in line with the seventh, in this way making the terminal part of the appendage straight instead of sharply bent as in the male. With the exception of the spines mentioned on the distal joints in the male, the ovigera of both sexes are practically smooth.

The egg-masses are subglobular, fairly compact, and the eggs proportionately rather large.

Legs somewhat over twice the length of the animal, comparatively rather stout. First coxal joint short; *c.2* about twice as long as *c.1*, swollen on ventral side in distal third in both sexes, the genital opening being situated on this swelling; *c.3* little longer than *c.1*; *f.* about equal in length to the coxal region, distended somewhat by the developing eggs in the female; in the male the so-called agglutinative gland opens on a slight prominence on the dorsal side about a fourth of the distance from the distal end of the femoral joint, this prominence not being present in the female; *t.1* and *t.2* about equal in length, slightly shorter than *f.*; *ts.1* very short, triangular; *ts.2* stout, strongly arched; *cl.* falciform, about half as long as *ts.2*; *aux. cl.* well developed, about half as long as *cl.* Convex proximal half of the inner (ventral) border of *ts.2* (the 'heel') armed with 5 or 6 strong, somewhat distally curved spines; concave distal half (the 'sole') beset with a close row of very small spines; the dorsal border of the same joint bears a series of comparatively long slender bristles. First tarsal joint armed with 1 or 2 strong and a number of short bristles. Tibial joints with a few scattered short bristles, especially on the dorsal margin; a longer one near the distal end of each joint, while the femoral has 2 or 3 in a similar position. Aside from these the legs are almost smooth, though in some cases there are scattered hairs, especially on the basal joints. Along the mid-dorsal line of *c.1*, and sometimes extending on to the basal part of *c.2*, is a chitinous ridge ('Chitinleiste,' Böhm, '79[a], p. 188).

Integument moderately thick, with numerous cavities; mostly smooth, but with scattered microscopic bristles.

Length of ♀ : body 3 mm., proboscis 1.3 mm., caudal segment 0.4 mm., extent 20 mm. Male slightly smaller and more slender.

This species has been found in three localities on the California coast, as shown in the accompanying table. Its range is undoubtedly more extensive than this, and it is not unlikely that it will be found in northern California and south to San Diego.

SPECIMENS EXAMINED.

Lot.[1]	Locality.	No. of specimens.	Date.	Source.
10	San Pedro Pt., San Mateo Co., Calif.	1 ♂	Sept. 2, 1895	Univ. of Calif.
18	Pacific Grove, Monterey Co., Calif.	1 ♀	Dec. 29, 1898	" " "
20	Dillon's Beach, Sonoma Co., Calif.	1 ♂, 1 ♀	Nov. 26, 1898	" " "

Remarks.—This species in a general way resembles *L. hilgendorfi* Böhm, but may readily be distinguished from that species by the differently shaped proboscis, its length, absolute and relative to the palpi, the restriction of the chitinous ridges, which in that species extend to the ends of the legs, and, judging by Böhm's figures (Böhm, '79[a], pl. 11, fig. 3 d), by the differently shaped and armed second tarsal joint, as well as by other marked differences.

The structure of the ovigera in the male as compared with those in the female is worthy of notice, the more complicated bending and the armature in the former being well adapted to keeping the egg-masses from slipping off. One of the males examined (collected on November 26) had a single egg-mass on one of this ovigera, while another specimen (collected September 2) was carrying eight rather bulky globules.

As mentioned above, the females are somewhat stouter than the males, and in a specimen collected on December 29 large ova were to be seen in the second and third coxal and femoral joints.

Genus **Ammothea** Leach ('14).

Achelia HODGE, '64, p. 114.

Trunk short, stout, segmentation usually suppressed; lateral processes closely crowded, making the body appear more or less disciform; first segment massive, with square frontal part. Caudal segment not separated from last trunk segment by a suture, narrow cylindric, usually horizontal. Eye tubercle near to the front of the first segment, strongly protuberant, with distinct eyes. Proboscis directed obliquely downward, constricted at the base, fusiform, often with an annular constriction near the distal end. Chelifori in fully developed specimens very small, 2-jointed, second joint globose. The chelifori are chelate in immature specimens. Palpi 8-jointed; *j*.1 and *j*.3 short; *j*.2 and *j*.4

[1] The numbers in this column are those given to each lot of specimens of the same species and from the same locality; the original numbers of the collectors, when there were such, are given in the column with the source.

longer. Ovigera relatively short, larger in the male than in the female; without terminal claw, but with a few denticulate spines (rarely absent, *cf. A. dohrni* Thomson, '84, p. 244). Legs usually rather short, and robust in the female; frequently spinous, usually more so in the male, especially on the basal joints; femoral joint very broad in female, the outer corner more or less projecting in both sexes; second tarsal joint strongly developed, more or less curved, and with a few strong and several weaker spines on the inner margin; terminal claw strong; auxiliary claws usually well developed. Genital openings of female on second coxal joint of all 4 pairs of legs; those of the male at the apex of prominent projections on the corresponding joints of the third and fourth pairs of legs only.

Remarks.—The genus *Ammothea* was first established by Leach to include certain forms having chelate chelifori; later Hodge gave the name *Achelia* to some very similar Pycnogonids, which had, however, rudimentary 2-jointed chelifori; but Dohrn ('81, p. 134) and others since have shown conclusively that *Achelia* represents merely the fully developed individuals of *Ammothea*. Dohrn believes that the following genera—*Phanodemus* Costa, *Pephredo* Goodsir, *Pasithoë*[1] Goodsir, *Endeis* Philippi, *Paribœa* Philippi, *Platychelus* Costa, and *Alcinous* Costa—should also be considered as synonyms of this genus.

It is possible that *A. longicaudata* Stimpson is identical with one of the species described here, and if so it is probably with *A. latifrons*. (See 'Remarks' under that species, p. 266.)

I have been unable to examine the description of *A. borealis* given by Schimkewitsch ('95) in a paper on the Pycnogonida of the White Sea, in order to compare with it the forms collected in Alaska, so that there remains a possibility that one of these may be the same as that described by him.[2]

AMMOTHEA LATIFRONS sp. nov.

Plate XI, fig. 3; plate XVI, figs. 1–9; plate XVII, figs. 1–3.

Type.— ♂ and ♀, University of California, No. 19,503, St. Paul Island, Bering Sea.

Trunk broad, especially anteriorly, each outer corner having an erect conical protuberance armed with a few spines, short, tapering posteriorly in a V-shape, smooth; sutures indistinct anteriorly, obsolete posteriorly; lateral processes very closely crowded, nearly twice as broad distally,

[1] Sars ('91, p. 137) considers *Pasithoë* as probably distinct, and uses it as the type of a family, the Pasithoidæ, including with it one other genus, *Colossendeis*.

[2] Subsequent comparison with Schimkewitsch's description shows that *A. borealis* is distinct from the species described in this paper.

where there are on the dorsal border three nodular processes, each armed with one or more spines.

Caudal segment very long and narrow (as long as proboscis), reaching a little beyond the middle of the second coxal joint of the posterior pair of legs; not marked off from trunk by a suture; directed somewhat downward; dorsal outline irregular and armed with a number of stout spines.

Eye tubercle on the extreme anterior edge of the first trunk segment, moderately high, cylindrical; apex obtusely conical; eyes rather large, near the apex.

Proboscis about as long as trunk to base of caudal segment, broadly elliptical, truncated at the extremity; dorsal border more convex than ventral as seen from side; without circular constriction, but with distinct longitudinal ribs.

Chelifori considerably over half the length of the proboscis, stout; first joint reaching at least to middle of proboscis; tuberculated on the dorsal side, the tubercles armed with spines; second joint small, spherical, with 1 or 2 spines. The chelifori are not parallel, being bowed outward in the middle.

Palpi 8-jointed, overreaching the proboscis by nearly a third of its length; *j*.2 and *j*.4 long, others short; *j*.2 somewhat longer than *j*.4, proximal joints sparsely armed with a few rather long bristles; outer side of distal joints densely crowded with somewhat shorter ones.

Ovigera considerably different in the two sexes. Oviger of female about as long as palp; *j*.1 short and broad; *j*.2 issuing somewhat from the side of *j*.1; *jj*.2 and 3 about equal, longer than *j*.1; *jj*.4 and 5 about equal, longest; *jj*.6 to 10 successively smaller; *j*.10 very small, rounded; *jj*.7, 8, 9, 10 each armed with two denticulate spines; *jj*.5 and 6 with a few small bristles. Oviger of male nearly twice as long as that of female; *j*.1 squarish; *j*.2 longer than *j*.1; both *jj*.1 and 2 broader than the succeeding joints; *j*.3 longer than *j*.2; *j*.4 and *j*.5 about equal, longer than *j*.3; *jj*.6 to 10 successively smaller, except *j*.9, which is longer than *j*.8; *j*.10 small and furnished with 2 denticulate spines, while *j*.9 has at least 1; no denticulate spines could be discerned on the preceding joints. Joints 4 to 7 are armed with short, backwardly projecting spines in rows, while the succeeding joints have only 2 or 3 simple bristles each. Terminal part of the oviger strongly incurved.

External egg-masses rather small, globular. So far as observed, but one mass on each oviger.

Legs relatively short, rather less than twice the length of the body; *c*.2 not much longer than *c*.1 and *c*.3; *c*.1 with 3 tubercles on its dorsodistal edge, each armed with spines; *f*. rather shorter than coxal region,

especially broad in the female, where it may equal the width of the proboscis; at the dorsodistal border is a long conical protuberance armed with a strong spine which usually projects distally; *t.*1 and *t.*2 equal, stout; all these joints armed more or less densely with moderate spines, which are longer, however, on the dorsal side of *t.*1 and *t.*2. First tarsal joint small, subtriangular, with short, even spines; *ts.*2 moderately strong, arcuate, armed dorsally and on the sides with rows of slender spines, and ventrally with 3 strong spines at the heel and a row of very short ones along the sole; *cl.* about one half *ts.*2.; *aux. cl.* well developed, half as long as *cl.* In the male the genital projection on the ventrodistal side of *c.*2 of the 2 posterior pairs of legs is pronounced and thumb-like, and provided with 1 or 2 slender bristles. As is characteristic of the genus, the genital openings of the female are in a corresponding position on all 4 pairs of legs, but are not situated on similar protuberances.

Length about 4 mm., extent 16 mm.; the two sexes nearly the same size.

Immature specimens.—Four immature specimens of this species were examined, two from each locality where the form was taken. They are but little smaller than the adults, which they closely resemble, but are provided with chelate chelifori (pl. XVII, fig. 1), and the ovigera are very short, with indistinct articulations (fig. 2). It is interesting to note that the denticulate spines are already forming in this early stage, in a space beneath the outer cuticle (fig. 3), and at the next moult would probably be free. If any of these specimens were males there was no trace at this stage of the genital protuberances; in fact, the genital openings were not distinguishable at all.

SPECIMENS EXAMINED.

Lot.	Locality.	No. of specimens.	Date.	Source.
1	St. Paul Island, Pribilofs	2♂, 3♀, 2 juv.	1897	Prof. Kincaid (123)
4	Dutch Harbor, Unalaska	1♂, 3♀, 2 juv.	July, 1899	H. A. E. (Prof. W. R. Coe)

Remarks.—Whereas *Ammothea alaskensis* may be taken as the representative of *A. lævis* (Hodge) in the Western Hemisphere, *A. latifrons* more closely approaches those forms grouped about the European species *A. echinata* (Hodge). It may readily be distinguished from any described species, however, by its very broadly elliptical proboscis and the long, knobby chelifori and caudal segment. This species is about twice the size of *A. echinata*.

The description of *Ammothea longicaudata* Stimpson ('64, p. 159) will apply in most respects to *A. latifrons*, but the description is so generic that it would apply almost equally well to a number of other species. Furthermore, Stimpson's single example was evidently an immature specimen, and if, as he says, the palpi were 9-jointed,[1] it is not unlikely that it belongs properly in the genus *Ammothella*. On the whole it seems best to regard it as a distinct species until further material from the region of Puget Sound shall enable us to settle the question.

All the specimens of *A. latifrons* had a quantity of foreign material entangled in the spines; those in the lot from Dutch Harbor especially were covered with this débris, containing, among other things, small brownish stalked bodies (similar ones are not infrequent on Pycnogonida) and groups of small cases appearing much like egg-cases of some animals, possibly the same as those referred to by Hoek ('81ª, p. 143).

AMMOTHEA ALASKENSIS sp. nov.

Plate XII, fig. 4; plate XVII, figs. 4–12.

Type.— ♂ and ♀, University of California, No. 19,505, Orca, Alaska.

Trunk short, stout, smooth; sutures very indistinct; first segment square in front, affording a broad attachment for the chelifori and palpi; lateral processes about equal to width of body, larger distally, and closely approximated, so that the body appears nearly circular in outline; a small protuberance with a short spine on the dorsal side of each process near the distal end.

Caudal segment long, narrow, somewhat smaller proximally, reaching to about the middle of the first coxal joint of the posterior pair of legs; with 3 or 4 small spines near the apex and a large bristle on the dorsal side.

Eye tubercle low, conical; the posterior side more slanting and with more of a 'hip.' Eyes large, at about the middle of the tubercle; no noticeable difference in size.

Proboscis about as long as trunk to base of caudal segment, distinctly fusiform in dorsoventral view, strongly convex on dorsal side and more nearly straight on ventral when viewed laterally; with a more or less irregular annular constriction about a fourth of its length from the apex.

Chelifori considerably less than half the length of the proboscis; first joint with a considerable triangular projection distally on the dorsal side, terminating in a small bristle; second joint small, globular, arising some-

[1] "Chelate 'antennæ' much shorter than the proboscis; their slender lower branch, however, is much longer, nine jointed, not tapering, and with blunt extremity" (*loc. cit.*).

what from the inner side of the first. Both joints unarmed, except as noted above.

Palpi 8-jointed, longer than proboscis: *j*.1 short and broad, and apt not to be seen when the animal is viewed from above; *j*.2 much longer and more slender, enlarging somewhat distally; *j*.3 short and small; *j*.4 about equal to *j*.2; *jj*.5 to 8 small, rounded, rather densely armed on the ventral side with strong bristles; the preceding joints with only 2 or 3 bristles.

Ovigera of female about as long as palpi: *j*.1 short, broad, longer on inner side; *j*.2 longer, arising well down on the outer side of *j*.1, triangular, broad at the distal end; *j*.3 equals *j*.1; *j*.4 somewhat longer, about equals *j*.2; *j*.5 equals *j*.4, broader; *jj*. 6, 7, 8, 9, 10 are usually turned back on the basal joints so that the appendage forms a simple hook; the diameter gradually decreases from *j*.5 to *j*.10; *jj*.6, 7, 8 rounded; *j*.9 longer; *j*.10 very small and not always very distinctly marked off. The tenth joint is armed with 2 feather-like denticulate spines; there are apparently[1] 2 also on each *j*.9 and *j*.8, while there is at least 1 on *j*.7. Joint 9 has a strong, straight, backwardly pointing spine on the dorsal side; on the other distal joints there are a few short, simple spines; the proximal part is unarmed. Oviger of male about twice the size of that of the female; the general form of the joints much the same, except that they are much longer in proportion to the width; arrangement of denticulate spines about as in female; corresponding long spine on back of *j*.9; but *jj*.4 to 8 have quite a number of long slender bristles, which are especially abundant on the outer side of *j*.6. There is also a row of some 8 or 9 short, stout, recurved spines on the side of *j*.5, while the proximal joints of the oviger have more of a tendency to be hairy than in the female. Terminal part of oviger strongly incurved.

Ova were observed in the femoral joint of the female, but no external egg-masses were found.

Legs comparatively rather stout, appearing especially so in the female, where the femoral joint is very broad. First coxal joint short, with a long, slender dorsal protuberance; *c*.2 only a little longer than *c*.1; *c*.3 equals *c*.1; *f*., *t*.1, and *t*.2 each about equal in length to coxal region; *f*. has at its dorsodistal corner a conical protuberance with a short spine; *ts*.1 small, triangular; *ts*.2 strongly developed, somewhat arched; heel not prominent, but there are 3 or 4 strong spines at this place; sole with a series of smaller spines, while there is a row of more slender

[1] The margins of these spines are so delicate and thin that when they chance to lie over or under the appendage on the slide it is exceedingly difficult to distinguish them from ordinary simple spines.

bristles along the dorsal curve; *cl.* strong, fully half as long as *ts.*2, but slightly curved; *aux. cl.* well developed, half as long as *cl.* Legs of female nearly smooth, a few small bristles, especially on the dorsal side of *f.*, *t.*1, and *t.*2; male considerably more spiny, especially on coxal joints.

Length of male about 3 mm., extent about 13 mm.; female slightly smaller.

As shown in the following table, the localities at which this species was taken were two—Orca, in Prince William Sound, and Popof Island, in the Shumagin group. Those at Orca were found on *Thuiaria turgida* Clark.[1]

SPECIMENS EXAMINED.

Lot.	Locality.	No. of specimens.	Date.	Source.
6	Popof Id., Alaska	1 ♀	July, 1899	H. A. E. (Prof. Kincaid) (113)
7	Popof Id., Alaska	1 ♀	July 8, 1899	H. A. E. (Prof. W. E. Ritter)
25	Orca, Alaska	1 ♂, 1 ♀	June, 1899	H. A. E.

Remarks.—This species resembles *Ammothea lævis* (Hodge) as described by Sars ('91, p. 124, pl. XIII, fig. 2, a–m), especially in lacking the very spiny character of many of the species of the genus. It appears, however, to be distinct from *A. lævis*. Among other differences may be noted the following: *A. alaskensis* has but one protuberance on the lateral processes, in place of two; the eye tubercle is much smaller, with the eyes of the same size; the proboscis is considerably larger in proportion and of a different shape; the chelifori are not half as long as the proboscis, and the basal joint has a prominent dorsal process; the second joint of the palpi is not shorter than the fourth; the auxiliary claws are much better developed. *A. alaskensis* is also about twice the size of *A. lævis*.

No immature specimens of *A. alaskensis* were found.

Rather thickly scattered over the surface of one of the specimens from Orca, and especially on the palpi, was observed a peculiar elliptical diatom, and it was of interest that the same form was found on one of the specimens from Popof Island, some six or seven hundred miles to the westward. Two or three other species of diatoms were also clinging to the latter. The first-mentioned diatom has also been observed on other species of Pycnogonida.

[1] I am indebted to Professor C. C. Nutting for the identification of this Hydroid.

AMMOTHEA GRACILIPES sp. nov.

Plate XII, fig. 5; plate XVIII, figs. 1–6.

Type.— ♂ and ♀, University of California, No. 19,506, Lands End, San Francisco County, California.

Trunk rather broad, tapering rather abruptly behind the third lateral processes, smooth, broader anteriorly, where the lateral corners are produced into rounded, unarmed tubercles; sutures indistinct; lateral processes close together, about as long as breadth of trunk, even with second pair, abruptly narrowed in proximal half, and with a small dorsal tubercle at the distal end.

Caudal segment moderately long, reaching at least to the end of the first coxal joint of the fourth legs, curved upward, and usually somewhat bifid as seen in lateral view; smooth.

Eye tubercle short, bluntly conical, and but slightly hipped. Eyes rather large; at base.

Proboscis about as long as trunk to base of caudal segment; rather narrow as seen from above and broadest at about the middle; from the side, broadest beyond the middle and more nearly straight on ventral side.

Chelifori somewhat less than half the length of the proboscis; scape short and thick, produced into a small dorsal tubercle at the distal end; second joint about half as long as scape, oval.

Palpi 8-jointed, but little longer than the proboscis; *jj*.1 and 3 short; *jj*.2 and 4 long, equal; *jj*.5, 6, 7, 8 short, rounded, bulging somewhat ventrally, where each is armed rather densely with short bristles; first four joints nearly unarmed.

Ovigera of female about as long as palpi; *j*.1 short, square; *j*.2 longer; *j*.3 equal to *j*.1; *j*.4 as long as *j*.2, broader distally; *j*.5 longest; *j*.6 smaller than *j*.7; *jj*.8 and 9 successively smaller; *j*.10 very minute; *jj*.7, 8, 9, 10 each provided with a pair of denticulate spines; aside from this the appendage is practically unarmed. Ovigera of male about one and three fourth times as long as that of female; *j*.1 short and thick; *j*.2 twice as long but of the same diameter; *j*.3 still longer, narrower; *j*.4 slightly shorter than *j*.3; *jj*. 5 and 6 about equal, each about as long as *j*.1; *j*.7 projecting somewhat at its outer distal corner; *j*.8 small; *j*.9 slightly longer; *j*.10 minute. The only denticulate spines distinguished were two on *j*.10. The third joint and those comprising the terminal part of the oviger have a few scattered bristles along the side of greater curvature, while *j*.7 has a clump of 4 or 5 at its distal end.

Eggs relatively large (about 0.13 mm. in diameter), in small balls with

6 or 8 eggs in a ball; the male may have from 10 to 15 of these masses on each oviger.

Legs about twice as long as body, rather slender, especially in the male; *c.*1 with an especially long finger-like projection on its dorsal side, nearly as long as the joint itself; *c.*2 about half again as long as *c.*1; *c.*3 equals *c.*1; *f.* broader in the female, with the conical projection and spine characteristic of the genus at its distal end; *t.*1 and *t.*2 each about equal to *f.*, outer border uneven and armed with scattering short spines; *ts.*1 nearly unarmed; *ts.*2 large and stout, nearly as long as *t.*2, well arched, with a few small spines on the dorsal side; heel with 3 rather strong, distally curved spines; a row of short, slender spines along the sole beyond it; *cl.* stout and but little curved, half as long as *ts.*2; *aux. cl.* well developed, half as long as *cl.* Except as mentioned, the leg is almost free of armature; there are a few short spines on *c.*2 and *c.*3.

Length 1.5 mm. to 2 mm.; extent about 8 mm.

SPECIMENS EXAMINED.

Lot.	Locality.	No. of specimens.	Date.	Source.
9	Lands End, San Francisco Co., Calif.	2 ♂, 1 ♀	Feb. 8, 1899	Univ. of Calif.
12	Oakland Creek, Calif.	2 ♂, 20 juv.	March, 1899	Univ. of Calif.

Remarks.—The present species of *Ammothea* was much the smallest representative of the genus in the collections. In size it compares with *A. echinata* of Europe. This species is described from the 3 specimens from Lands End (Lot 9); the specimens from Oakland Creek (Lot 12) differ slightly from these, but with the material at hand it did not seem advisable to separate them as a subspecies. The process on the first coxal joint is not so long, while the chelifori and caudal segments are apparently a little longer in proportion. With Lot 12 there are 20 immature specimens in various stages of development, and all with chelate chelifori.

There were two species of Hydroids in the bottle with Lot 12, among which the Pycnogonids were probably collected. These were identified by Professor Nutting, one as *Obelia dichotoma*, the other as *Obelia gelatinosa* or a closely related species.

AMMOTHEA PRIBILOFENSIS sp. nov.

Plate XII, fig. 6; plate XVIII, figs. 7 and 8; plate XIX, figs. 1–8.

Type.— ♂ and ♀, University of California, No. 19,507, St. Paul Island, Bering Sea.

Trunk broad, not markedly tapering posteriorly, unarmed; antero-

lateral corners produced, rounded, smooth; sutures indistinct; lateral processes crowded, about as long as breadth of trunk in median part, much broader distally, where they have on the dorsal border two small tubercles which bear a few short bristles. On the first lateral process one of these tubercles is usually much reduced (pl. XIX, fig. 2).

Caudal segment moderately long, reaching to the posterior border of the first coxal joint of the fourth pair of legs, narrow, curved slightly upward, and continued more or less into an upward projection at the tip; possessing a few minute bristles.

Eye tubercle slightly back from the anterior margin of the first trunk segment, moderately high, sharply pointed, nearly straight on the anterior border, sloping and with a slight hip posteriorly. Eyes dark; at the base of the tubercle.

Proboscis large, equal in length to femoral joint of leg, broadly clavate, truncate at the apex, usually bent far over so as to be directed downward; roughly triangular in section, thus appearing from the side much more convex on the dorsal border. Without circular constriction.

Chelifori barely one third as long as proboscis; scape short and comparatively thick, produced dorsally at the distal end into a considerable projection; second joint nearly half as long as first, elliptical. The cheliforus is unarmed except for a few very short bristles at the end of the scape.

Palpi 8-jointed; when fully extended distal 4 joints reaching beyond the proboscis; *jj.*1 and 3 short; *jj.*2 and 4 long, equal; *jj.*5, 6, 7, 8 short, the first three of these triangular, being much broader at the distal end, the next distal joint in each case articulating at the dorsal side, thus leaving a rounded projection below, which is bristly with short spines; *j.*8 elliptical, similarly armed. Joints 2 and 3 have a few rather stout bristles at their distal ends, and a row of similar bristles extends along the dorsal side of *j.*4.

Ovigera of female about as long as palpi: *j.*1 short and broad; *j.*3 short; *jj.*2, 4, and 5 longer and broader than *j.*3; *jj.* 6 to 10 gradually diminishing in size; *jj.*7 to 10, at least, with two denticulate spines each; appendage otherwise unarmed except for a few scattered minute spines. Oviger of male nearly twice as long as that of female; *j.*1 short, broad; *j.*2 two or three times as long, also broad; *jj.*3 and 4 somewhat longer than *j.*2, but more slender; *j.*5 nearly as long as *j.*4, broader again; *j.*6 shorter, about as broad as *j.*5; *jj.*7 to 10 decrease gradually in size and diameter, except that *j.*9 is longer than *j.*8. Denticulate spines, two in number, were observed only on *j.*10. The terminal part of the oviger is turned sharply inward and curved back upon itself.

Joints 3 to 8 are provided, mostly on the outer curve, with rather long, closely set bristles, which tend to turn backward for the most part, except on *j.*3.

Eggs carried by the male in numerous small pear-shaped masses, which are attached to the ovigera by short thread-like stalks. One male may carry between 30 and 40 of these masses, in each of which there are relatively few eggs.

Legs about twice as long as body: *c.*1 short, square, provided on the dorsodistal border with a strong median protuberance which has on each side of it a smaller projection bearing a few short bristles and forming the outer corners of the joint (pl. XIX, fig. 2); *c.*2 nearly twice as long as *c.*1, bearing in the male on the third and fourth legs, in the usual position, a long thumb-like genital projection, about half as long as the joint from which it arises, considerably broader distally than proximally, and rather thickly beset with long slender bristles; *c.*3 shorter again. Femoral joint about equal to coxal region, of the usual shape, much broader in the female and with a rounded protuberance distally on the dorsal edge; *t.*1 and *t.*2 about equal to each other and to *f.* in length, but of smaller diameter than the last; *ts.*1 small, triangular, rounded below; *ts.*2 stout, over half as long as *t.*2, rather strongly arcuate; heel hardly differentiated, but there are 3 rather strong, distally curved spines at this point; sole armed with comparatively long, thickly set bristles which extend back on to the heel (fig. 5). Claw about half as long as *ts.*2, but slightly curved; *aux. cl.* well developed, half as long as *cl.* All the joints beyond *c.*1 beset with more or less scattered short bristles; these are considerably longer and thickly crowded on the ventral side of *c.*3 and the proximal end of *f.*

Length 6 mm. to 7 mm., extent fully 30 mm.; the two sexes about the same size.

Color in alcohol yellow to dark brown. Integument thick; cuticular cavities large and numerous.

Immature specimen.—There was with Lot 2 one immature specimen, about two thirds the size of the adult animals, and with chelate chelifori; the chelæ rather stout and strongly forcipate (fig. 3). The ovigera were small and undeveloped.

SPECIMENS EXAMINED.

Lot.	Locality.	No. of specimens.	Date.	Source.
2	St. Paul Island, Pribilofs	2♂, 3♀, 1 juv.	Aug. 10, 1897	Prof. Kincaid (121)
23	St. Paul Island, Pribilofs	1♂	1897	Prof. Kincaid (123)

Remarks.—As shown in the table above, this remarkably large representative of the genus *Ammothea* has been found only at St. Paul Island, presumably in shallow water. Besides by its large size, it may be distinguished by its relatively very large and peculiarly shaped proboscis, the nearest approach to which would seem to be found in this genus in *A. magniceps* Thomson ('84, p. 244, pl. xv, figs. 1–5, and pl. xvi, fig. 3).

Genus **Ammothella** (Verrill).

Ammothea (in part).

Ammothella (subgenus) VERRILL, :00, p. 581.

Similar in most respects to *Ammothea*, from which it differs principally in the fact that the trunk is usually proportionately broader and distinctly segmented, the chelifori 3-jointed,[1] and the palpi 9-jointed (sometimes 10-jointed?), while the femoral joint lacks the projection at its distal and always present in *Ammothea* proper.

Remarks.—Dohrn ('81) described three species of Pycnogonida from the vicinity of Naples which present the characters outlined above, but he included them all in the genus *Ammothea*. Recently Verrill (:00, p. 581) has reported a species from the Bermudas which is very insufficiently described, but which agrees with the forms reported by Dohrn except that, according to Verrill, the Bermuda specimen has 10-jointed palpi. Verrill named his specimen "*Ammothea* (?) *rugulosa*," and, evidently because it differed from typical *Ammothea* in the number of joints in the palpi, made a new subgenus for it which he called *Ammothella*. From a study of the specimens described in this paper I believe that they, together with Verrill's species and the three species *A. appendiculata*, *A. uni-unguiculata* and *A. bi-unguiculata* of Dohrn may properly be put into a genus distinct from the restricted *Ammothea*, and to this I give the name *Ammothella* proposed as a subgeneric name by Verrill.

AMMOTHELLA TUBERCULATA sp. nov.

Plate xii, fig. 7; plate xx, figs. 1–6.

Type.— ♀, University of California, No. 19,508, Northern California.

Trunk broad, elliptical, segmentation clearly marked; anterior corners produced into short rounded tubercles; the first, second, and third segments each with a conical tubercle dorsally near its posterior border (this was lacking on the third segment in one of the specimens, Lot 22), anterior of these tallest, decreasing in height posteriorly; lateral processes short, only half as long as breadth of trunk, closely crowded, somewhat broader

[1] Dohrn ('81, p. 154) considers the chelifori 2-jointed and explains the 3-jointed appearance by saying: "Sie ist auf weit ausgezogenen Basalstücken eingelenkt."

distally, where the dorsal corners are continued into 2 short, knob-like processes.

Caudal segment moderately long, curved slightly upward, reaching slightly past the middle of the second coxal joint of the fourth pair of legs; narrow, swollen distally, slightly bifid at the apex as seen from above; armed with a few short bristles and a longer one on the dorsal side.

Eye tubercle moderate, taller than the dorsal tubercles, bluntly rounded. Eyes of good size; near the apex.

Proboscis equals trunk to base of caudal segment, broadly ovate, somewhat narrower in side view.

Chelifori over half as long as proboscis; second joint about equal to first, clavate, with a number of short bristles at its distal end; third joint short, less than half as long as second, subchelate, the somewhat triangular pieces representing the fingers of the chela probably being the rudiments of those organs in the larva. The third joint has one short spine.

Palpi 9-jointed; when fully extended but little longer than the proboscis, about 3 joints reaching beyond its tip; *jj*.1 and 3 short; *jj*.2 and 4 longer; *j*.2 somewhat longer than *j*.4; *jj*.5 to 9 short and decreasing gradually in size, subtriangular, being bulged ventrally toward their distal ends, and here armed with numerous short bristles. The fourth joint has scattered similar bristles; the remaining (basal) joints practically unarmed.

Ovigera of the female equal to the palpi in length; *j*.1 short; *j*.2 longer; *j*.3 shorter again; *jj*.4 and 5 longest, each about equal to *j*.1 + *j*.2; *jj*.6, 7, and 8 successively smaller; *j*.9 larger again, about equal to *j*.7; *j*.10 very small, and armed with 2 denticulate spines, as is also the case with *j*.9 and *j*.8. Aside from this the appendage is almost unarmed, except for 3 or 4 short curved spines on *j*.6.

Legs stout, somewhat less than twice as long as body; *c*.1 short, square, with a short rounded protuberance dorsally; *c*.2 longer, considerably narrower at proximal end, where it joins *c*.1, somewhat bulged distally below; *c*.3 equals *c*.1; *f*. comparatively short and broad, without the thumb-like protuberance at the distal end usual in *Ammothea*, but with several bristles at this point and scattered along its dorsal border; shorter than coxal region; *t*.1 and *t*.2 each about equal to *f*., both with more or less wavy dorsal borders, where they have a row of bristles of irregular size; *ts*.1 not unusual, armed with a few small bristles, especially ventrally; *ts*.2 equals about four fifths of *t*.2, rather stout, but slightly arcuate; with a row of small bristles dorsally, 3 stout spines on the heel, and a row of short slender spines along the sole. Claw half as long as *ts*.2, rather strongly curved; *aux*. *cl*. about half as long as *cl*.

Length of female 1.8 mm., extent about 9.5 mm.

Color in alcohol light yellowish. General appearance clean and smooth.

SPECIMENS EXAMINED.

Lot.	Locality.	No. of specimens.	Date.	Source.
22	"Northern California"	1 ♀	1893	Dr. S. J. Holmes
27	Dillon's Beach, Sonoma Co., Calif.	1 ♀	Nov. 26, 1898	Univ. of Calif.

Remarks.—Both of the specimens at hand were females; in one ova could be distinguished in the second and third coxal and femoral joints of the legs, while in the other the character of the ovigera and the fact that genital openings could be plainly distinguished in the usual place on all four pairs of legs left no doubt of its sex.

AMMOTHELLA SPINIFERA sp. nov.

Plate XII, fig. 8; plate XX, figs. 7–9; plate XXI, figs. 1–6.

Type.— ♀, University of California, No. 19,509, San Diego, California.

Trunk broad, not especially tapering, the outer anterior corners without prominent protuberances; segmentation distinct; 1 or 2 short spines at the base of the eye tubercle, and a longer one on each side of the mid-dorsal line on the posterior border of the first and second segments. Lateral processes well separated, comparatively short, about half as long as breadth of body at second segment, somewhat swollen distally, with a short spine dorsodistally and usually one to each side on the distal border.

Caudal segment long, slender, about equal to first 2 trunk segments, projecting upward at an angle of about 45°, slightly arched; armed with several slender spines, those on the dorsal border especially long.

Eye tubercle narrow, high, erect; about two thirds as long as caudal segment, with a sharp angle or hip on each side as seen in antero-posterior profile; eyes large, dark, situated at the tip of the tubercle.

Proboscis about as long as trunk, rather broadly fusiform, as broad as trunk between the first and second lateral processes.

Chelifori long, reaching to within a short distance of the tip of the proboscis; first joint nearly as long as second; second joint clavate; both this and the first armed with a few short spines. Terminal joint small, rounded, bituberculate, showing evidence of its former chelate condition; armed with 1 or 2 short spines.

Palpi 9-jointed, fully half again as long as proboscis: *jj.* 1 and 3 short;

jj.2 and 4 longer, *j*.4 being longer than *j*.2; *j*.5 longer than *j*.3, about half as long as *j*.2; *j*.6 longer than *j*.5, fully half as long as *j*.4; *j*.7 small, shorter than *j*.5; *j*.8 slightly longer than *j*.7; *j*.9 longer than *j*.8; *jj*.5, 6, 7, 8 somewhat clavate, the succeeding joint being in each case articulated at the dorsal side of the broad distal end of the joint preceding it. The palp is armed with short, rather stout spines, especially along the ventral side of the distal 5 joints.

Oviger of female measures somewhat less than fully extended palp: *j*.1 short; *j*.2 considerably longer; *j*.3 slightly longer than *j*.1; *j*.4 longest, about twice as long as *j*.3; *j*.5 shorter again; *j*.6 still shorter; *j*.7 longer than *j*.6 but shorter than *j*.5; *j*.8 about equal to *j*.6; *j*.9 about equal to *j*.7; *j*.10 very small, rounded. Joint 10 has two rather large denticulate spines, *j*.9 at least one, and *j*.8 two smaller ones; besides this the terminal joints of the oviger may bear 1 or 2 short simple spines, while the remainder of the appendage is unarmed.

Legs about twice as long as body; *c*.1 short, armed distally with 1 to 3 or 4 short, stout spines; *c*.2 about twice as long as *c*.1, considerably broader distally; *c*.3 about as large as *c*.2; *f*. about as long as coxal region, but little broader than *c*.3, and without a projection dorsodistally; *t*.1 equals *f*.; *t*.2 somewhat longer; both with a more or less irregular wavy dorsal margin; *ts*.1 rather long in proportion to its breadth, terminating dorsally in a well-marked 'lappet'; *ts*.2 somewhat less than half as long and nearly as broad as *t*.2, of about the same width throughout, and slightly arcuate; armed dorsally with 5 or 6 long slender spines and several shorter ones; heel with 3 short stout spines which project slightly distally; sole with a comb-like series of much shorter spines; *cl*. less than half as long as *ts*.2, the dorsal surface curved about evenly, the ventral straight proximally and curved near the tip; *aux*. *cl*. over half as long as *cl*., slender.

Length 1.8 mm., extent about 8 mm.

Specimens of a dark brownish color, due chiefly to adhering dirt; light brown when this is removed. Integument thin and cuticular cavities scattered.

Immature specimen nearly as large as adults, more slender; chelifori chelate (pl. XXI, fig. 4); chelæ slender, strongly curved, crossing one another at tip; ovigera short, not fully developed.

SPECIMENS EXAMINED.

Lot.	Locality.	No. of specimens.	Date.	Source.
14	San Diego, Calif.	2 ♀, 1 juv.	July 8, 1895	Dr. S. J. Holmes (236)

Remarks.—The 3-jointed chelifori, the 9-jointed palpi, and the absence of a marked protuberance on the dorsodistal extremity of the femoral joint clearly relate this form to *A. tuberculata*, and to those forms which I have placed with it in the genus *Ammothella*, viz., three species from the Gulf of Naples (see 'Remarks,' p. 273).

The two mature specimens of this lot were both females with ova in various stages of development in the second and third coxal and femoral joints of the legs.

The species is well characterized by the long eye tubercle and the longer, spiny, elevated, and curved caudal segment, the spines on the dorsal surface of the body, and the long, slender spines of the legs.

Genus **Tanystylum** Miers ('79).

Trunk broad; lateral processes comparatively short and closely crowded, making the body disciform; segmentation suppressed. Chelifori usually mere 1-jointed knobs; sometimes 2-jointed; chelate in immature specimens. Palpi with 6 or 7 joints; first and third joints short, second and fourth longer. Femoral joint of legs of female considerably swollen. Openings of oviducts in usual position on all four legs. Openings of the genital ducts of the male not upon genital protuberances.

Remarks.—The genus *Tanystylum* is undoubtedly very closely related to *Ammothea*, but differs in several important respects. I was at first inclined to include *Clotenia* with this genus, as Schimkewitsch has done (Schimkewitsch, '89), but in view of the highly concentrated body,[1] closely approximated eye tubercle and caudal segment, 4-jointed palpi, and male genital openings in the second as well as the third and fourth pairs of legs, I think it may well be left, for the present at least, as a separate genus.

The species which I have here called *Tanystylum intermedium* differs from previously described species of the genus in having 2-jointed chelifori, and from all but *T. chierchiæ* Schimkewitsch ('89, p. 333) in having 7-jointed palpi instead of 6-jointed. It is, however, so similar in other respects that a separation into another genus does not seem justifiable.

Discoarachne brevipes Hoek ('81a, p. 74) is undoubtedly very closely related to the forms under discussion, and perhaps should be classed as a species of *Tanystylum*.

[1] Dohrn ('81, p. 162) well says: "Dieses Thier [*Clotenia conirostris*] hat die bei weitem concentrirteste Gestalt aller Pantopoden, die ich kenne."

TANYSTYLUM INTERMEDIUM sp. nov.

Plate XXI, figs. 7–9; plate XXII, figs. 1–7; plate XXIII, figs. 1–3.

Type.— ♂ and ♀, University of California, No. 19,510, San Diego, California.

Trunk broad, segmentation not evident; the anterior border with the outer corners each produced into a prominent tubercle which bears a spine. Lateral processes not so long as width of body, wedge-shaped and closely crowded, the outline of their outer borders, together with the anterior border of the trunk, making a complete circle; first, second, and third pairs with a dorsal tubercle near the distal end, shorter and rounded in the female, longer, more pointed, and terminated by a short bristle in the male.

Caudal segment moderate, reaching to about the middle of the second coxal joint of the fourth pair of legs; rather narrow, about half as broad as basal joint of leg; diameter somewhat larger distally than proximally as seen from above; directed obliquely upward at less than 45°; smooth, apex rounded.

Eye tubercle moderate, rather thick, blunt; situated at the extreme anterior end of the first trunk segment and directed forward at about the same angle that the caudal segment projects backward. Eyes rather large, dark; posterior pair apparently the larger.

Proboscis pyriform, being widest a third of its length from the base and tapering to a more or less truncated tip; usually directed somewhat downward; about as long as trunk from its anterior border to the distal end of the fourth pair of lateral processes. In side view nearly straight on ventral side; dorsal side strongly convex.

Chelifori 2-jointed, very short, about one fourth as long as proboscis; first joint about twice as long as broad, slightly curved, with a small tubercle and a short spine near the distal end; second joint very small, rounded, divided into two parts by a groove, showing the former presence of chelæ. The second joint also bears a short spine.

Palpi 7-jointed, rather stout, slightly overreaching the proboscis (by the terminal joint). First and third joints short; *j.*2 and *j.*4 longer, *j.*2 longer than *j.*4; *jj.*5, 6, and 7 successively smaller. These 3 joints with a considerable number of short bristles or hairs; other joints with a few scattered ones, *j.*2 having a somewhat stronger one on its outer distal corner.

Oviger of female slender, about equal in length to the palp. First 3 joints short and of about the same length; *jj.*4 and 5 longest; the suc-

ceeding joints smaller (not successively); *j.*10 very small. The tenth joint is armed with two rather long, curved, denticulate (?) spines; the 1 or 2 spines on the preceding joints appear to be simple. Oviger of the male about half as long again as that of the female; proportionate size of joints nearly the same, but *jj.*8, 9, and 10 turn inward (or downward if the appendage is carried in a horizontal position, as in fig. 7, pl. XXI) upon *j.*7, and the preceding joints at nearly a right angle. The joints of the terminal part of the oviger are armed with a few short, slender, simple spines.

Legs about twice as long as body: *c.*1 short, with a spine-bearing process on each of the distal dorsolateral corners; the male with an additional similar projection on the mid-dorsal line between these. The tubercles are also longer and sharper in the male. Second coxal joint a little longer than *c.*1, broader distally; *c.*3 shorter again; *f.* equal in length to coxal region, gradually increasing in breadth distally, where it ends in a triangular projection terminated by a short, stout spine; *f.* of female swollen, broadest in middle; *t.*1 and *t.*2 each about equal to *f.*, rather slender, armed on the dorsal border with 2 or 3 long, slender bristles and a few shorter ones; ventral border of *t.*2 with a regular series of short, slender spines. First tarsal joint about as long as broad, convex ventrally, where it bears several fine bristles; with a well-marked 'lappet' dorsally. Second tarsal joint long and slender, at least five times as long as broad, nearly straight; dorsal surface with a series of spines, 2 or 3 of which are especially long and slender (about like those on *t.*1 and *t.*2); the others shorter; no distinct heel; the ventral surface furnished with a more or less regular row of about 10 short spines. In addition to what has been mentioned, the several joints of the leg have scattered short hairs or slender spines. Claw comparatively rather short, hardly half as long as *t.*2, falciform; *aux. cl.* slender, half as long as *cl.*

Length about 1.3 mm., extent slightly over 5 mm. The two sexes of about equal size.

Immature specimen.—The one immature specimen examined was about three fourths the size of the adults and more slender; otherwise it much resembled the female, especially in the character of its tubercular projections and spines. It had, however, chelate chelifori, the chelæ being large and strong.

SPECIMENS EXAMINED.

Lot.	Locality.	No. of specimens.	Date.	Source.
26	San Diego, Calif.	1 ♀,	July 8, 1895	Dr. S. J. Holmes
29	San Diego, Calif.	1 ♂, 1 ♀, 1 juv.	July 8, 1895	Dr. S. J. Holmes (236)

Remarks.—There is considerable difference between male and female in these lots with regard to the character and number of spine-bearing projections, but they are so similar in other respects that I think there can be very little doubt about their being the same species.

No egg-masses were found upon the ovigera of the male, but ova of various sizes could be seen in the third coxal and femoral joints of the legs of the females.

The peculiar structure of the ovigera of the male, the last three joints being articulated to the seventh at an angle, reminds one of the somewhat similar condition in the male of *Discoarachne* (*cf.* Cole, :01[b], Taf. 13, fig. 4), and strongly suggests the close relationship, and probable synonymy, of these two genera.

The character of the spines on the ovigera could not be well made out; at a medium magnification they appeared to be simple, but with a $\frac{1}{12}$ oil immersion objective the two on the tenth joint of the female showed fine lines indicating a denticulate margin. On the ninth joint of the same leg was a peculiar, flat, double-notched spine, shown in figure 3, plate XXIII.

The single female specimen of Lot 26 was almost completely covered with small stalked protozoa (*Vaginicolinæ*).

Genus **Clotenia** Dohrn ('81).

Trunk very short and broad, the lateral processes short and closely crowded, so that the body is concentrated and disciform; trunk segmentation suppressed. Eye tubercle set well back on first trunk segment; caudal segment well forward and pointed upward, so that the distance between it and the eye tubercle is short. Chelifori 1-jointed; palpi 4-jointed; ovigera present in both sexes, 10-jointed. Legs rather stout; openings of the male genital ducts in the usual position on the second, third, and fourth pairs of legs (Dohrn); without genital protuberances.

Remarks.—The greatly concentrated body, with the consequent nearness of the caudal segment to the eye tubercle, which is set well back, and the 4-jointed palpi, would seem to be sufficient to distinguish this genus, though it is certainly very closely related to *Tanystylum*. Dohrn makes a strong point of the fact that the genital openings of the male occur on the three posterior pairs of legs. Although there can be no doubt of the close affinity of the specimen from California to Dohrn's *Clotenia conirostris*, I was unable to confirm this point. The openings could be seen on the third and fourth pairs of legs, but on the second pair I was unable to find them.

CLOTENIA OCCIDENTALIS sp. nov.

Plate XIII, fig. 9; plate XXIII, figs. 4–8.

Type.— ♂, University of California, No. 19,511, Pacific Grove, Calif.

Trunk unsegmented, smooth, short, and broad, especially in front; anterior outer corners rounded, without projecting knobs. Lateral processes short and very closely crowded, the lines between them radiating toward a common point slightly anterior to the caudal segment.

Caudal segment well forward, rather short, thick, bluntly conical, directed obliquely upward, armed on the dorsal surface with 2 or 3 short stiff spines.

Eye tubercle situated on the middle of the first trunk segment; about two thirds as high as caudal segment; conical, nearly straight and vertical anteriorly; sloping behind; thus giving, with the anteriorly directed face of the caudal segment and the dorsal part of the trunk segments between a saddle-shaped outline when seen from the side. The posterior, sloping, face of the eye tubercle is notched, or 'hipped,' just above the eyes, the portion above being a smaller cone set upon the anterior part of the larger truncated basal cone. Eyes close together.

Proboscis short and thick, barely twice as long as broad, directed straight forward, cylindrical, bluntly rounded at the apex.

Chelifori short, knob-like, connected at the base; armed distally with 2 or 3 short spines.

Palpi 4-jointed, not reaching to end of proboscis; nearly straight. Joints 1, 3, and 4 short; *j.*2 long, half as long as the entire appendage, considerably larger at its proximal end than distally; *j.*4 with several short stout spines distally; *jj.*2 and 3 each with 2 or 3 smaller ones.

Oviger of male about three and a half times as long as palp. First joint short, thick; *j.*2 longer and more slender; *j.*3 equal in length to *j.*1; *jj.*4 and 5 each about equal to, or slightly longer than, *j.*2; *j.*6 about as long as *j.*3; *j.*7 considerably smaller, coming off somewhat from the side of *j.*6; *jj.*8 and 9 slightly smaller than *j.*7; *j.*10 a very small rounded knob. The terminal part of the appendage bears a few scattered weak spines, besides 2 longer, stouter, divergent ones on *j.*10.

Legs comparatively stout, anterior pair somewhat over twice as long as body (measured from tip of proboscis to distal border of fourth pair of lateral processes); posterior legs noticeably shorter than anterior pairs. Coxal joints all short and of about equal length; *c.*1 with a more or less irregular projection distally on its anterior side, which is armed with a few short spines. Femoral joint stout, somewhat shorter than

coxal region; broader distally, where it is produced dorsally into a blunt angle armed with 1 to 2 or 3 short spines rather stouter than the others. Tibial joints both stout and about equal to *f.* in length; dorsally each has 3 swellings, one at either end and one in the middle, and the short spines are grouped in small clumps of 3 or 4 on these swellings. First tarsal joint very short and broad, armed ventrally with 1 stout spine and 2 or 3 smaller ones; *ts.2* nearly as long as *t.2*, stout, broader proximally than distally, and moderately arched; armed dorsally with an irregular series of short bristles; the heel bears 3 stout spines, the sole a series of small ones. Claw fully half as long as *ts.2*, strong, evenly tapering, and curved; *aux. cl.* well developed, about half as long as *cl.*, rather straight. Besides the armature mentioned, there are short stiff spines scattered sparsely over all the joints of the leg.

The following measurements are approximate: length (in this case from tip of proboscis to distal border of fourth lateral processes) 1.3 mm.; extent 7 mm.; length of palp 0.45 mm.; length of oviger 1.5 mm.

SPECIMEN EXAMINED.

Lot.	Locality.	No. of specimens.	Date.	Source.
16	Pacific Grove, Calif.	1 ♂	Dec. 30, 1896	Univ. of Calif.

Remarks.—This species was, unfortunately, represented by only a single specimen, which, however, is distinct from *C. conirostris* Dohrn, as may be seen by the blunt, cylindrical proboscis, the shorter, more rounded caudal segment, the processes on the anterior sides of the first coxal joints, and other details.

Each of the ovigera carried a small irregular rounded egg-mass containing probably 50 to 60 eggs. The ovigera were thrust through the masses eccentrically, so that the bulk of the mass lay to one side.

Family *PHOXICHILIDIIDÆ.*

Chelifori present, chelate; palpi absent; ovigera present in the male only, 5- or 6-jointed.

Genus **Phoxichilidium** Milne Edwards ('40, p. 535).

Orithyia JOHNSTON ('37, p. 368).

Trunk slender, cylindrical; lateral processes well separated. Neck short, i.e., first trunk segment projects but little if at all beyond base of proboscis; emarginate between bases of chelifori. Proboscis comparatively short, cylindrical. Eye tubercle small, subconical. Caudal seg-

ment simple, pointing upward. Chelifori well developed; chelæ strong and curved. Ovigera 5-jointed, sigmoid; third joint with a constriction at about one third or less of its length; last joint nearly as large as fourth, armed with a few (one or more) rows of unguiform spines. Legs slender; *ts.*1 small; *ts.*2 well developed and armed at base with distally curved spines; *cl.* strong; *aux. cl.* distinct. Genital openings on second coxal joints of all the legs.

Remarks.—This genus has been made to include rather diverse forms, many of which, as stated by Sars, probably belong even to other families. Wilson ('78[a]) removed from these into the genus *Anoplodactylus* those forms in which the first trunk segment projects considerably beyond the base of the proboscis, and which have 6-jointed ovigera. I accept the genus *Phoxichilidium* as restricted by Sars ('91), "principally characterized by the cephalic segment not projecting anteriorly beyond the base of the proboscis, the comparatively well-developed chelifori, and the structure of the false legs in the male," i.e., 5-jointed, with the last joint comparatively large. Sars concludes that but three species of the genus can be recognized with certainty, viz., *Ph. femoratum* (Rathke), *Ph. robustum* Dohrn, and *Ph. minor* Wilson. He considers the form described by Stimpson ('54) from the eastern coast of North America to be identical with *Ph. femoratum* of Europe; but Wilson ('78[b]), in his description of *Ph. minor*, says (p. 14): "This species is closely similar to *P. maxillare*, of which it may be a dwarf variety"; and in a later paper ('80, p. 481) he adds that since the publication of the first paper "a much larger series of specimens has been obtained, which shows conclusively that the two forms cannot be separated, though extreme forms appear very unlike." Thus if *Ph. maxillare* is a synonym of *Ph. femoratum* it leaves but two species, *Ph. femoratum* and *Ph. robustum*, to be referred to this genus.

PHOXICHILIDIUM FEMORATUM (Rathke).

Plate XIII, fig. 10; plate XXIV, figs. 1–5.

Nymphon femoratum RATHKE, 1799, p. 201.
Orithyia coccinea JOHNSTON, '37, p. 378, pl. XII, figs. 4–6.
Phoxichilidium coccineum MILNE EDWARDS, '40, p. 536.
Phoxichilidium coccineum GOODSIR, '44, p. 2, pl. I, figs. 6–8.
? *Phoxichilidium globosum* GOODSIR, '42, p. 136, pl. III, fig. 1.
Phoxichilidium femoratum KRÖYER, '45, p. 122.
Phoxichilidium femoratum KRÖYER, '49, pl. XXXVIII, fig. 2, a–g.
? *Phoxichilidium femoratum* HOEK, '77, p. 6, Tab. XV, figs. 8–10.
? *Phoxichilidium femoratum* HOEK, '81[b], p. 512, pl. XXVI, figs. 18–21; pl. XXVII, fig. 19.
Phoxichilidium femoratum HANSEN, '84, p. 650.

Phoxichilidium femoratum HANSEN, '85, Tab. VII, fig. 21.
Phoxichilidium femoratum G. O. SARS, '88, No. 4.
Phoxichilidium femoratum G. O. SARS, '91, pp. 21–24, pl. II., fig. 1, a–g.
Phoxichilidium maxillare STIMPSON, '54, p. 37.
Phoxichilidium maxillare WILSON, '78b, pp. 12, 13, pl. IV, figs. 1a–1e.
Phoxichilidium maxillare WILSON, '80, pp. 480, 481, pl. III, figs. 12–15.
Phoxichilidium minor WILSON, '78b, pp. 13, 14, pl. IV, figs. 2a–2f.

Trunk cylindrical, tapering somewhat posteriorly; sutures well defined. Lateral processes about as long as width of trunk, well separated; except last pair, issuing from the middle of their respective trunk segments. First trunk segment longer than succeeding ones.

Caudal segment comparatively small, oval or oblong, unarmed.

Eye tubercle situated ahead of middle of first trunk segment, small, obtusely conical, the 4 eyes nearer the base; the posterior pair lower than the anterior.

Proboscis about the length of the first and second trunk segments together; cylindrical or somewhat clavate, being larger distally; obtusely truncate, with a circular constriction near the distal end. It arises somewhat ventrally from the first trunk segment; the ventral border starts obliquely downward, but soon bends forward at an obtuse angle.

Chelifori comparatively powerful, considerably longer than proboscis. Scape cylindrical or somewhat claviform; chela movably connected to it, usually carried somewhat downward, so as to overhang the proboscis; oval, smooth. Fingers powerful, about as long as palm; strongly curved, leaving an open space between, even when closed; the movable finger the longer and overlapping the other without crossing.

Ovigera strong, about equal in length to the body. First joint short, about one and a half times as long as broad; *j.2* of smaller diameter, somewhat less than twice as long as first, and about equal to fourth; *j.3* longest, two and a half times *j.1*, curved slightly dorsalward, with a decided constriction at about one fourth of its length from the proximal end; *j.4* curved ventrally; *j.5* large, nearly as long as *j.4*, broad, compressed, arcuate, the appendage as a whole forming a sigmoid curve. On the basal half of the inner margin of this joint there are 3 closely set unguiform spines, while at either side occurs a set of feebler ones; other joints sparingly beset with exceedingly small, simple spiniform bristles.

Legs comparatively robust, two and one half to three times the length of the animal, smooth, except for microscopically minute spines. First coxal joint short, nearly square; *c.2* more than twice as long as *c.1*; *c.3* shorter again. Femoral joint longest, swollen in the female; tibial joints of about equal length, somewhat shorter than *f.* and about as long as coxal region; both of less diameter than *f.*, and the second smaller

than the first. First tarsal joint very small, triangular, terminating dorsally as a small lappet, and slightly convex ventrally, where it is beset with a few slender bristles. Second tarsal joint beset with short spiniform bristles; the ventral ('inner') side is somewhat lamellarly expanded at the base, and is here armed usually with 6 strong, anteriorly curving spines, the 2 distal ones in most cases being in juxtaposition. Claw powerful, slightly curved, about half as long as *ts.2*; *aux. cl.* very small, though distinctly developed. At the distal end of *f.* are 1 or 2 strong bristles, and another projects from a slight depression on the dorsal side of *t.2*, a short distance from its distal end.

SPECIMENS EXAMINED.

Lot.	Locality.	No. of specimens.	Date.	Source.
3	Dutch Harbor, Unalaska	1♂, 1♀	July, 1899	H. A. E. (Prof. W. R. Coe)
5	Popof Id., Shumagin Group, Alaska	1♂	July, 1899	H. A. E. (Prof. T. Kincaid)
8	Popof Id., Shumagin Group, Alaska [1]	4♂, 1♀	July 8, 1899	H. A. E. (Prof. W. E. Ritter), Univ. of Calif., No. 19,512
24	Orca, Prince William Sound, Alaska	1♂	June, 1899	H. A. E.

Distribution.—If all the synonyms given above properly belong to this species its distribution covers a great range. It has been found along the coasts of the British Isles, Holland, Denmark, Norway, Greenland, the eastern coast of North America as far south as Massachusetts, and the present record extends its range to the western coast of North America from Orca to Unalaska. It ranges in depth from the shore rocks to 100 fathoms (Sars). Apparently it is a truly circumpolar species.

Remarks.—The specimens which I have examined from the Alaska coast agree very closely with the excellent description of this species given by Sars. They are, however, most of them considerably larger, the smallest specimen, from Orca, measuring about 3.5 mm., those collected at Popof Island 4.5 mm. to 5 mm., and those from Dutch Harbor 5.5 mm. from the tip of the proboscis to the tip of the caudal segment. Sars describes the color as "a more or less vivid red," or "sometimes dark-brownish or a sepia tint." Most of the Alaska specimens (alcoholic) are lighter than this, especially those from Dutch Harbor, which are a light brown or yellowish; the specimens from the Shumagins are a darker brown, and in 2 or 3 of them the branches of the intestine in the legs

[1] "Undershore rocks."

show up very plainly as dark brown lines. Wilson says of "*Ph. maxillare*" that the color is "blackish or sepia to nearly pure white."

In the armature of the tarsal joints I find some variation from the description and figures of Sars. On the first I do not find one spine noticeably longer than the others, but a regular gradation up to the longest. In the majority of cases the second agrees with the description, but in various specimens the number of spines on the heel varies from 5 to 7, and the distal two are not always opposed to one another. The number and arrangement may vary on the different legs of the same specimen.

Genus **Halosoma**[1] gen. nov.

Trunk rather stout; lateral processes broad, first 3 pairs closely crowded; fourth pair separated from third by a space. Neck short but projecting somewhat beyond base of proboscis, which issues ventro-anteriorly from the first segment. Chelifori strong, chelate. Ovigera ? Legs rather stout; second tarsal joint with expanded heel and a thin, chitinous, knife-like ridge along the sole. Claw well developed; auxiliary claws minute.

Remarks.—It was only after considerable hesitation that the present genus was instituted, as it is based upon a single specimen, and that evidently a female, though no ova could be made out in the ovaries. It seems, however, especially in the greater concentration, producing a stouter trunk and closely approximated lateral processes, to be generically distinct from both *Phoxichilidium* and *Anoplodactylus;* in the moderate development of the 'neck,' on the other hand, it is intermediate between those genera. It is unfortunate that the specimen does not possess ovigera, as the structure of those organs would help much in showing the position of this genus and its relation to the other genera. Should it prove to be an immature specimen which has not yet developed the ovigera, it is possible that it may be found to be related to the Pallenidæ rather than to the Phoxichilidiidæ. In either case the only thing to be done with it now seemed to be to describe it as a separate genus under the Phoxichilidiidæ, treating it as an adult female, until its true position can be determined by future collections.

HALOSOMA VIRIDINTESTINALIS sp. nov.

Plate XIV, fig. 11; plate XXIV, figs. 6–8; plate XXV, figs. 1–4.

Type.—University of California, No. 19,513, Dillon's Beach, Sonoma County, California.

Trunk stout, compressed; sutures deep and well marked; first segment

[1] From *ἅλως*, *disc*, and *σῶμα*, *body*.

about two and one half times as long as second. Lateral processes about as broad as long, a slight protuberance on the dorsal side distally; the first 3 pairs closely crowded; between the third pair and the fourth, which is directed posteriorly, is a considerable space, about half as wide as the process. First trunk segment projecting forward beyond the base of the proboscis a short distance, producing a thick neck, of moderate length.

Caudal segment rather long, over half as long as first trunk segment erect, subcylindrical, rounded at apex.

Eye tubercle about in the middle of the anterior half of the first trunk segment, directed slightly forward, shorter than caudal segment, conical; eyes at about the middle, large.

Proboscis issuing from the antero-ventral side of the first segment, as long as first and second trunk segments together, thick (half as long as broad), cylindrical, obtusely truncate, with a circular constriction near the distal end; ventral border with a projecting angle at the proximal end.

Chelifori stout, overhanging proboscis; scape reaching to about even with end of proboscis, slightly clavate; chelæ hanging downward almost vertically, with the movable finger on the outside. Palm slightly swollen; immovable finger slender, about as long as palm, slightly curved; movable finger slender, acuminate, arcuate.

Ovigera?

Legs rather stout: *c.*1 short, squarish; *c.*2 nearly double *c.*1, swollen on the ventral side, where genital pore is situated on posterior pairs; *c.*3 slightly longer than *c.*1; *f.* about as long as coxal region, stout; *t.*1 somewhat shorter than *f.*; *t.*2 equals *t.*1; *ts.*1 very short, irregularly triangular or squarish, with a few small spines on the ventro-distal corner; *ts.*2 over half as long as *t.*2, somewhat arched, with a distinct heel at the base. Heel armed with 2 strong curved spines and 5 or 6 smaller ones; sole with a thin lamellar chitinous membrane (pl. xxv, fig. 4), in which are some 10 or 11 small spines; *cl.* equals about three-fourths of *ts.*2, nearly straight, inner margin slightly convex at middle; *aux. cl.* minute. The femoral and first tibial joints have slender bristles projecting from slight protuberances on the dorsal side and at their distal ends; *t.*2 has a similar bristle a short distance from the distal end. Otherwise the legs are smooth except for a few microscopic hairs, as is the whole body.

Integument thin and transparent, the light green intestine with its prolongations into the legs showing through very distinctly, making the animal appear of a greenish color. Intestine considerably dilated in femoral joint. Cuticular cavities not so numerous as in related genera.

Length but slightly over 1 mm.; first leg about 3.5 mm.; extent 7.5 mm.

SPECIMEN EXAMINED.

Lot.	Locality.	No. of specimens.	Date.	Source.
28	Dillon's Beach, Sonoma Co., Calif.	1 ♀ (?)	Nov. 26, 1898	Univ. of Calif.

Remarks.—This single specimen was in a vial with *Lecythorhynchus marginatus* and *Ammothella tuberculata.* No data as to depth were given, but they were probably all taken in shallow water. It has the general appearance of a *Phoxichilidium*-like form, but is distinguished by its short, stout body and crowded lateral processes.

Genus **Anoplodactylus** Wilson ('78[a]).

Phoxichilidium (in part).

Trunk rather slender, with the first segment constricted anteriorly and extending forward some distance beyond the base of the proboscis, thus producing a long narrow neck. Lateral processes comparatively long and well separated. Proboscis projecting obliquely downward from ventral side of first trunk segment. Eye tubercle at extreme forward end of the segment. Chelifori comparatively feeble. Ovigera slender, 6-jointed; terminal joint very small. Egg-masses several, globular (*A. petiolatus et erectus*), or one or two, loose and more or less irregular in shape (*A. lentus*). Legs long, slender; first tarsal joint very short; ventral margin of second tarsal joint projecting at the base (the heel) and there armed with strong spines; auxiliary claws minute.

Remarks.—This genus can readily be distinguished from *Phoxichilidium*, which it much resembles in general appearance, by the long, projecting neck, the feebler chelifori, and the 6-jointed ovigera with the ultimate joint very much smaller than the penultimate.

Hoek ('98) lists the species which he considers as properly belonging to this genus. Besides the new species described below, I think the following should be added to his list:[1]

A. gestiens (Ortmann) = *Phoxichilidium gestiens* Ortmann, '91. Japan.

A. plumulariæ (von Lendenfeld) = *Phoxichilidium plumulariæ* von Lendenfeld, '83. Port Philip, Australia.

A. tubiferus (Haswell) = *Phoxichilidium tubiferum* Haswell, '85. Port Jackson, New South Wales.

[1] In a recent paper Möbius (:02) has referred two new species to the genus *Anoplodactylus*, viz., *A. aculeatus* and *A. spinosus.* The latter differs from the established genus in having 9-jointed ovigera, but in this connection Möbius says (p. 187): "Ich stelle für *Anoplodactylus spinosus* mit 9-gliedrigen Brutbeinen keinen neuen Gattungsbegriff auf, sondern scheide aus dem WILSON'schen Begriff *Anoplodactylus* das Merkmal einer bestimmten Gliederzahl der Brutbeine aus."

ANOPLODACTYLUS ERECTUS sp. nov.

Plate XIV, fig. 12; plate XXVI, figs. 1–9.

Type.— ♂ and ♀, University of California, No. 19,514, San Diego, California.

Trunk rather slender, cylindrical, tapering posteriorly; lateral processes long, well separated, larger distally, where each has a small conical projection on the dorsal side and pointing somewhat outward. First trunk segment rather larger than the 2 following segments together; constricted in its anterior half and produced forward into a long narrow neck.

Caudal segment moderately long (nearly one and a half times second trunk segment); projecting upward at a sharp angle; approximately cylindrical, tapering to a point, often bulging somewhat in the middle, notched at tip; may be armed with 1 to 2 or 3 hairs on each side.

Eye tubercle placed at extreme forward end of first trunk segment and projecting upward and a little forward; about as long as second trunk segment, cylindrical. Viewed from the side it rounds evenly to a blunt point; viewed anteriorly or posteriorly it is seen to have a projecting angle on each side at the point of narrowing. Eyes nearer the top of the tubercle than the base; the anterior pair somewhat larger and a little lower than the posterior.

Proboscis about as long as first trunk segment, from the posterior part of which it issues ventrally and projects obliquely downward and forward; basal portion of slightly smaller diameter than the distal; truncate.

Chelifori extending forward from the extreme end of the first trunk segment, which furnishes but a slight projection beyond the eye tubercle for their attachment; about equal in length to the segment to which they are attached. Scape slender, nearly cylindrical, only slightly enlarged at distal end; smooth except for a few small hairs. Chela pendant, bent at nearly a right angle to the scape and hardly half as long, sparingly beset with hairs; fingers slender, curved, sharply pointed, about as long as palm; movable finger longer and more strongly curved.

Ovigera long (as long as, or longer than, animal), slender. First joint short and comparatively thick; *j.2* over twice as long and more slender; these 2 joints extend downward from their attachment to the first trunk segment. The third joint bends backward, running nearly parallel with the trunk; it is half again as long as the first two joints taken together and even more slender than the second; slightly curved, with the convexity upward; about one fourth of its length from the proximal end is a constriction which on superficial examination might be taken for an

articulation. The fourth joint is somewhat shorter than the second, slightly curved; *j.*5 still shorter and bent sharply back on the under side of the fourth; *j.*6 very small, oval; the fifth and sixth together scarcely equal the fourth. The third, fifth, and sixth joints are sparingly beset with rather stiff bristles, some of which on *j.*6 are directed backward.

Eggs on ovigera in several globular masses.

Legs slender, second pair about two and one half times as long as the animal; *c.*1 short, little longer than broad; *c.*2 rather over twice the length of *c.*1; at about the middle of the dorsal side is a slight rounded protuberance; in the male the ventral side extends at the distal end into a considerable projection, on which are several small bristles, and at the end of which is the genital opening. The female lacks this projection, but the distal end of the joint is swollen and the genital opening is situated on a slight prominence of its own a little way back from the tip. Third coxal joint rather longer than first; like all the joints out to *t.*2, it becomes gradually larger distally. Femoral joint nearly as long as whole of coxal region, commonly larger in the female; produced dorsally at the distal end into a rounded projection very similar in shape to that on the dorsal side of the lateral process and the genital prominence on the second coxal joint; from this projection grows a long, slender bristle. In the male there is another process on the femoral joint, just beyond the middle on the dorsal side; it is drawn out into a narrow tube which projects distally; at its end is the opening of the so-called agglutinative gland, the secretion from which is supposed to be used in gluing the egg-masses together. Second tibial joint slightly longer than *t.*1; neither quite so long as *f.*; at the distal end of *t.*1 is a projection similar to that on *f.*, but smaller, and likewise furnished with a rather long bristle; about one fourth of the distance from the distal end of *t.*2, on the dorsal side, is a slight nodular protuberance from which projects a long, delicate bristle. First tarsal joint very small, roughly triangular, with a broad base ventrally bearing a few moderately strong spines, and a narrow knob dorsally; *ts.*2 comparatively slender, about equal in length to *c.*2, not strongly curved, but appearing arched on the ventral side in consequence of being much expanded at the base, where it is armed with 2 stout, distally curved spines and a few strong bristles. The proximal half of the remainder of the ventral margin, the sole, is armed with a series of close-set distally curved spines, varying in number from 7 or 8 to 11; along the distal part extends a thin, lamellar, knife-like chitinous plate along the sides of which are a few very small bristles. Claw long, falciform, reaching back as far as the heel of *ts.*2; inner edge thin and knife-like. Auxiliary claws very small but distinct. The legs are very sparsely hairy; besides what have

been mentioned, there are a few fine hairs, especially on *f.*, *t.*1, *t.*2, and *ts.*1, and a more or less regular row of small bristles along the dorsal side of *ts.*2.

Integument thin, clear, and with comparatively few cuticular cavities. Color in alcohol light.

Length about 2.5 mm.; sexes of nearly the same size.

SPECIMENS EXAMINED.

Lot.	Locality.	No. of specimens.	Date.	Source.
13	San Diego, Calif.	6♂, 1♀	Sept., 1896	Univ. of Calif. (coll. by Prof. Kelsey)
15	San Diego, Calif.	1♀	July 8, 1895	Dr. S. J. Holmes

Remarks.—This species of *Anoplodactylus*, which I have called *erectus* on account of the position of the caudal segment, is in many respects very similar to *A. petiolatus* (Kröyer). The important differences are shown in the following table:

A. petiolatus.	*A. erectus.*
Trunk "somewhat short and stout, and, relatively to its length, rather broad."	Trunk rather slender.
Lateral processes not much separated.	Lateral processes well separated.
Caudal segment long, cylindrical, abruptly acuminated, placed horizontally.	Caudal segment not especially long, more or less conical, directed upward at a sharp angle.
Proboscis of plain cylindrical form, obtusely truncated.	Proboscis not plain cylindrical, narrower in basal portion.
Immovable finger of chela almost quite straight.	Fingers of chela both curved.
Ovigera nearly as long as animal.	Ovigera as long as, or longer than, animal; third joint especially proportionately longer than in *A. petiolatus.*
Legs hardly two times length of animal.	Legs proportionately longer; two and one half times length of animal.
Second tarsal joint strongly curved; 4 to 6 spines on proximal part of sole.	Second tarsal joint not strongly curved; 7 to 11 spines on proximal part of sole.

Family *PYCNOGONIDÆ*.

Chelifori and palpi both absent; ovigera present in the male only

Genus **Pycnogonum** Brünnich (1764).

Trunk stout and square-set. Ovigera small, present only in the male, 9- or 10-jointed. Legs comparatively short, stout, tapering. First tarsal joint small; claw powerful; auxiliary claws usually absent.

Remarks.—There seems to be a disagreement among authors as to whether in this genus the ovigera are 9-jointed or 10-jointed. This is probably due to the fact that some count the terminal claw as a joint, while others do not; but as it differs from the others only in being smaller and more chitinous, I see no reason why it should not be considered a joint the same as the terminal claw of the legs.

PYCNOGONUM STEARNSI Ives.

Plate XIV, figs. 13–15; plate XXVI, fig. 10.

Pycnogonum stearnsi IVES, '92, p. 142, pl. X, figs 1–4.

Trunk broad, somewhat depressed; lateral processes with scarcely any interval between them. Each trunk segment with a prominent tubercle at its posterior border on the mid-dorsal line (considerably smaller on the last segment), and a somewhat smaller tubercle on the outer edge of each lateral process. First trunk segment about two thirds the length of the proboscis, slightly constricted just ahead of the lateral processes; second and third segments each equal to the portion of the first back of the constriction; the fourth somewhat shorter. Posterior borders of the segments slightly elevated.

Caudal segment clavate, or nearly cuneiform, truncated at its extremity, sometimes slightly swollen in the middle; somewhat longer than the fourth trunk segment, about equal to the third. The anus is a longitudinal slit on the ventral side of the caudal segment near the tip.

Eye tubercle bluntly conical, placed just behind the constriction of the first segment; eyes black or dark brown, distinct, or in some cases indistinct and without pigment; the posterior pair usually farther apart than the anterior.

Proboscis subcylindrical, slightly swollen at or a little anterior to the middle; somewhat longer than the first trunk segment.

Ovigera (pl. XXVI, fig. 10) small and rather slender; 10-jointed, the last joint a strong, straight, or nearly straight, claw. The joints do not diminish gradually in length; the first, second, fourth, seventh, and eighth are approximately as long as broad, while the others are proportionately longer. The diameter does not decrease greatly until the ninth

joint, where it begins tapering gradually to the tip of the claw. Practically smooth except for a few very small bristles on the outer side of the third joint. When not carrying eggs, the appendages commonly extend outward and a little backward, then curve forward and in again toward the middle line. The bending occurs particularly at the fourth and at the eighth and ninth joints.

Eggs small, carried on the ovigera in one (pl. XIV, fig. 15) or two (fig. 14) large, wrinkled, cake-like masses, occupying the whole space under the animal and extending so far that when looked at from below only the legs from the fourth joint outward are visible, except the posterior pair, which can usually be seen because the eggs are carried well forward.

Legs stout: *c.*1 broader than the lateral processes of the segments, with the appearance of a dorsal notch on its outer border due to the close approximation of two dorsal tubercles; *c.*2 rather smaller than *c.*1; *c.*3 rather smaller than *c.*2; the 3 joints together in the third leg about as long as the proboscis; *f.* strongly developed, about two thirds as long as the coxal region; proximal half of the ventral surface considerably swollen (in male as well as female), a rather weak dorsal tubercle at the distal extremity; *t.*1 about equal to *f.*, but more slender; *t.*2 rather shorter than *t.*1; *ts.*1 very short, subtriangular; *ts.*2 about as long as *t.*2; *cl.* less than half as long as *ts.*2, rather strongly curved. On the dorsal surface of *f.*, and of *t.*1 and *t.*2, near their distal ends, there is a single comparatively strong spine; ventral side of *t.*2 beset with smaller spines at its distal end, while the tarsal joints, especially the first, have their ventral surfaces thickly beset with these short spines.

The 11 females measured range from 4 mm. to 8 mm.; the males average somewhat smaller, the largest being but 6.3 mm. in length.

SPECIMENS EXAMINED.

Lot.	Locality.	No. of specimens.	Date.	Source.
11	San Pedro Point, San Mateo Co., Calif.	2♂, 2♀	Sept. 1, 1895	Univ. of Calif.
17	Pacific Grove, Monterey Co., Calif.	1♀	July 13, 1896	Univ. of Calif.
19	Dillon's Beach, Sonoma Co., Calif.	2♀	Aug. 4, 1898	Univ. of Calif.
21	Shelter Cove, Humboldt Co., Calif.[1]	14♂, 6♀	June 24, 1894	Univ. of Calif., No. 19,516

Remarks.—This species was established by Ives from 5 female specimens collected at San Diego, and it has not been recorded since that

[1] Collected "on rocks." Ten of the fourteen males in this lot were carrying egg-masses.

time until now. Ives's description and figures are readily recognizable, and besides being able to include the description of the male I have very little to add.

Pycnogonum stearnsi is closely allied to *P. littorale* (Ström). The principal differences can be seen at a glance in the following table:

P. littorale.	*P. stearnsi.*
Average length of female about 15 mm.	Average length of female about 6 mm.
Claw more than half the length of the second tarsal joint.	Claw less than half the length of the second tarsal joint.
A smaller conical protuberance on the dorsal side of the first trunk segment between the one on the posterior border of the segment and the eye tubercle.	No protuberance on the first trunk segment between the one on the posterior border and the eye tubercle.
Ovigera: "Along the inner margin of the joints extend a few very small and irregularly distributed spines of quite a simple form" (Sars, '91, p. 10).	Ovigera practically unarmed except for a few small spines on the *outer* side of the third joint.

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1880 The Pycnogonida of New England and Adjacent Waters. Rept. U. S. Fish Com. for 1878, PT. VI, pp. 461–506, pls. I–VII.

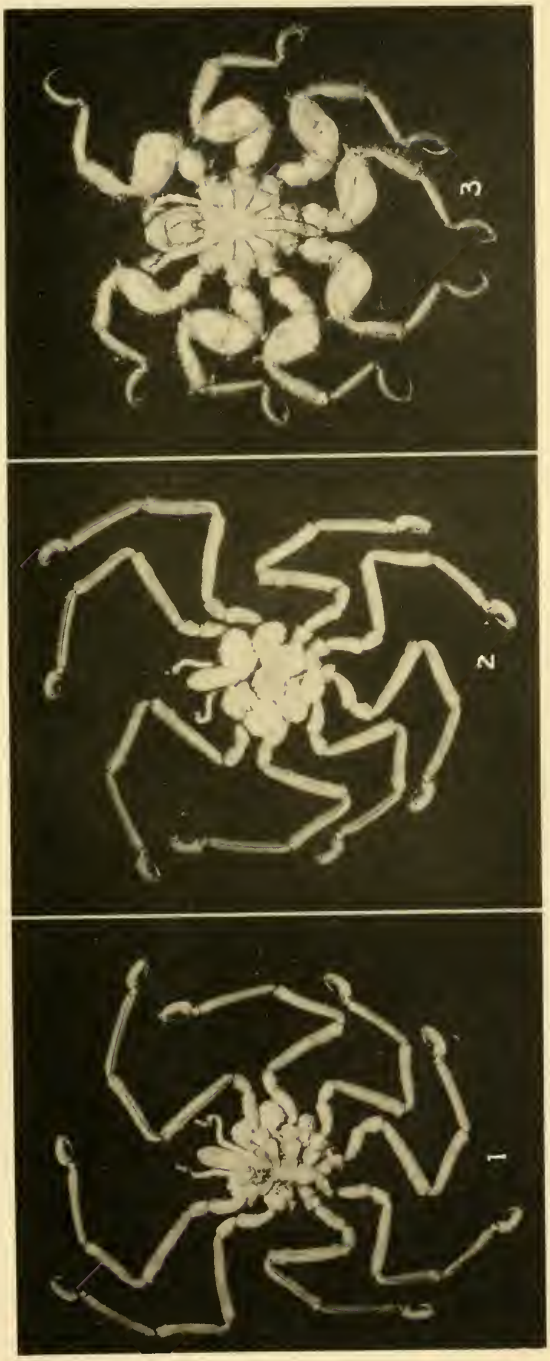
1881 Report on the Pycnogonida. Reports on the results of dredging, under the supervision of Alexander Agassiz, along the east coast of the United States, during the summer of 1880, by the U. S. Coast Survey steamer *Blake*, Commander J. R. Bartlett, U. S. N., commanding. XIII. Bull. Mus. Comp. Zool., vol. VIII, pp. 239–256, pls. I–V.

PLATE XI.

FIG. 1. *Lecythorhynchus marginatus* sp. nov., male (Lot 10), from above; showing egg-masses below.

2. *Lecythorhynchus marginatus* sp. nov., male (Lot 10), from below; showing egg-masses attached to the ovigera.

3. *Ammothea latifrons* sp. nov., female (Lot 1), from above.

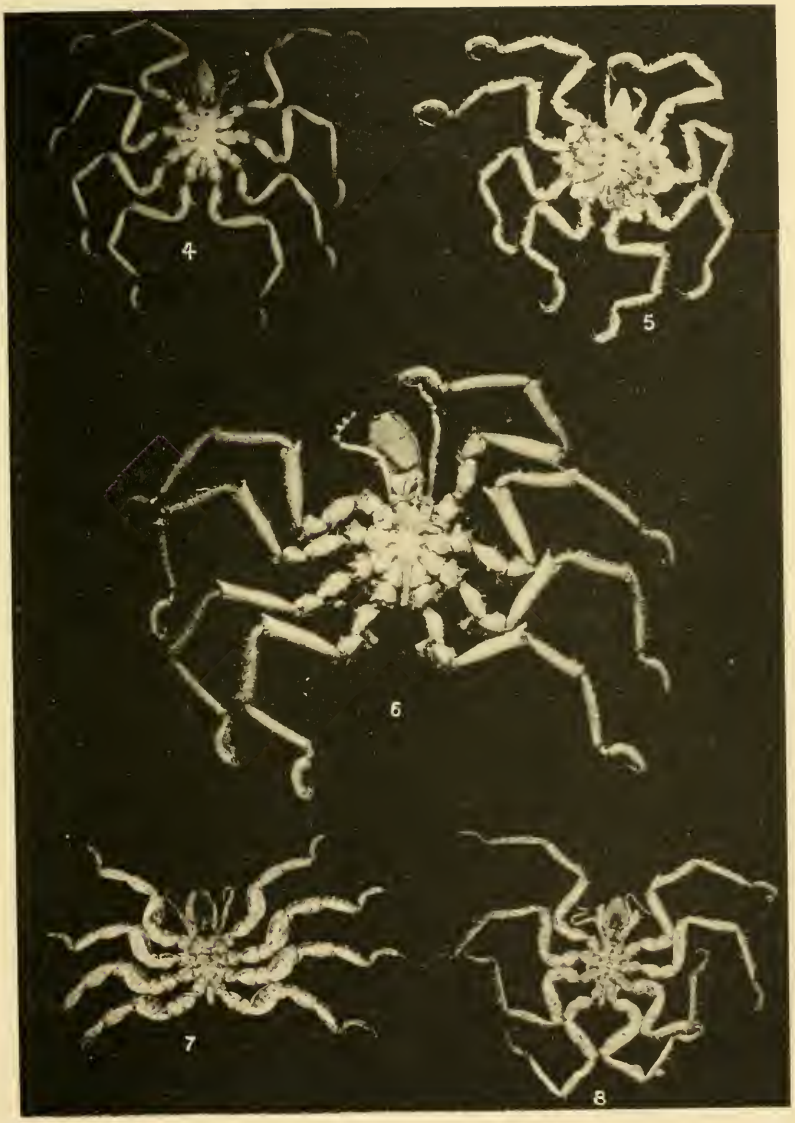


PYCNOGONIDA

HELIOTYPE CO., BOSTON.

PLATE XII.

FIG. 4. *Ammothea alaskensis* sp. nov., male (Lot 25), from above.
5. *Ammothea gracilipes* sp. nov., male (Lot 9), from above; showing egg-masses below.
6. *Ammothea pribilofensis* sp. nov., male (Lot 23), from above.
7. *Ammothella tuberculata* sp. nov., female (Lot 22), from above.
8. *Ammothella spinifera* sp. nov., female (Lot 14), from above.



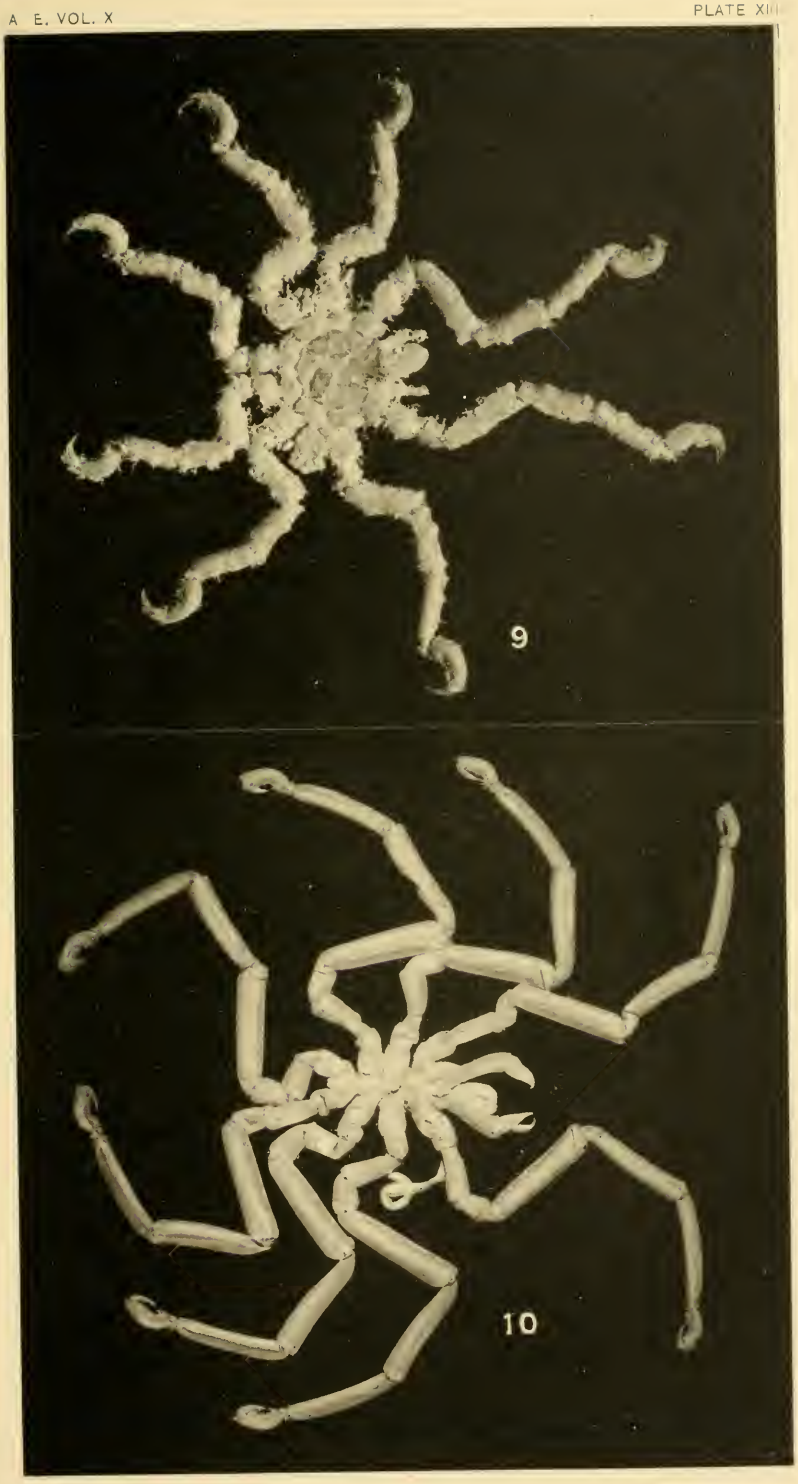
PYCNOGONIDA

HELIOTYPE CO., BOSTON.

PLATE XIII.

FIG. 9. *Clotenia occidentalis* sp. nov., male (Lot 16), from above. (The peculiar ragged appearance of this specimen is due partly to adhering particles of dirt.)

10. *Phoxichilidium femoratum* (Rathke), male (Lot 5), from above.



PYCNOGONIDA

HELIOTYPE CO., BOSTON.

PLATE XIV.

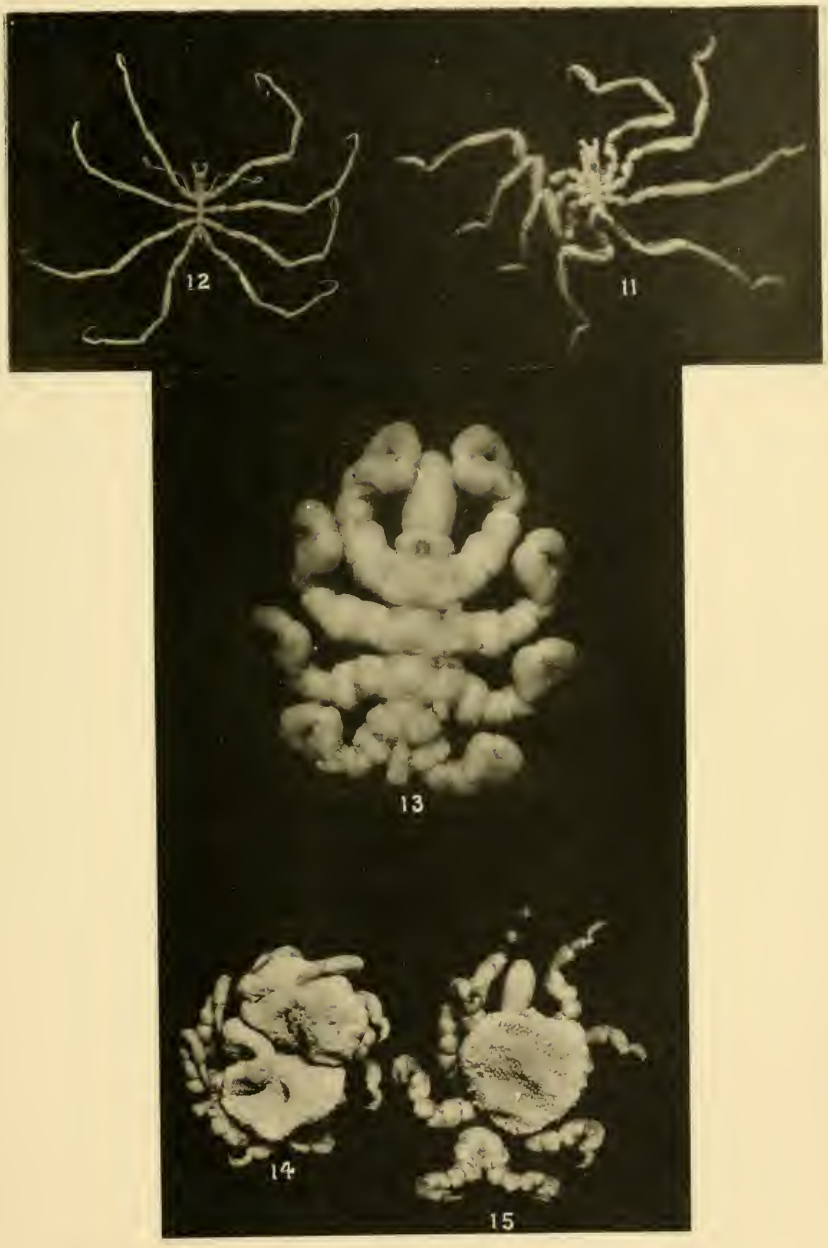
FIG. 11. *Halosoma viridintestinalis* gen. nov., sp. nov., female (?) (Lot 28), from above.

12. *Anoplodactylus erectus* sp. nov., male (Lot 13), from above.

13. *Pycnogonum stearnsi* Ives, female (Lot 17), from above.

14. *Pycnogonum stearnsi* Ives, male (Lot 21), from below; carrying two egg-masses.

15. *Pycnogonum stearnsi* Ives, male (Lot 21), from below; carrying a single egg-mass.



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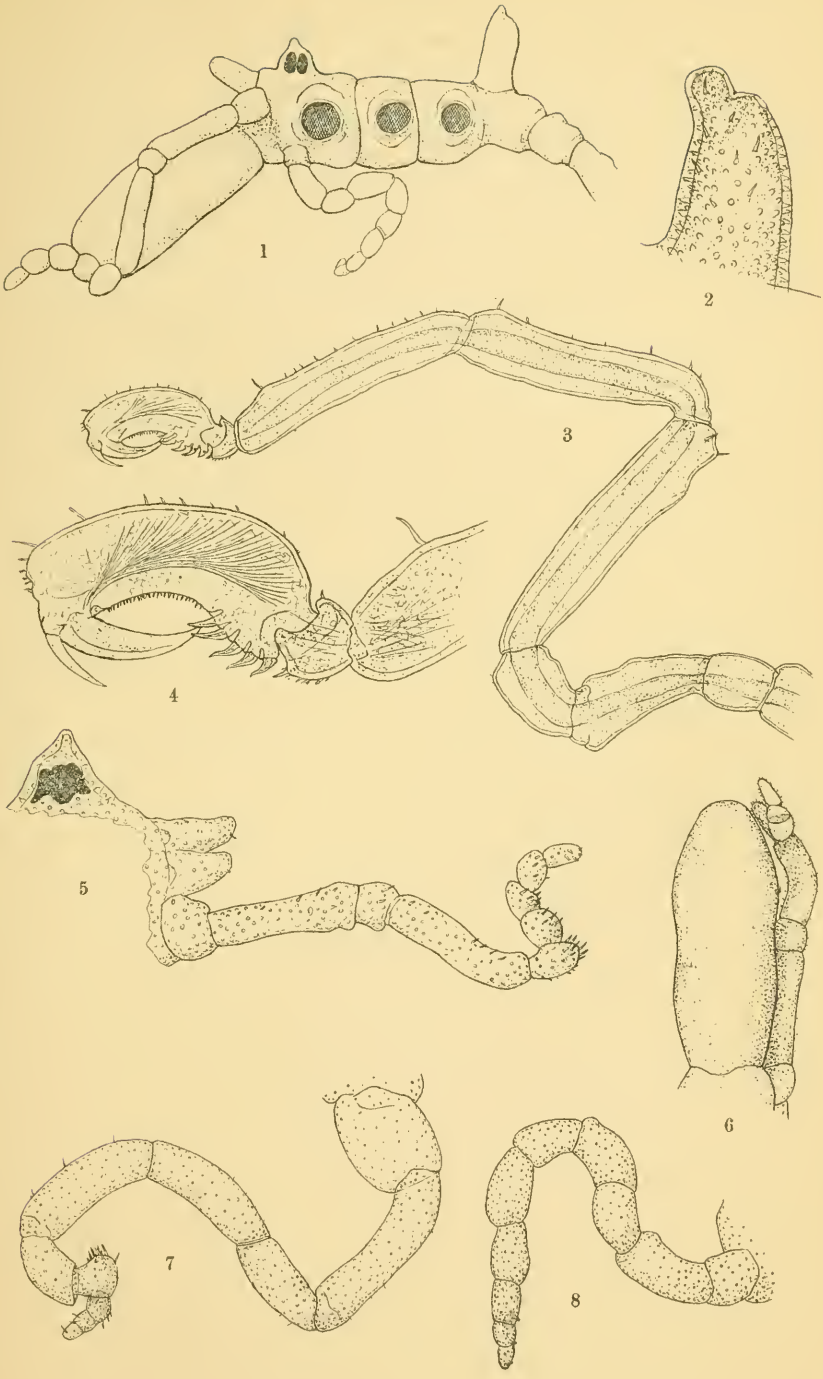
HELIOTYPE CO., BOSTON.

PLATE XV.

Lecythorhynchus marginatus sp. nov.

FIG. 1. Female from left side (Lot 18). × 20.
2. Caudal segment seen from left side; male (Lot 20). × 53.
3. Third right leg of male (Lot 20). × 20.
4. Foot of same. × 43.
5. Eye tubercle, chelifori and right palp of male (Lot 20); seen from the side. × 33.
6. Proboscis and right palp seen from above. × 25.
7. Left oviger of male (Lot 20). × 33.
8. Right oviger of female (Lot 20). × 33.



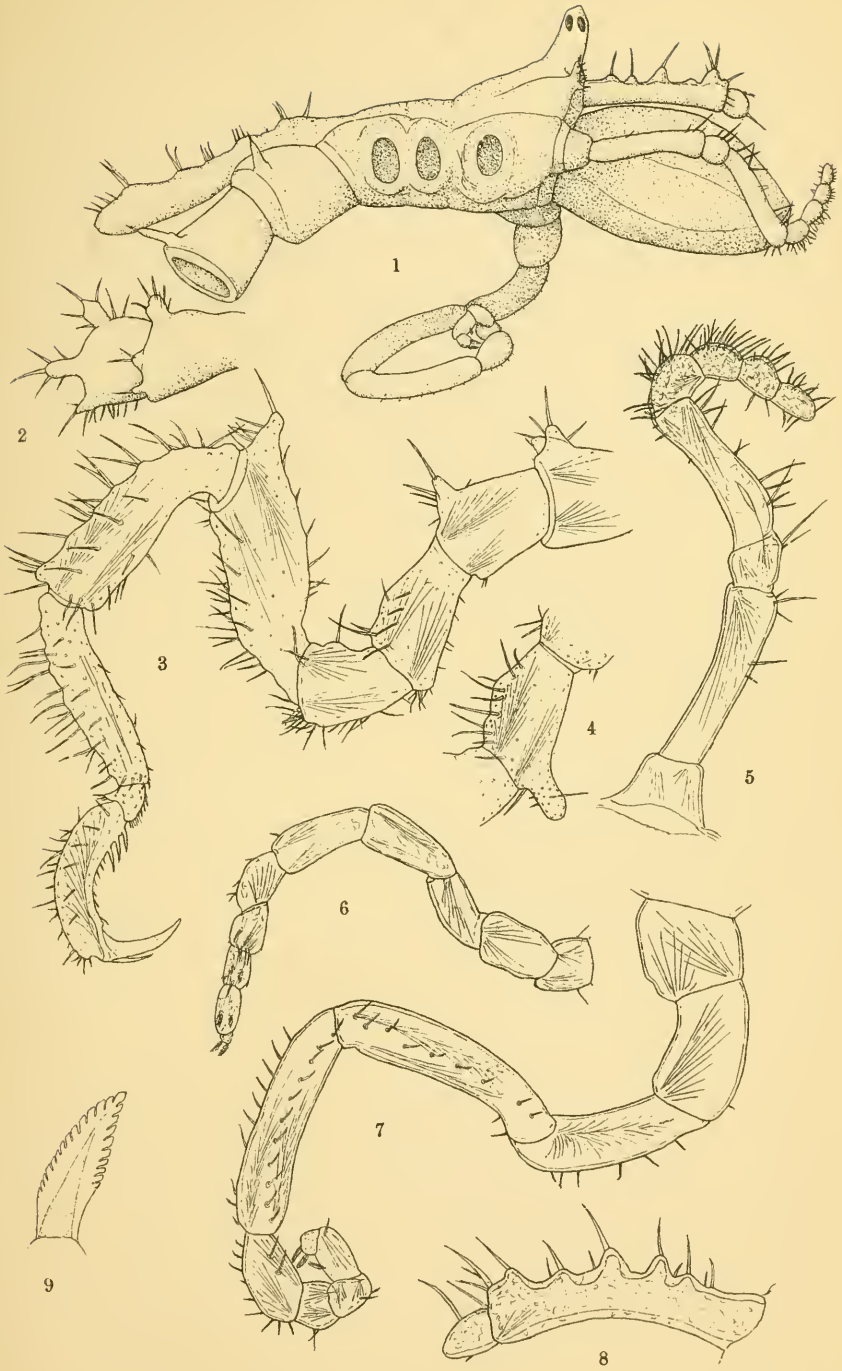
PYCNOGONIDA

HELIOTYPE CO., BOSTON.

PLATE XVI.

Ammothea latifrons sp. nov.

FIG. 1. Male from right side (Lot 1). × 20.
2. Lateral process and first coxal joint of third left leg of male (Lot 1); seen from dorsal side. × 20.
3. Second right leg of male (Lot 1b). × 20.
4. Second coxal joint of third right leg of male (Lot 1b). × 20.
5. Palp of female (Lot 1a). × 33.
6. Oviger of female (Lot 1a). × 33.
7. Oviger of male (Lot 1c). × 33.
8. Cheliforus of female (Lot 1a). × 33.
9. Denticulate spine from oviger of male (Lot 4b). × 247.



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HELIOTYPE CO., BOSTON.

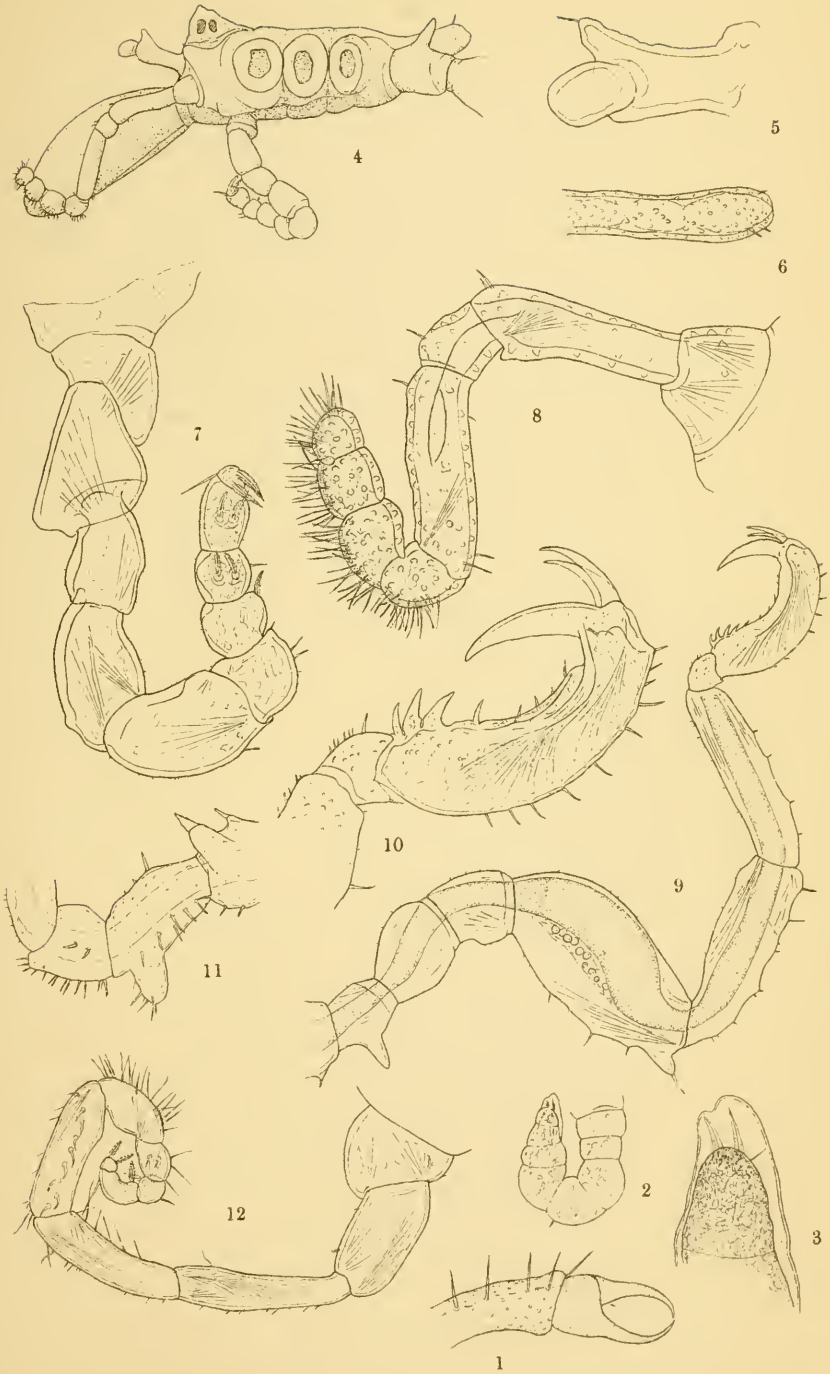
PLATE XVII.

Ammothea latifrons sp. nov.

FIG. 1. Cheliforus of immature specimen (Lot. 1–1). × 33.
2. Oviger of immature specimen (Lot 1–1a). × 33.
3. Terminal part of same. × 107.

Ammothea alaskensis sp. nov.

4. Female from left side (Lot 25). × 27.
5. Cheliforus of adult (Lot 7b). × 73.
6. Caudal segment, dorsal view (Lot 7b). × 43.
7. Left oviger of female (Lot 7a). × 73.
8. Right palp of female (Lot 7b). × 73.
9. Third left leg of female (Lot 25a). × 27.
10. Foot of second left leg, female (Lot 7a). × 53.
11. Second coxal joint of third left leg of male (Lot 25). × 27.
12. Right oviger of male (Lot 25b). × 37.



PYCNOGONIDA

HELIOTYPE CO., BOSTON.

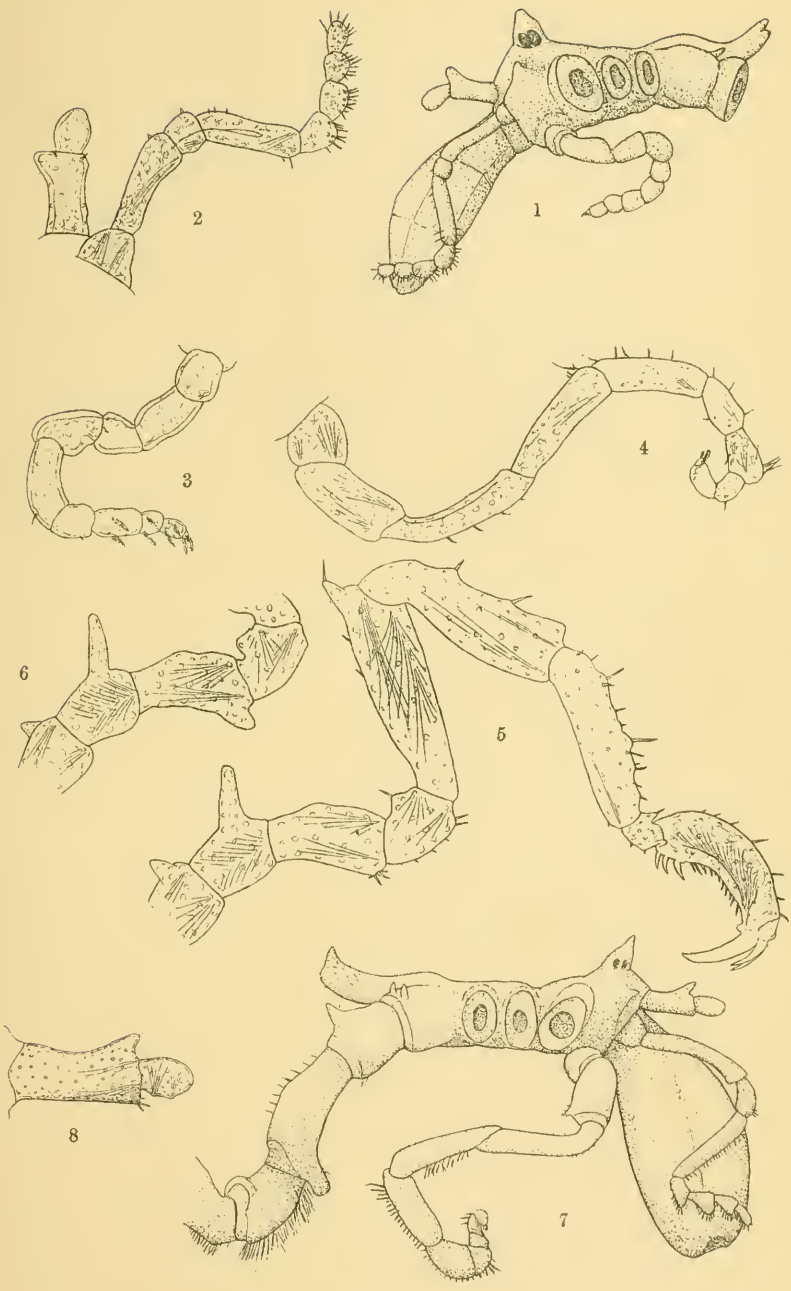
PLATE XVIII.

Ammothea gracilipes sp. nov.

FIG. 1. Female from left side (Lot 9). × 27.
2. Right cheliforus and palp of female (Lot 9a). × 43.
3. Right oviger of female (Lot 9a). × 43.
4. Left oviger of male (Lot 9b). × 43.
5. Second right leg of male (Lot 9b). × 33.
6. Lateral process and coxal joints of third right leg of male (Lot 9b). × 33.

Ammothea pribilofensis sp. nov.

7. Male from right side (Lot 2). × 11.
8. Left cheliforus of male (Lot 2a). × 20.



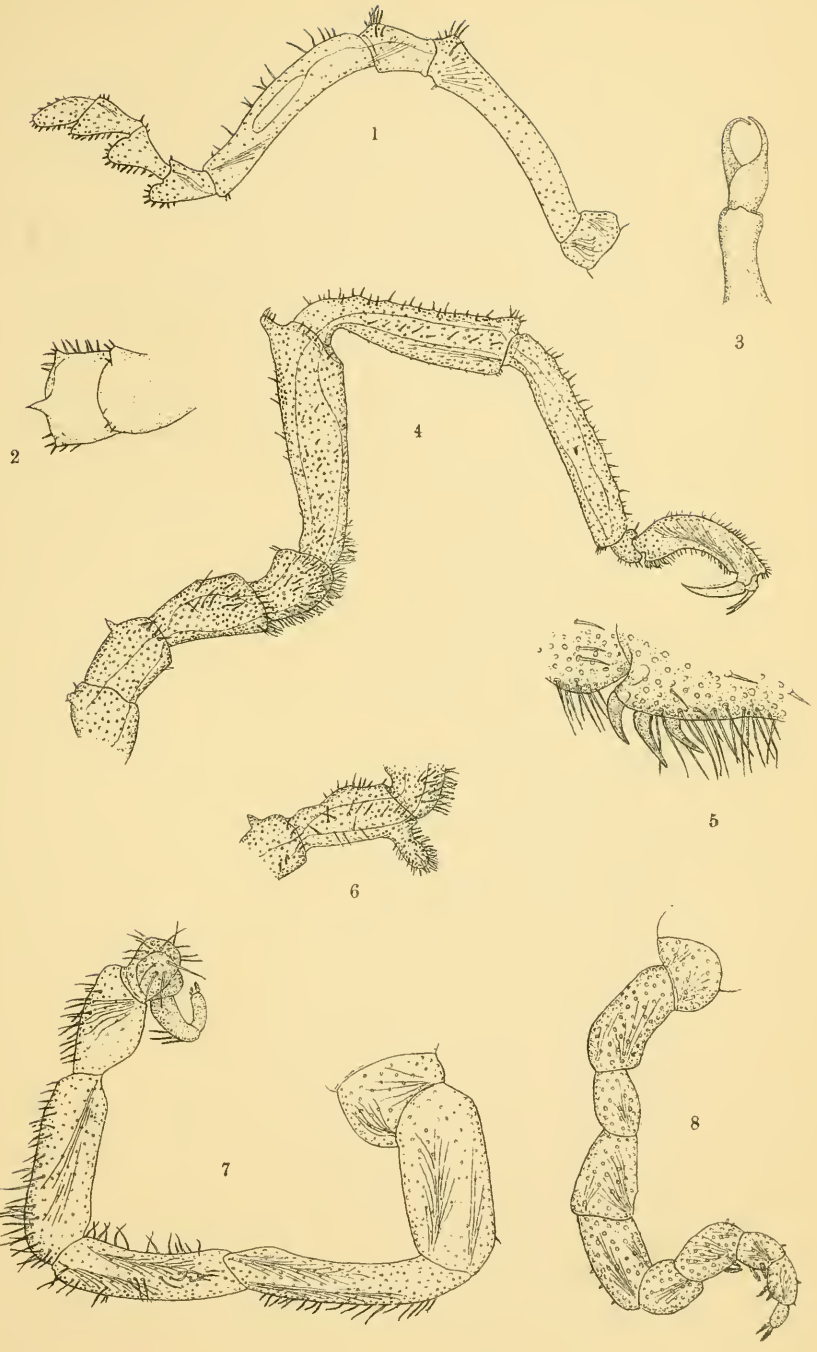
PYCNOGONIDA

HELIOTYPE CO., BOSTON.

PLATE XIX.

Ammothea pribilofensis sp. nov.

FIG. 1. Left palp (Lot 2a). × 20.
2. Lateral process and first coxal joint of first left leg of male (Lot 2); dorsal view.
3. Left cheliforus of immature specimen (Lot 2–1); dorsal view. × 20.
4. First right leg of male (Lot 2a). × 10.
5. Heel of same. × 20.
6. Second coxal joint of third right leg of male (Lot 2a). × 10.
7. Left oviger of male (Lot 2a). × 20.
8. Oviger of female (Lot 2b). × 20.



PYCNOGONIDA

HELIOTYPE CO., BOSTON.

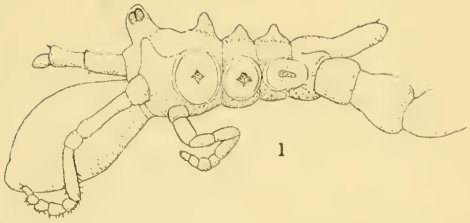
PLATE XX.

Ammothella tuberculata sp. nov.

FIG. 1. Female from left side (Lot 27). × 20.
2. Female specimen from dorsal side (Lot 22). × 20.
3. Right cheliforus of female (Lot 27). × 37.
4. Right palp and right oviger of female (Lot 27). × 37.
5. Second left leg of female (Lot 27). × 33.
6. Right cheliforus of female (Lot 22a). × 43.

Ammothella spinifera sp. nov.

7. Female from right side; chelifori, palpi, and proboscis not shown; portion of side cut away, exposing alimentary canal and nerve ganglia (Lot 14). × 43.
8. Eye tubercle of immature specimen seen in posterior view (Lot 14). × 70.
9. Proboscis (Lot 14). × 33.



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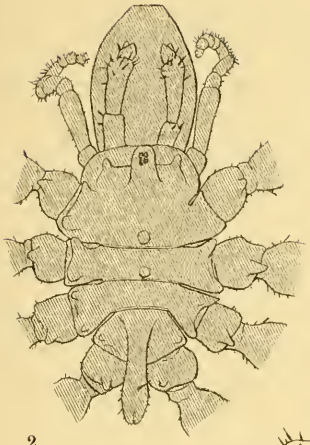

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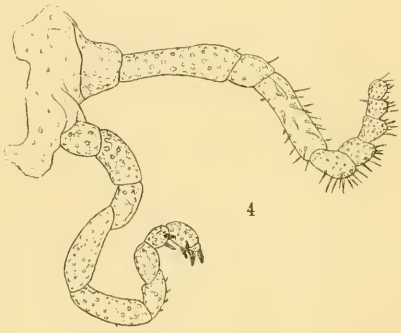

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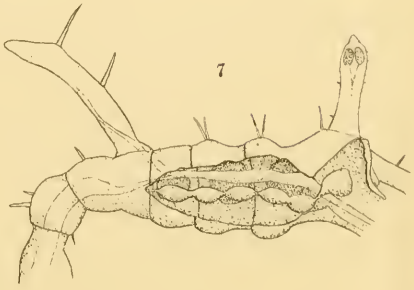

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HELIOTYPE CO., BOSTON.

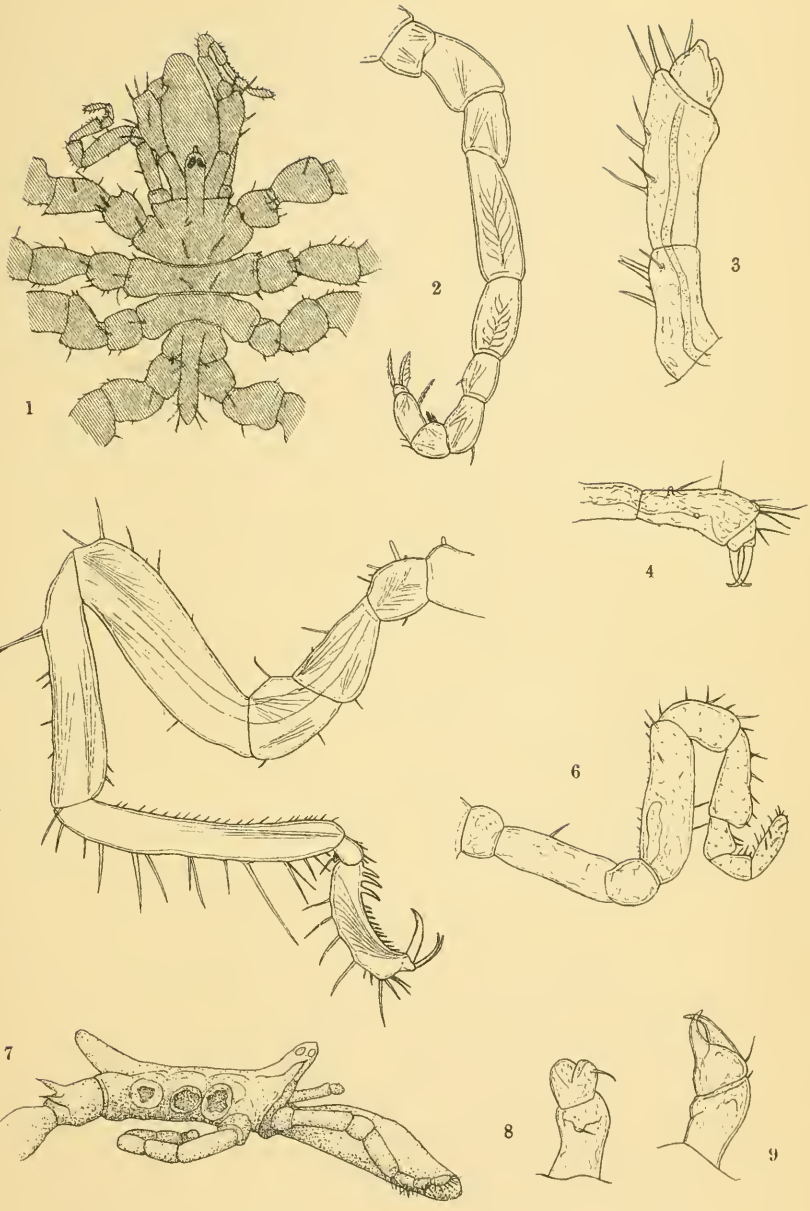
PLATE XXI.

Ammothella spinifera sp. nov.

FIG. 1. Female from above (Lot 14). × 27.
2. Left oviger of female (Lot 14a). × 70.
3. Left cheliforus of female (Lot 14a). × 70.
4. Left cheliforus of immature specimen from above (Lot 14). × 70.
5. First left leg of female (Lot 14a). × 43.
6. Left palp (Lot 14). × 70.

Tanystylum intermedium sp. nov.

7. Male from right side (Lot 29). × 40.
8. Right cheliforus of male (Lot 29b); from above. × 107.
9. Right cheliforus of immature specimen (Lot 29). × 107.



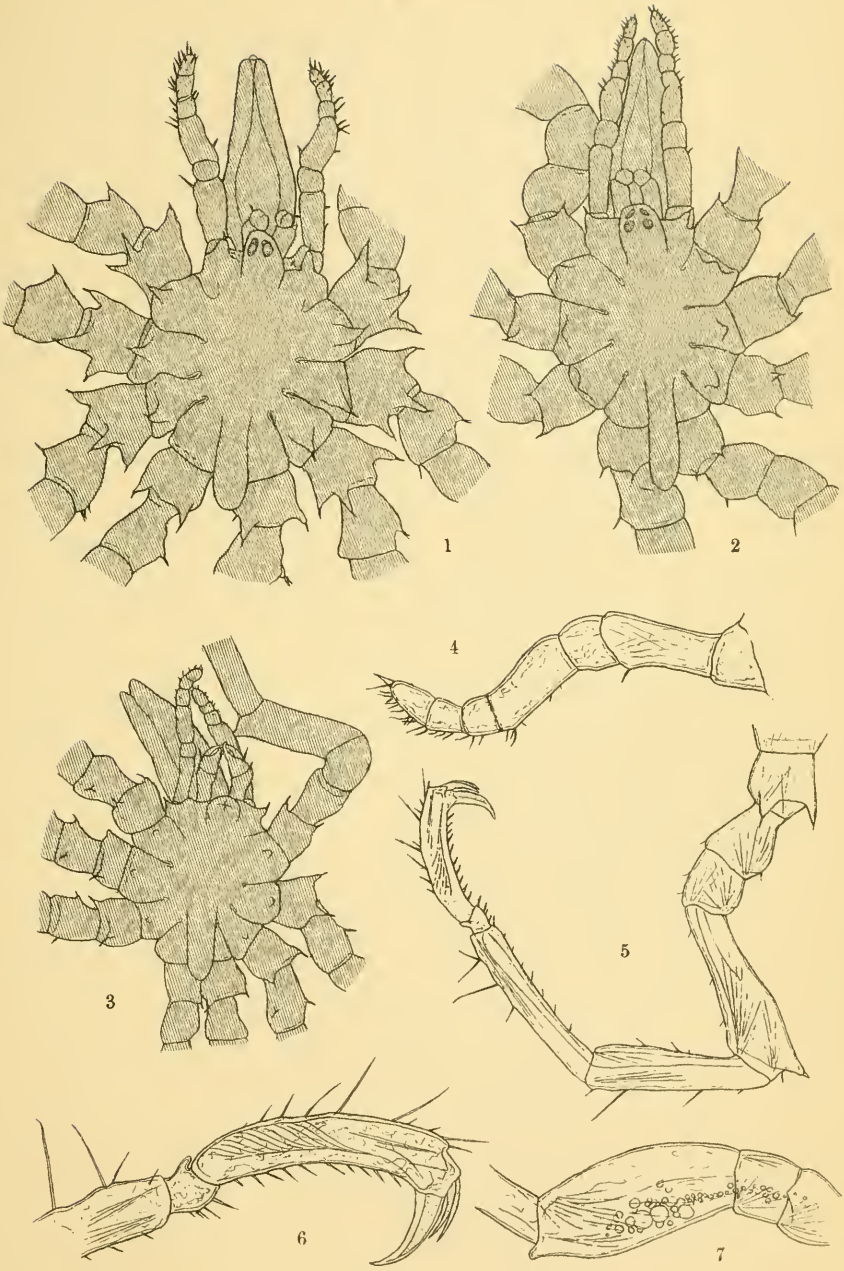
PYCNOGONIDA

HELIOTYPE CO., BOSTON.

PLATE XXII.

Tanystylum intermedium sp. nov.

FIG. 1. Male from above (Lot 29). × 44.
2. Female from above (Lot 29). × 44.
3. Immature specimen from above (Lot 29). × 44.
4. Left palp of female (Lot 29a). × 70.
5. Second right leg of male (Lot 29b). × 43.
6. Foot (Lot 29b). × 80.
7. Femoral joint of second left leg of female (Lot 29a). × 43.



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HELIOTYPE CO., BOSTON.

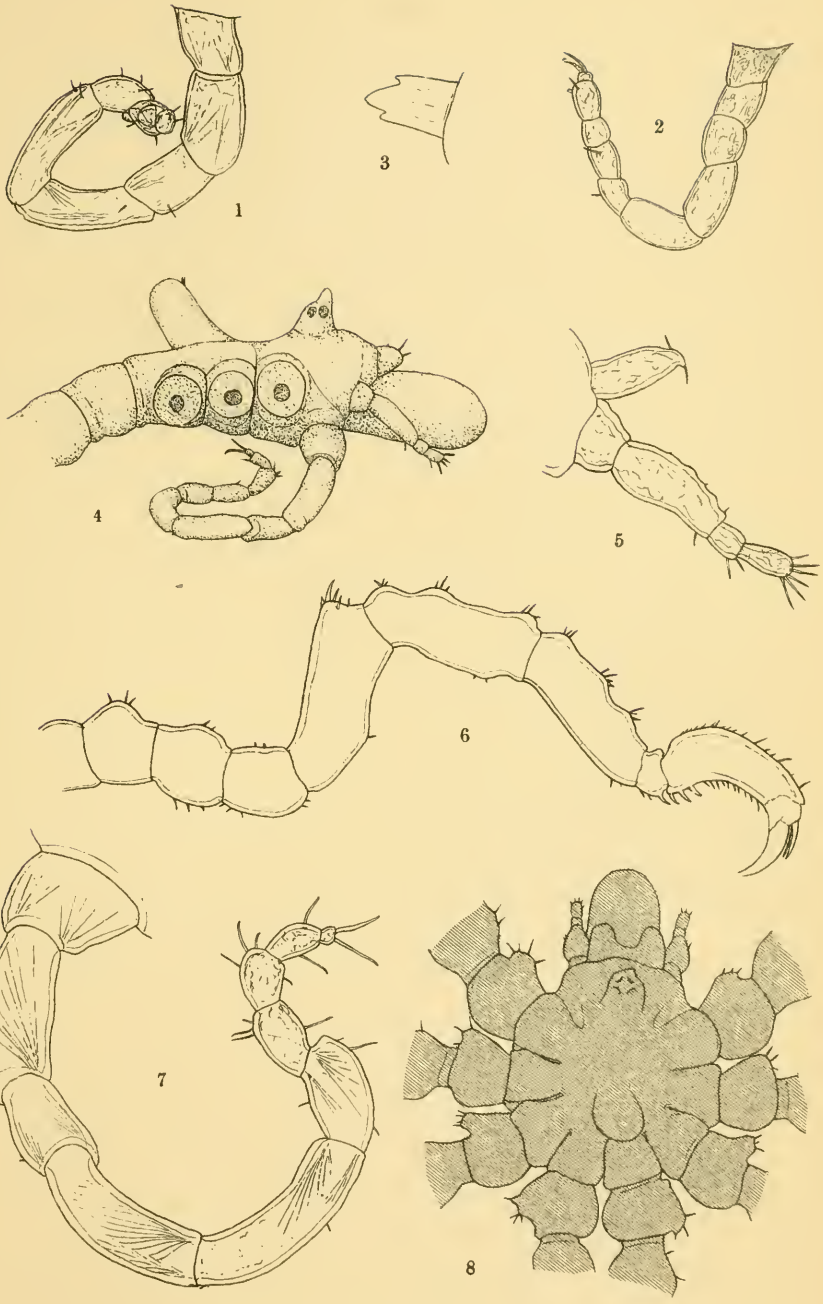
PLATE XXIII.

Tanystylum intermedium sp. nov.

FIG. 1. Left oviger of male (Lot 29a). × 70.
2. Left oviger of female (Lot 29a). × 70.
3. Spine from joint 9 of above (Fig. 2) highly magnified.

Clotenia occidentalis sp. nov.

4. Male from right side (Lot 16). × 34.
5. Cheliforus and palp of same. × 70.
6. Third right leg of same. × 33.
7. Left oviger of same. × 70.
8. Same specimen from above. × 33.



PYCNOGONIDA

HELIOTYPE CO., BOSTON.

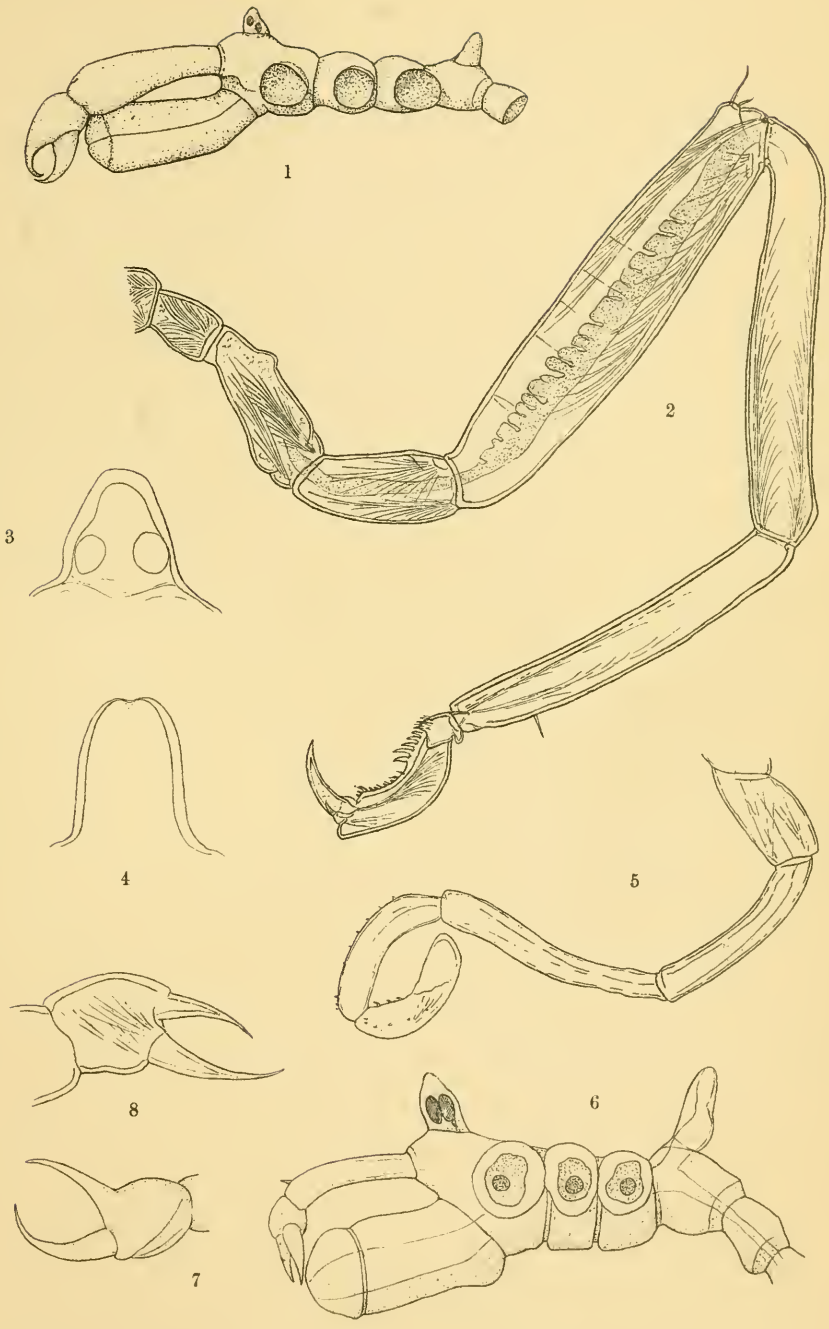
PLATE XXIV.

Phoxichilidium femoratum (Rathke).

FIG. 1. Female from side (Lot 3). × 10.
2. Second left leg of female (Lot 3). × 13.
3. Eye tubercle, anterior view (Lot 3). × 43.
4. Caudal segment, posterior view (Lot 3). × 43.
5. Right oviger of male (Lot 8). × 20.

Halosoma viridintestinalis gen. nov., sp. nov.

6. From left side (Lot 28). × 43.
7. Left chela of same. × 107.
8. Same as Fig. 7, cleared and mounted. × 107.



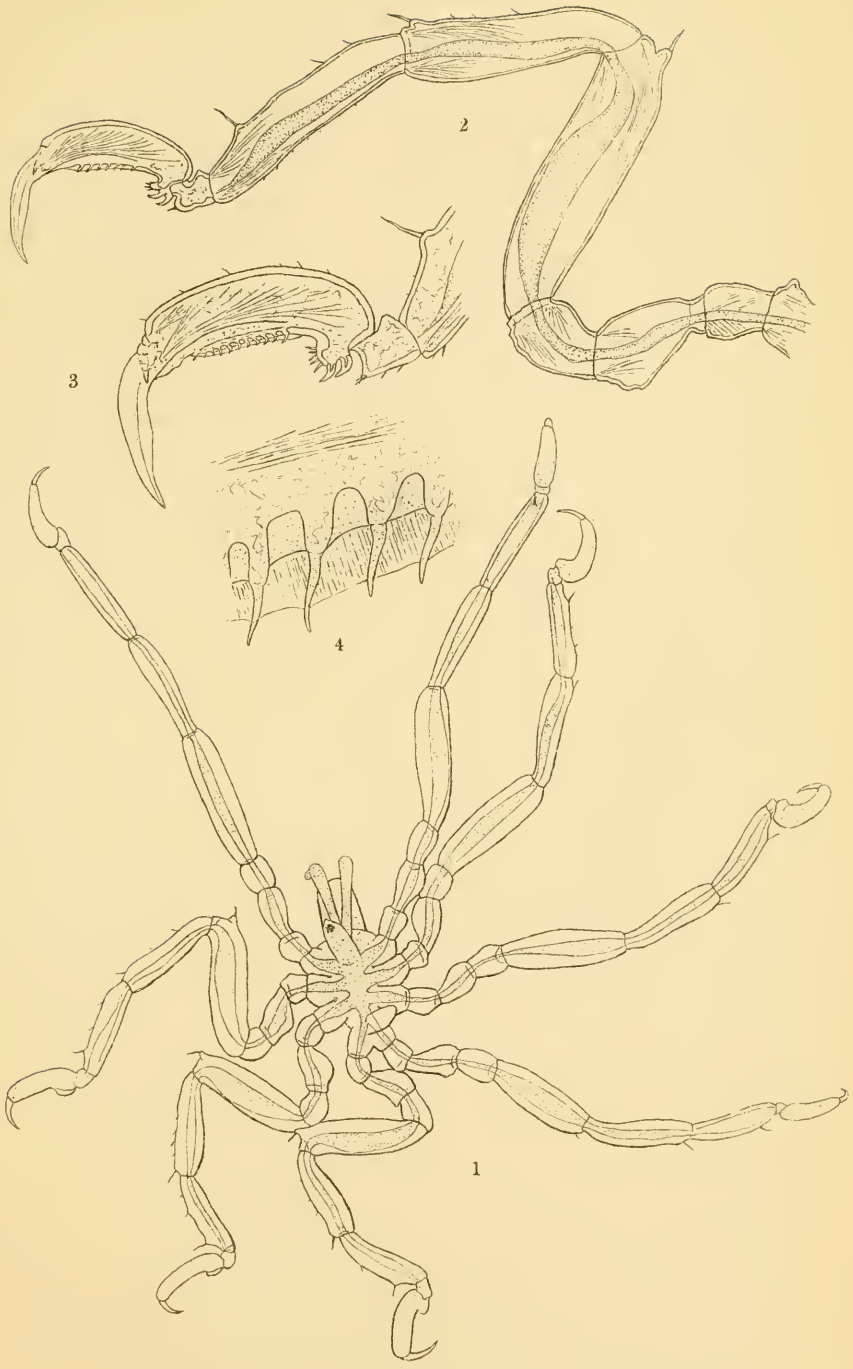
PYCNOGONIDA

HELIOTYPE CO., BOSTON.

PLATE XXV.

Halosoma viridintestinalis gen. nov., sp. nov.

FIG. 1. Specimen from above (Lot 28). × 20.
2. Second left leg of same. × 43.
3. Foot of same. × 67.
4. Portion of the sole highly magnified.



PYCNOGONIDA

HELIOTYPE CO., BOSTON.

PLATE XXVI.

Anoplodactylus erectus sp. nov.

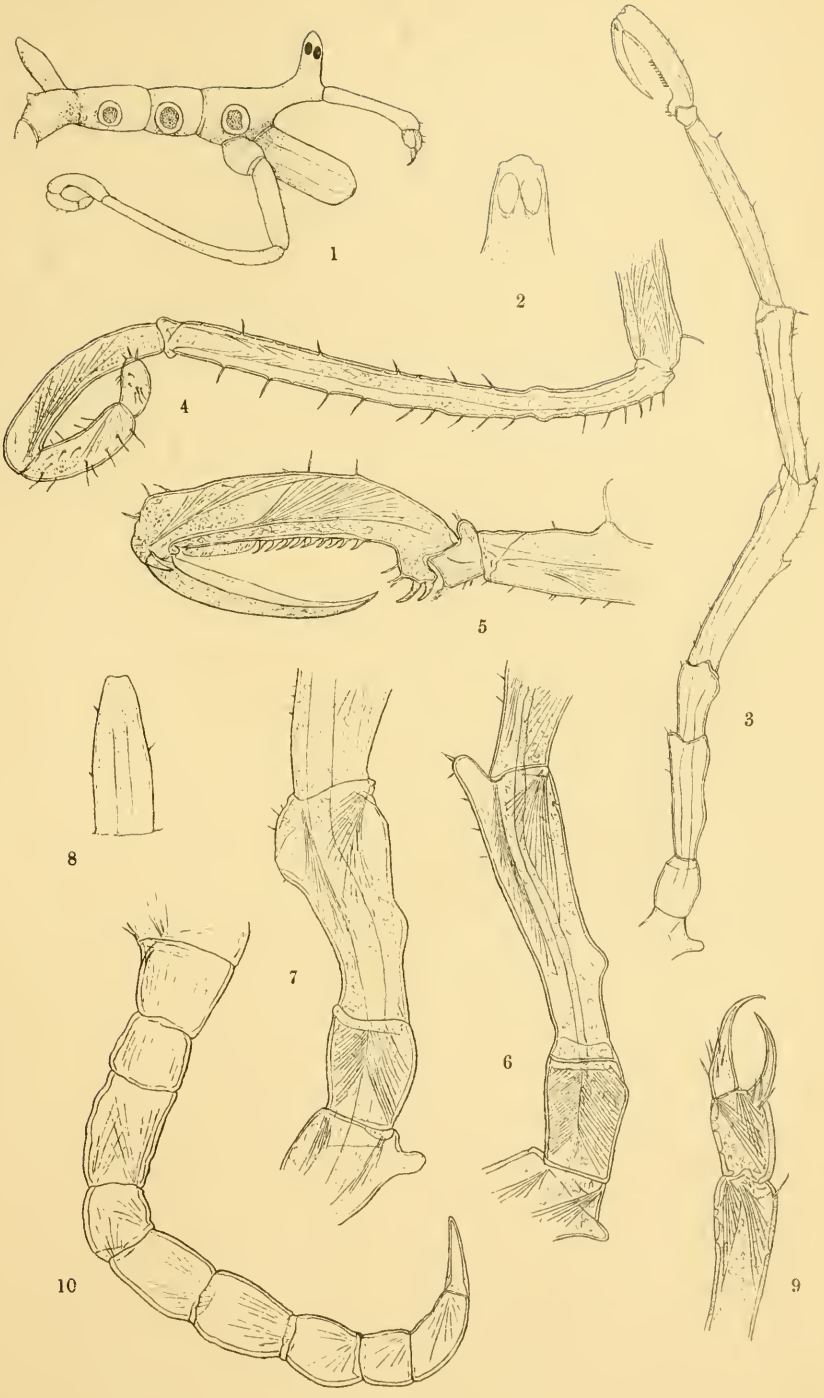
FIG. 1. Male from side (Lot 13). × 20.
2. Eye tubercle of female (Lot 13); posterior view. × 43.
3. Third right leg of male (Lot 13b). × 20.
4. Terminal part of left oviger of same specimen. × 53.
5. Foot of Fig. 3. × 53.
6. Second coxal joint of fourth right leg of male (Lot 13c). × 43.
7. Second coxal joint of second right leg of female (Lot 13c). × 43.
8. Caudal segment of female (Lot 13); anterior view. × 43.
9. Left chela (Lot 13c). × 67.

Pycnogonum stearnsi Ives.

10. Left oviger of male (Lot 21–1). × 27.

INDEX

(New genera and species, and the pages on which they are described, are in **black-face** type; synonyms in parenthesis.)



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HELIOTYPE CO., BOSTON.