NEW MARINE DECAPOD CRUSTACEANS FROM WATERS INFLUENCED BY HYDROTHERMAL DISCHARGE, BRINE, AND HYDROCARBON SEEPAGE

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ABSTRACT

Five species of decapod crustaceans new to science are described. These are caridean shrimps of the family Bresiliidae—*Alvinocaris markensis* from a Mid-Atlantic Rift Valley hydrothermal field, *A. muricola* from a cold brine seep at the foot of the West Florida Escarpment in the Gulf of Mexico, and *A. stactophila* from a hydrocarbon seep on the continental slope of the northern Gulf of Mexico, with a key to the species of *Alvinocaris*; a squat lobster of the family Galatheidae—*Munidopsis alvisca* from the Guaymas Basin and from the Juan de Fuca and Explorer ridges in the eastern Pacific; and a brachyuran crab of the family Bythograeidae—*Bythograea mesatlantica* from a Mid-Atlantic Rift Valley hydrothermal field. Species of both *Alvinocaris* and *Bythograea* are now known from the eastern Pacific and Mid-Atlantic. *Munidopsis* species are widely represented in the world oceans.

Deep ocean hydrothermally active fields and waters influenced by brine and hydrocarbon seeps continue to yield species new to science. Such environments were unknown until explored with the aid of submersible research vessels from which observations and collections could be accomplished. The species of decapod crustaceans reported here come from hydrothermal fields in the Mid-Atlantic Rift Valley, the Guaymas Basin in the Golfo de California, and Juan de Fuca and Explorer Ridges in the northeastern Pacific, a cold brine seep at the foot of the West Florida Escarpment, and a hydrocarbon seep on the continental slope of the northern Gulf of Mexico. These are scattered localities that exhibit diverse environmental conditions but that are bound together by the common thread of chemotrophic food chains (Childress et al. 1986; Brooks et al. 1987).

The material from the Mid-Atlantic Rift Valley, West Florida Escarpment, and Guaymas Basin was observed and collected by scientists working with the aid of the DSRV *Alvin* and RV *Atlantis II* based at the Woods Hole Oceanographic Institution. That from the northern Gulf of Mexico came from the Minerals Management Service Northern Gulf of Mexico Outer Continental Slope (MMS/NGOMCS) Regional Office Project, involving observation and collection of material by scientists from LGL Ecological Research Associates and Texas A&M University, with the aid of the submersible research vessel *Johnson-Sea-Link* and its support vessels. Specimens from Explorer and Juan de Fuca Ridges were collected with the aid of the Canadian DSRV *Pisces IV* and its support vessels.

All specimens studied are deposited in the Crustacean Collection of the United States National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560.

CARIDEA: BRESILIIDAE

Alvinocaris Williams and Chace, 1982

Three species of bresiliid shrimps described below as new to science are placed in the heretofore monotypic genus *Alvinocaris*. Certain features of these species necessitate minor changes in the generic diagnosis by Williams and Chace (1982) as follows: Rostrum with or without ventral teeth. Telson with 2–5 pairs of principal spines on posterior margin. Strong median sternal spine between posterior pair of pereopods.

Moreover, the branchial formula seems uniformly fixed in this genus as well as in the genus *Rimicaris* Williams and Rona, 1986. The arrangement, figured in Williams and Chace (1982) and Williams and Rona (1986) may be described as follows:

Phyllobranchs extensively developed in 2 series; asymmetrically Y-branched pleurobranchs with relatively short ventral and progressively longer and more expansive dorsal ramus associ-

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separated from peduncle, tapering to slender elongate tip reaching about 1/4 length of second article, basal article with distodorsal margin flanked by transverse row of setae, extended into strong lateral spine reaching level equal to that of stylocerite and closely appressed to second article; shorter second article with strong mesiodistal appressed spine. Dorsolateral flagellum about 1.5 length of carapace, thickened proximal half bearing conspicuous ventral setae; ventromesial flagellum somewhat more slender in lateral view and shorter.

Antennal scale (Fig. 1*a*, *b*) about 2.5 as long as wide, distolateral tooth falling short of distomesial apex of broadly rounded distal margin of blade; basal article with strong ventrolateral spine; flagellum slightly exceeding length of body (missing from holotype).

Mandibles (Fig. 2*g*) similar, with 2-segmented palp, incisor process broad and armed with 8 marginal teeth, slender molar process simple, divergent, its narrowly rounded tip minutely setose.

First maxilla (Fig. 2*h*) with proximal endite asymmetrically oval-triangular, distal margin bearing many long setae; distal endite with narrowed base but broadened distally, armed with many (about 37) short spines on mesial margin and with scattered longer spinules marginally and submarginally beyond either end of spine row; palp scarcely bifurcated, with long distal spine on obsolescent proximomesial branch and 1 shorter submarginal spine on distal branch.

Second maxilla (Fig. 2*i*) with proximal endite represented by 2 similar lobes; distal endite subtriangular, expanded mesiodistally and paralleled laterally by narrow somewhat twisted palp, scaphognathite with anterior lobe rectangulo-ovate, fringed with uniformly long, silky setae on anterior and mesial borders, shorter setae along entire lateral margin; posterior lobe narrowly ovate-triangular, fringed on blunt tip and adjacent mesial margin by strikingly long, tangled, strong setae preceded proximally by shorter setae similar to those on lateral margin.

First maxilliped (Fig. 2*j*, partly flattened view) with irregularly fusiform endite, short palp much exceeded in length and size by leaflike exopod, epipod obscurely bilobed.

Second maxilliped (Fig. 2*k*, *l*) somewhat pediform but flattened, mesial margin of articles bearing long, feathered setae, mesial surface of terminal article densely setose, tip of exopod exceeding leaflike epipod.

Third maxilliped (Fig. 2*m*, *n*) slender, 5-segmented, reaching beyond antennular peduncle; terminal segment trigonal in cross section, tapered distally, bearing 3 terminal spines, oblique tracts of dense setae along mesial surface; similar tract of setae on carpus and another less conspicuous group on merus-ischium, latter with distolateral spine at articulation with carpus; exopod much reduced, ovate-triangular, without lash.

First pereopods (Fig. 1*e*, *f*) chelate, subequal; fingers curved ventrally and slightly laterad; dactyl much more slender than and slightly longer than fixed finger; mesial surface of each finger convex, lateral surface deeply concave; prehensile surfaces uniformly offset, closing without gape, each armed with row of almost uniform teeth so closely set as to be almost contiguous, line of sensory hairs mesial to cutting edges, acute tip of dactyl slightly spooned by elongate teeth slanted distad and curving around its external edge. Leg not reaching tip of third maxilliped and exceeding antennal peduncle. Palm of holotype female inflated, length slightly greater than height and shorter than fingers (0.60); low ridge ending in small hooked spine on proximomesial surface near articulation with carpus. Carpus longer than palm; bearing oblique ventral crest ending in strong distoventral spine and flanked mesially by patch of setae on triangular raised area; rectangular distal notch above spine followed by oblique distomesial margin leading to poorly defined spine at condyle articulating with palm; distolateral margin with rounded ventral corner leading to sinuous border above it bearing 2 lobes near articulation with palm. Merus somewhat swollen is distal half and bearing small distomesial spine, distinct from ischium but fused to it.

Second pereopod (Figs. 1*g*, *h*; 7*l*) shorter and more slender than first, but reaching beyond antennal peduncle by about length of fingers. Fingers slightly shorter than palm, similar in size and shape; opposed edges without gape, each spineless proximally, but distal half pectinate with single row of spines directed obliquely distad and increasing slightly in size to end in noticeably stronger spine crossing opposite member when closed. Carpus slender, about 0.9 length of chela; merus and ischium unarmed.

Third to fifth pereopods (Fig. 2*a–f*) similar in length and structure, third reaching distal edge of antennal scale. Length articles of these legs in holotype ♀, mm:

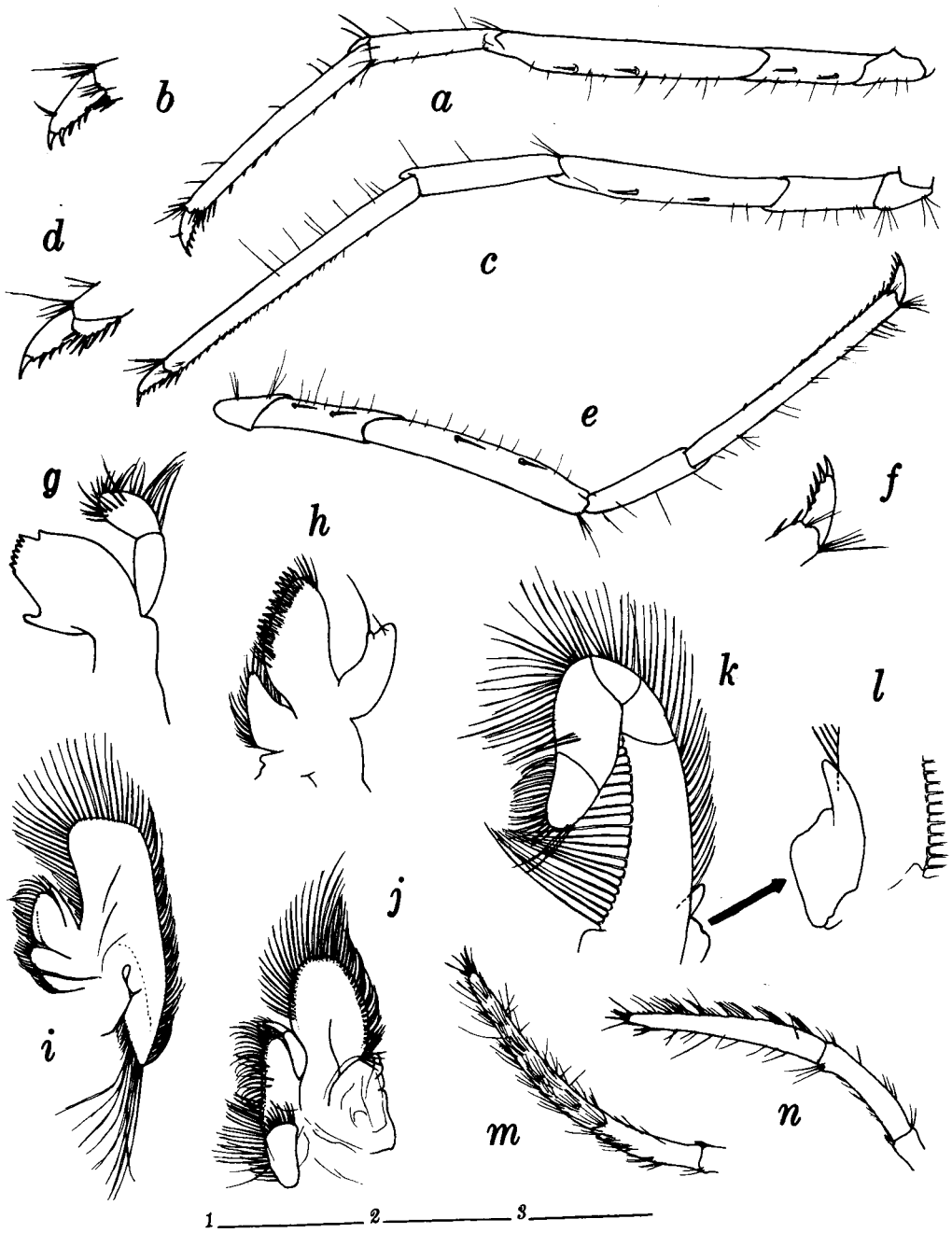

FIGURE 2.—*Alvinocaris markensis*, holotype ♀: *a* pereopod 3, *b* dactyl; *c* pereopod 4, *d* dactyl; *e* pereopod 5, *f* dactyl; *g* mandible; *h* maxilla 1; *i* maxilla 2; *j* maxilliped 1 partly flattened; maxilliped 2, *k* endopod, ventral, *l* part of exopod dorsal; maxilliped 3, *m* ventral, *n* dorsal, distal articles only. Scales: 1(*k*, *l*) = 1 mm; 2 (*b*, *d*, *f*, *g*, *h*) = 1 mm; 3 (*a*, *c*, *e*, *i*, *j*, *m*, *n*) = 2 mm.

	ischio-merus	*carpus*	*propodus*	*dactyl*
3rd	6.14	2.56	3.78	0.64
4th	5.76	2.18	4.12	0.70
5th	5.44	2.30	5.44	0.64

Each short dactyl armed with 5 spines on flexor surface, grading from small proximally to longest and strongest distally, often a sensory seta on extensor surface. Propodi with setae along flexor surface progressively more crowded distally. Carpi with distodorsal extension projecting as a stop along proximal part of propodal extensor surface. Third leg stronger, at least in merus-ischium, than fourth and fifth; merus of third and fourth with closely appressed ventral spine at 1/2 and 3/4 length, that of fifth with spines at 1/3 and 2/3 length, distal spine strongest in each case; ischium of third and fourth leg with 2 spines in line with those on merus.

Pleopods well developed, pair 1 with endopods about half length of exopods, tapering to acute tip; appendices internae simple, that of pair 5 with blunt tip.

Uropod (Fig. 1*d*) with rami subequal in length, slightly exceeding distal end of telson, lateral ramus with movable spine mesial to smaller distolateral tooth, diaeresis sinuous.

Remarks.—Remarks are given in the account for *A. stactophila*.

Etymology.—The name is taken from an acronym for the site of collection in the Mid-Atlantic Ridge Valley about 70 km south of an area known as the Kane Fracture Zone, "MARK", and the Latin genitive suffix "ensis".

Alvinocaris muricola new species

Figures 3, 4, 7

Material.—USNM 234288, Holotype ♂ (cephalothorax and abdomen broken apart), USNM 234289, Allotype ♀, West Florida Escarpment, 26°01'N, 84°54.61'W, 3,277 m, *Alvin* Dive 1754, 15 October 1986, pilot W. Sellers, observers R. Carney and B. Hecker. USNM 234290, Paratype ♀, West Florida Escarpment, same locality, *Alvin* Dive 1753, 14 October 1986, pilot P. Tibbetts, observers R. Carney and G. Knauer. All from Barbara Hecker, Lamont Geological Observatory, Columbia University, Palisades, NY.

Measurements in mm.—Holotype ♂, postorbital carapace length 6.4, rostrum 4.4, maximum carapace height 4.5. Allotype ♀, same, 6.4, rostrum broken, 5.6.

Description.—Integument thin, shining, minutely punctate. Rostrum (Fig. 3*a*, *b*) almost straight to slightly upturned in distal half, sharply pointed tip reaching to proximal part of third peduncular article of antennule; dorsal margin raised into thin serrate crest containing 17-21 teeth varying from obliquely erect in proximal part to nearly horizontal, shorter and more distant distally, about 1/3 length of crest continued onto carapace; ventral margin much less prominent and armed with row of 6 correspondingly smaller subterminal teeth, sometimes obscure; lateral carina broadened proximally and confluent with orbital margin. Carapace (Fig. 3*a*) with broad based but slender, acuminate antennal spine; pterygostomian spine correspondingly acuminate and prominent. Prominent anterior antennal carina curving posteroventrally to intersect obliquely with carina extending from pterygostomian spine at about midlength of carapace, associated groove continuing indistinctly posteriad.

Abdomen (Fig. 3*d*, *e*, *f*) of both male and female broadly arched dorsally, gradually tapering distally, narrowest part of sixth somite less than 2/3 (0.60) width of first somite; pleura of 3 anterior somites broadly rounded, margin of third slightly serrated, that of fourth somite drawn posterolaterally to strong spine flanked dorsally by 0–3 more slender and smaller spines and preceded on ventral margin by 0–2 small spines; number, position, and shape of either lateral or ventral spines may be asymmetrical; posterolateral corner of fifth pleura acuminate and flanked dorsally by 1 or 2 spines analogous to those on somite 4; sixth somite with middorsal length about 1.7 that of fifth, broad-based midlateral spine overlapping base of telson, smaller posterolateral spine acute; fourth and fifth somites each with strong, posteriorly directed spine on sternite. Telson (Fig. 3*g*) elongate subrectangular, length about 3.0 anterior width, 6.8 posterior width, and about 1.4 length of sixth somite, not including posterior spines; armed with 7 dorsolateral spines of nearly uniform size; posterior margin convex, armed with 2 principal spines at each corner and 10 or 11 feathered strong setae on distal margin between.

Eyes (Fig. 3*a*, *b*) with cornea imperfectly developed, unfaceted though diffusely pigmented,

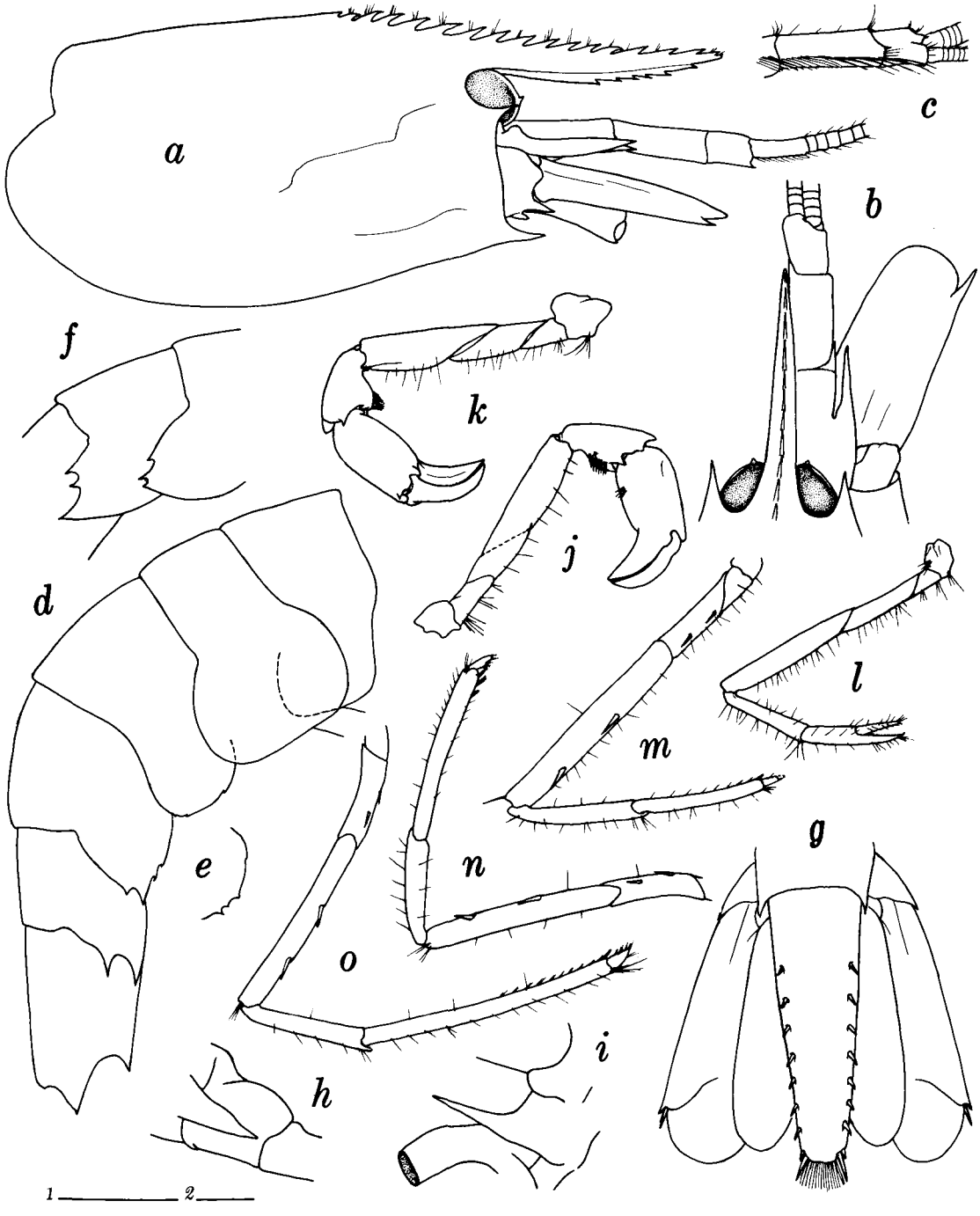

FIGURE 3.—*Alvinocaris muricola*, holotype ♂: *a* cephalothorax and anterior appendages, lateral; *b* rostrum, eye, antennular peduncle, antennal scale, dorsal of right side; *c* antennular peduncle, distal articles, mesial; abdomen with variations in spination of pleural margins (of allotype ♀), *d* lateral, *e* margin of pleuron 3 from opposite side, *f* (of holotype ♂) segments 4 and 5; *g* tail fan; *h* median sternal spine between fifth pereopods; *i* median sternal spine on abdominal segment 5; cheliped, *j* mesial, *k* lateral; *l*, *m*, *n*, *o* pereopods 2, 3, 4, 5. Scales = 1 mm: 1 (*a–g*, *j–o*); 2 (*h*, *i*).

ovate in outline, though fused to each other mesially, and each with a short upturned spine on anterior surface.

Antennular peduncle (Fig. 3*a*, *b*, *c*) reaching beyond end of antennal scale; basal article 1.1 as long as second and about 2.5 as long as third, all measured on ventral margin; stylocerite well separated from peduncle, tapering to slender elongate tip reaching tip of distolateral spine on basal article; latter exceeding distodorsal margin of article, fringed by transverse subdistal row of setae, and closely appressed to second article, distomesial spine much smaller; shorter second article with stronger mesiodistal spine. Dorsolateral flagellum about length of carapace, thickened in basal 2/3, with annulations, except at base, longer in female than in male and much longer than in whiplike distal part; ventromesial flagellum somewhat shorter and with annulations of variable but shorter length.

Antennal scale (Fig. 3*a*, *b*) about twice as long as wide, distolateral tooth strong, falling slightly short of broadly rounded distal margin of blade; basal article with acute distal spine ventrally; flagellum (broken in material studied) probably slightly exceeding length of body.

Mandibles (Fig. 4*a*) similar, with 2-segmented palp, incisor process broad and armed with 8 marginal teeth, slender molar process simple, divergent, its narrowly rounded tip minutely setose.

First maxilla (Fig. 4*b*) with proximal endite asymmetrically oval-triangular, distal margin bearing many long setae; distal endite with narrowed base but broadened distally, armed with many (about 30) short spines on mesial margin and with scattered longer spinules submarginally and marginally beyond either end of spine row; palp scarcely bifurcated, with long distal spine on obsolescent proximomesial branch and 1 shorter submarginal spine on distal branch.

Second maxilla (Fig. 4*c*, *d*) with proximal endite represented by 2 similar lobes; distal endite subtriangular, expanded mesiodistally and paralleled laterally by narrow, somewhat twisted palp; scaphognathite with anterior lobe rectangulo-ovate, fringed with uniformly long, silky setae on anterior and mesial borders, uniformly shorter setae along entire lateral margin; posterior lobe narrow and acuminate, fringed on blunt tip and adjacent mesial margin by strikingly long, strong, tangled setae preceded proximally by shorter setae similar to those on lateral margin.

First maxilliped (Fig. 4*e*, *f*) with irregularly fusiform endite, short palp concealed and much exceeded in length and size by leaflike exopod, epipod obscurely bilobed; indistinct mesial lobule on exopod possibly representing incipient lash.

Second maxilliped (Fig. 4*g*, *h*) somewhat pediform but flattened, mesial margin of articles bearing long, feathered setae, mesial surface of terminal article densely setose, exopod barely exceeding leaflike epipod.

Third maxilliped (Fig. 4*i*, *j*) slender, 5-segmented, reaching beyond antennular peduncle; terminal article trigonal in cross section, tapered distally, bearing 3 spines, transverse tracts of dense setae along mesial surface; similar tract of setae on carpus and another conspicuous group mesiodistally on merus-ischium, latter with stout distolateral spine at articulation with carpus; exopod much reduced, subtriangular, without lash.

First pereopods (Figs. 3*j*, *k*; 7*f–k*) chelate, subequal and sexually dimorphic, at least in fully mature individuals; fingers curved ventrally and slightly laterad; dactyl more slender than and with level of tip slightly shorter than or equal to that of fixed finger; mesial surface of each finger convex, lateral surface concave, with opposed surfaces uniformly offset; closing without gape, each armed on prehensile edge with row of almost uniform teeth so closely set as to be almost contiguous, acute tip of dactyl slightly spooned by elongate teeth slanted distad and curving around its external edge; line of sensory hairs mesial to cutting edges. Leg shorter than to almost equaling third maxilliped. Palm of holotype male inflated laterally, but apparently somewhat irregularly concave mesially, length 1.4 greatest height and longer than fingers; palm relatively shorter in allotype female, 0.3 length of fingers. Carpus shorter than palm, with oblique ventral crest ending in strong distolateral spine, flanked mesially by patch of setae on polygonal raised area. Merus somewhat swollen in distal half, distinct from ischium but fused to it, neither armed.

Second pereopod (Figs. 3*l*; 7*e*) shorter and more slender than first, reaching about to end of antennal peduncle; fingers slightly longer than palm, similar in size and shape, opposed edges without gape, each pectinate with single row of teeth in distal half directed obliquely distad and increasing slightly in size to end in noticeably stronger tooth crossing opposite member when closed, but spineless proximally; carpus slender, about 1.16 longer than chela; merus and ischium unarmed.

Third to fifth pereopods (Fig. 3*m*, *n*, *o*) similar in length and structure, third reaching to tip of or

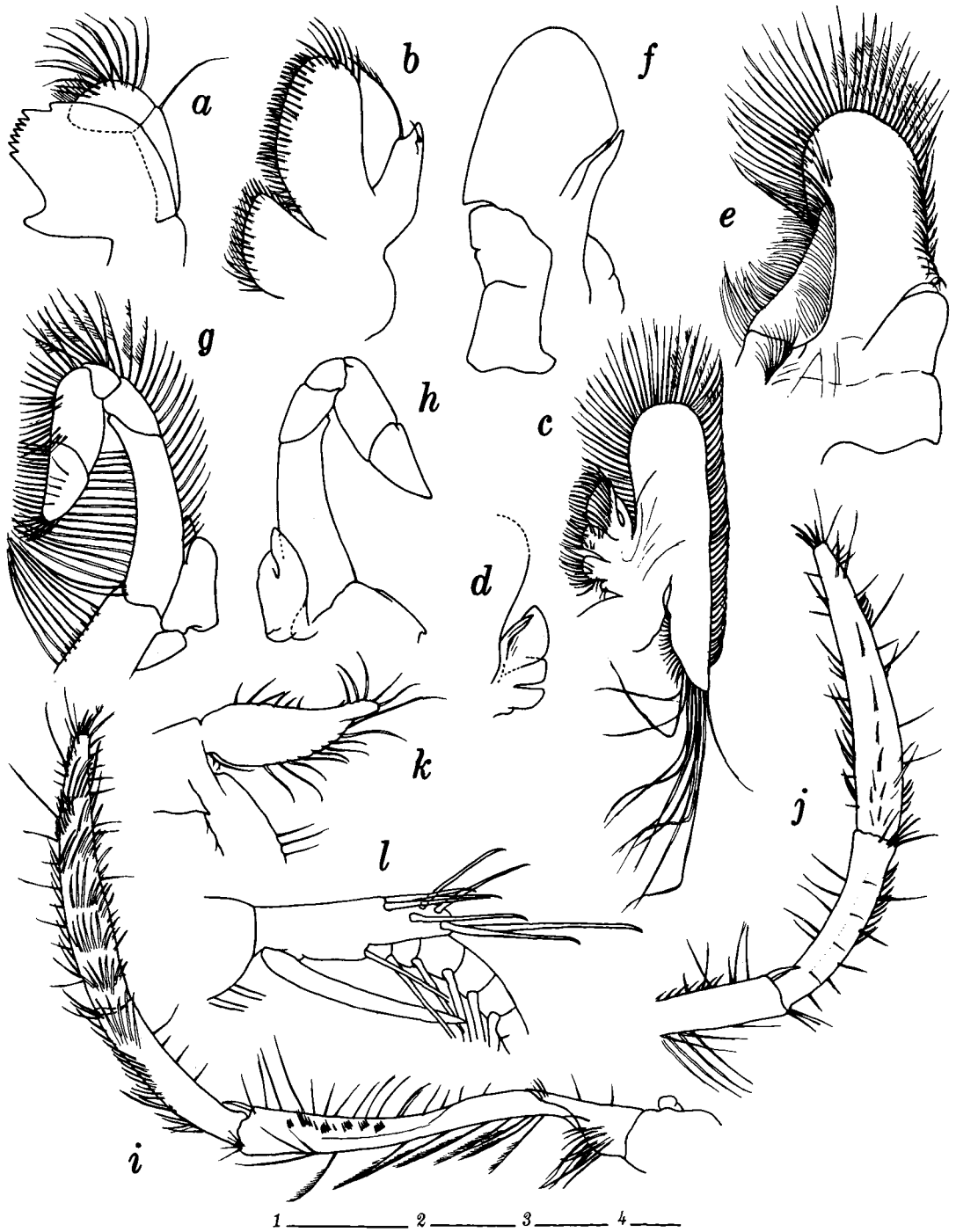

FIGURE 4.—*Alvinocaris muricola*, holotype ♂: *a* mandible; *b* maxilla 1; maxilla 2, *c* ventral, *d* palp dorsal; maxilliped 1, *e* ventral, *f* dorsal; maxilliped 2, *g* ventral, *h* dorsal; maxilliped 3, *i* ventral, *j* dorsal; *k* endopod of pleopod 1; *l* appendix masculina, pleopod 2. Scales: 1 (*e*, *f*, *g*, *j*, *o*, *k*, *l*) = 1 mm; 2 (c, *d*) = 1 mm; 3 (*l*) = 0.2 mm; 4 (*a*, *b*) = 0.2 mm.

slightly beyond antennal scale. Length articles of these legs in holotype ♂, mm:

	ischium	*merus*	*carpus*	*propodus*	*dactyl*
3rd	1.76	3.84	2.33	2.34	0.35
4th	1.60	3.52	1.98	3.04	0.06
5th	1.60	3.20	2.43	4.96	0.42

Each short dactyl armed with about 4–6 corneous spines on flexor surface, grading from small proximally to longest and strongest distally; carpus of each with distodorsal extension projecting as a stop along proximal part of propodal extensor surface; third leg stronger, at least in merus-ischium, than fourth and fifth, but propodus successively longer from third to fifth; merus of each with ventral spine at 1/3 and 2/3 length; ischium of third, fourth, and fifth leg with 2 spines in line with those on merus.

Pleopods well developed; first pair with endopods about 1/2 length of exopods in both sexes, narrowed into distomesial projection in male (Fig. 4*k*) but evenly tapered in female; appendix masculina (Fig. 4*l*) of second pair in male (holotype) armed with 7 slender spines extending beyond level of simple slender appendix interna; endopods of third to fifth in male and second to fifth in female with simple slender appendix interna, but that of fifth blunt tipped.

Uropod (Fig. 3*g*) with rami subequal in length, lateral ramus slightly exceeding distal end of telson, and with movable spine mesial to smaller distolateral tooth, diaeresis sinuous.

Remarks.—Remarks are given in the account for *A. stactophila*.

Etymology.—The name is from the Latin "muria", brine, and "cola", inhabiting, for association of the species with cold brine seeping from the base of the West Florida Escarpment.

Alvinocaris stactophila new species

Figures 5, 6, 7

Material.—USNM 234291, Holotype ♂, USNM 234292, Allotype ♀, USNM 234293, Paratypes, 5 ♂, 2 ♀; north central Gulf of Mexico about 129 km (80 miles) S of Louisiana, 27°46.94'N, 91°30.34'W, 534 m, *Johnson-Sea-Link* Dive 1879, 28 September 1986, Bush Hill hydrocarbon seep. From Linda H. Pequegnat and Randall Howard, LGL Ecological Research Associates, Bryan, TX, supported by partial funding for Minerals Management Service-Northern Gulf of Mexico contract 14-12-0001-30212.

Measurements in mm.—Holotype ♂, postorbital carapace length 7.0, rostrum 2.7, maximum carapace height 5.3, total length about 25. Allotype ♀, same 6.8, 2.0, 5.9, 24. Paratype ♂, same 4.2, 1.9, 3.2, total length not measured; paratype ♀, same, 4.9, 2.0, 4.1.

Description.—Integument thin, shining, minutely punctate. Rostrum (Fig. 5*a*, *b*) almost straight, imperceptibly elevated above horizontal in distal half, sharply pointed tip usually reaching proximal level of second peduncular article of antennule, but sometimes to proximal part of third peduncular article; dorsal margin raised into thin serrate crest containing 12–17 teeth, strongest in central sector of row, with about 1/2 length of crest continued onto carapace; ventral margin less prominent and armed with 0 or 1 subterminal tooth; sample tooth formulas 11/1, 12/0, 14/1, 17/1; lateral carina broadened proximally and confluent with orbital margin. Carapace (Fig. 5*a*, *b*) with buttressed acuminate antennal spine distinct; pterygostomian spine acuminate and prominent. Prominent anterior antennal carina curving posteroventrally to intersect obliquely with carina extending from pterygostomial spine at about midlength of carapace, associated groove continuing indistinctly posteriad.

Abdomen (Fig. 5*d*) of both male and female broadly arched dorsally, gradually tapering distally, narrowest part of sixth somite less than 1/2 (0.44) width of first somite; pleura of 3 anterior somites broadly rounded, that of fourth somite drawn posterolaterally to acuminate spine flanked dorsally by 0–3 much more slender and smaller spines; posterolateral corner of fifth pleuron varying from strongly acuminate to nearly rectangular and flanked dorsally by 2–5 spines analogous to those on somite 4; sixth somite with middorsal length about 1.8 that of fifth, broad-based midlateral spine overlapping base of telson, smaller posterolateral spine acute; fourth and fifth somites each with strong, posteriorly directed spine on sternite. Telson (Fig. 5*e*) elongate subrectangular, length about 2.8 anterior width, 5.2 posterior width, and about 1.7 length of sixth somite, not including posterior spines; armed with 5–8 dorsolateral spines of

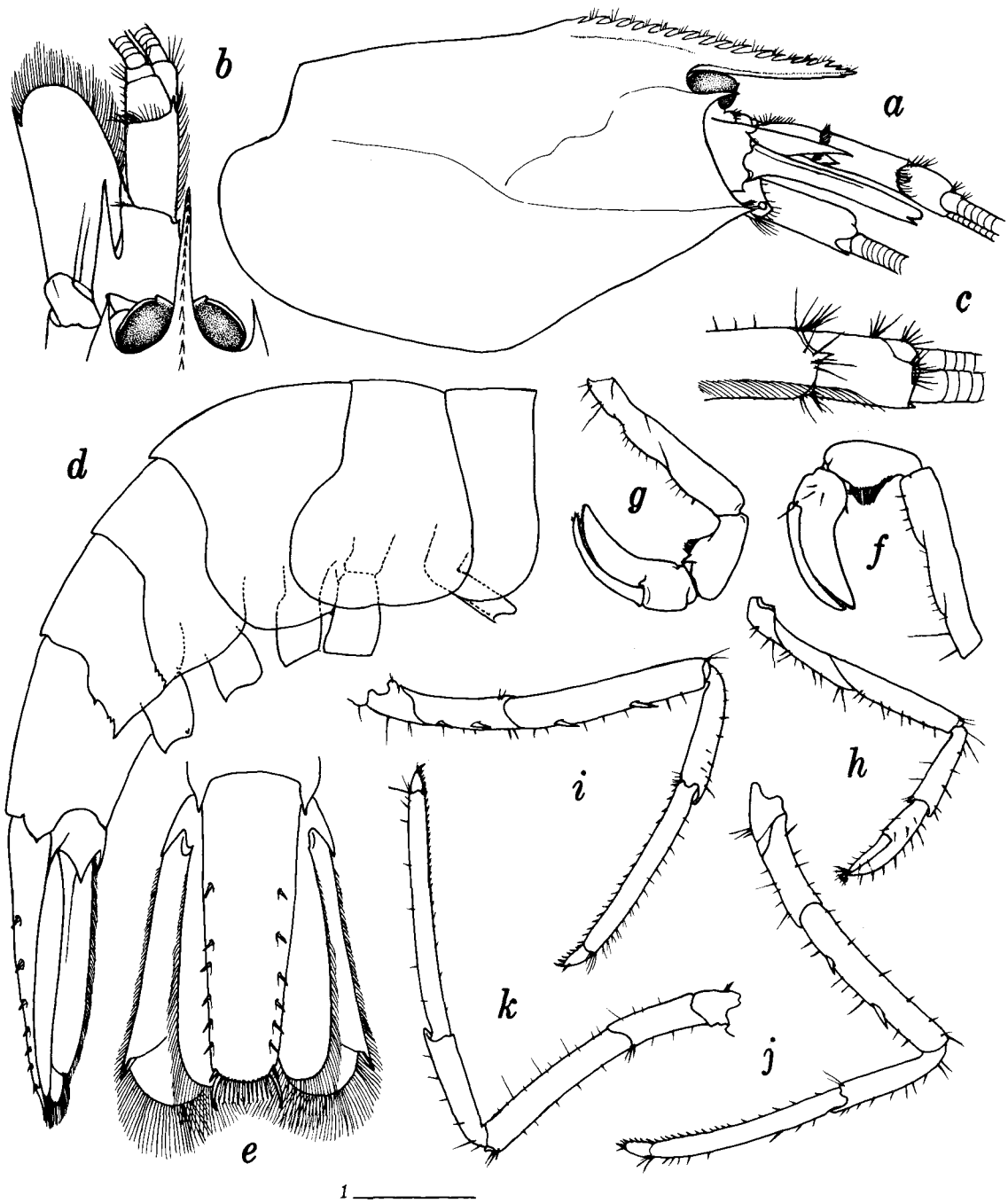

FIGURE 5—*Alvinocaris stactophila*, holotype ♂: *a* cephalothorax and anterior appendages, lateral; *b* rostrum, eye, antennular peduncle, antennal scale, dorsal of left side; *c* antennular peduncle, distal articles, mesial; *d* abdomen, lateral; *e* tail fan. Allotype ♀: cheliped, *f* mesial, *g* lateral; *h*, *i*, *j*, *k* pereopods 2, 3, 4, 5. Scale = 2 mm.

nearly uniform size, occasionally unequal in number on either side; posterior margin convex, armed with 2 principal spines at each corner and 8–12 feathered strong setae on distal margin between.

Eyes (Fig. 5*a*, *b*) with cornea imperfectly developed; unfaceted though diffusely pigmented in adults, but with internal facetlike pattern in smaller individuals; ovate in outline though fused to each other mesially, and each with an upturned spine on anterodorsal surface.

Antennular peduncle (Fig. 5*a*, *b*, *c*) reaching beyond end of antennal scale; basal article 1.3 length of second and about 2.2 length of third, all measured on dorsal margin; stylocerite well separated from peduncle, tapering to slender elongate tip variably reaching as far as midlength of second article; basal article with distodorsal margin exceeded by rostral tip though extended into strong lateral spine reaching level equal to that of stylocerite and closely appressed to second article, much smaller distomesial spine slightly divergent; shorter second article with stronger mesiodistal spine. Dorsolateral flagellum about twice length of carapace, thickened in basal half; ventromesial flagellum somewhat shorter.

Antennal scale (Fig. 5*a*, *b*) about twice as long as wide, distolateral tooth strong, falling short of broadly rounded distal margin of blade; basal article with small distal spine ventrally; flagellum slightly exceeding length of body.

Mandibles (Fig. 6*a*) similar, with 2-segmented palp, incisor process broad and armed with 7 marginal teeth, slender molar process simple, divergent, its narrowly rounded tip minutely setose.

First maxilla (Fig. 6*b*) with proximal endite asymmetrically oval-triangular, distal margin bearing about 25 long setae; distal endite with narrowed base but broadened distally, armed with many short spines on mesial margin and with scattered longer spinules submarginally and marginally beyond either end of spine row; palp scarcely bifurcated, with long distal spine on obsolescent proximomesial branch and shorter adjacent submarginal spine and tangled setae on distal branch.

Second maxilla (Fig. 6*c*) with proximal endite represented by 2 similar lobes; distal endite subtriangular, expanded mesiodistally and paralleled laterally by narrow somewhat twisted palp; scaphognathite with anterior lobe rectangulo-ovate, fringed with uniformly long, silky setae on anterior and mesial borders, uniformly shorter setae along entire lateral margin, posterior lobe narrow and acuminate, fringed on blunt tip and adjacent mesial margin by strikingly long, tangled strong setae preceded proximally by shorter setae similar to those on lateral margin.

First maxilliped (Fig. 6*d*, *e*) with irregularly fusiform endite, short palp concealed and much exceeded in length and size by leaflike exopod, epipod obscurely bilobed; indistinct mesial lobule on exopod possibly representing incipient lash.

Second maxilliped (Fig. 6*f*, *g*) somewhat pediform but flattened, mesial margin of articles bearing long, feathered setae, mesial surface of terminal article densely setose, exopod barely exceeding leaflike epipod.

Third maxilliped (Fig. 6*h*, *i*, *j*) slender, 5-segmented, reaching beyond antennular peduncle; terminal article trigonal in cross section, tapered distally, bearing 3 spines, transverse tracts of dense setae along mesial surface; similar tract of setae on carpus and another less conspicuous group on merus-ischium, latter with stout distolateral spine at articulation with carpus; exopod much reduced, subtriangular, without lash.

First pereopods (Figs. 5*f*, *g*; 7*c*, *d*) chelate, subequal and sexually dimorphic, at least in fully mature individuals; fingers curved ventrally and slightly laterad; dactyl more slender than fixed finger, tips varying slightly in relative length; mesial surface of each finger convex, lateral surface concave; prehensile surfaces uniformly offset, closing without gape, each armed with row of almost uniform teeth so closely set as to be almost contiguous, line of sensory hairs mesial to cutting edges, acute tip of dactyl slightly spooned by elongate teeth slanted distad and curving around external edge. Leg exceeding third maxilliped by length of fingers in holotype male, but shorter than third maxilliped in other individuals. Palm inflated in holotype male, length 1.4 greatest height and longer than fingers; palm relatively shorter in allotype female and other individuals examined, 0.3 length of fingers. Carpus shorter than palm in holotype but longer than palm in remainder of specimens examined, bearing oblique ventral crest ending in strong distolateral spine and flanked mesially by patch of setae on polygonal raised area; notch above spine smoothly concave and opposing low ridge ending in small rounded spine on heel of palm; shallowly concave anteromesial margin of carpus leading dorsally to 2 low rounded lobes. Merus somewhat swollen in distal half, distinct from ischium but fused to it, neither armed.

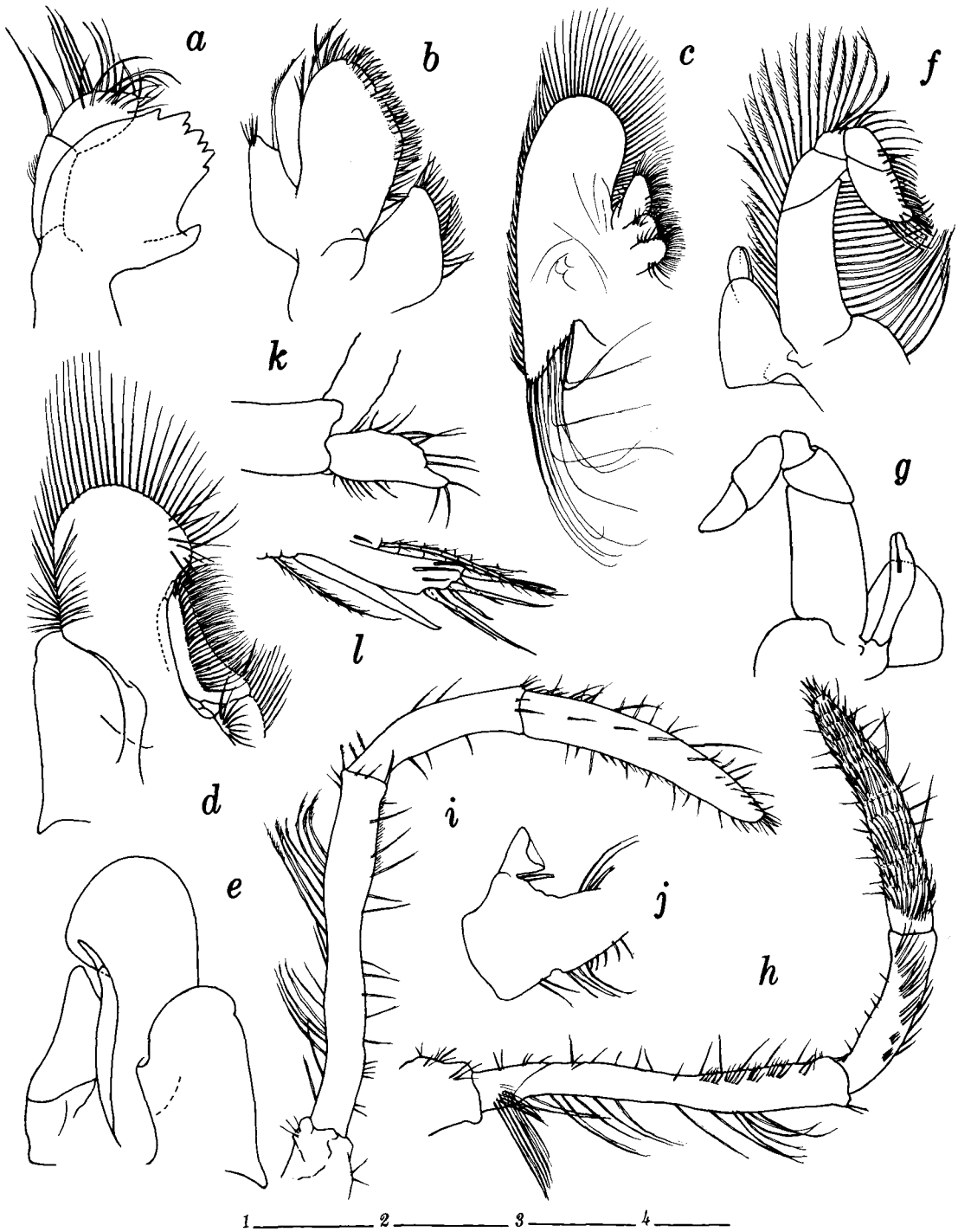

FIGURE 6.—*Alvinocaris stactophila*, allotype ♀: *a* mandible; *b* maxilla 1; *c* maxilla 2; maxilliped 1, *d* ventral, *e* dorsal; maxilliped 2, *f* ventral, *g* dorsal; maxilliped 3, *h* ventral, *i* dorsal, *j* exopod. Paratype ♂: *k* endopod of pleopod 1; *l* appendix masculina, pleopod 2. Scales: 1 (*d–g*, *k*) = 1 mm; 2 (*a*, *b*) = 0.5 mm; 3 (*l*) = 0.3 mm; 4 (*c*) = 1 mm.

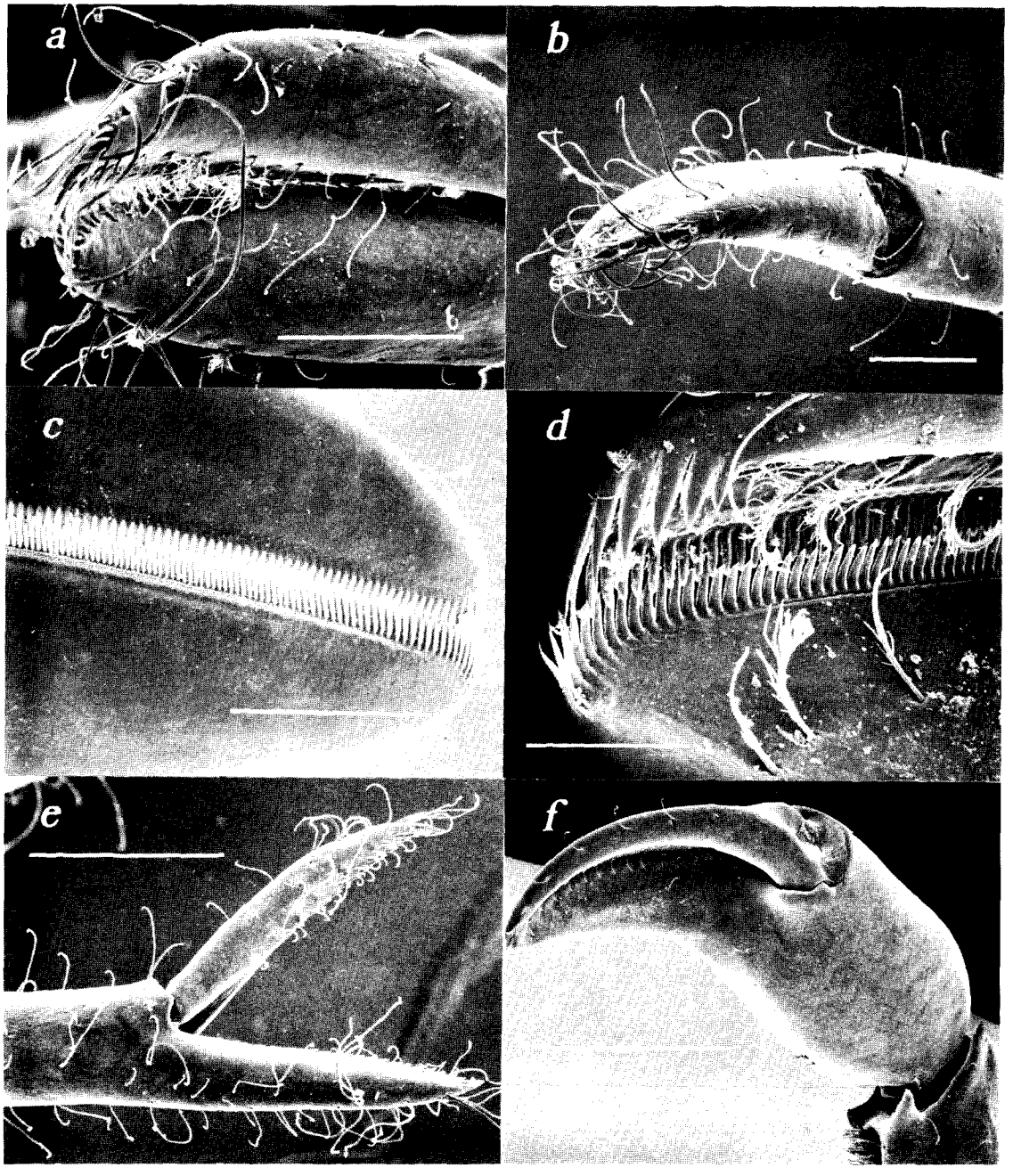

FIGURE 7.—Parts of *Alvinocaris* chelae viewed by SEM. *A. stactophila*: fingers of small chela, *a* mesial, *b* dorsal; fingers of large chela showing finely toothed opposed edges near tips, *c* mesial, teeth flush with convex surface, *d* lateral, teeth marginal on spooned tips, with points rounded on dactyl, acute on fixed finger. *A. muricola*: *e* fingers of small chela, lateral; *f* large chela and distal part of carpus, lateral. Scales: 100 μm, *d*; 200 μm, *a–c*; 500 μm, *e*; 1 mm, *f*.

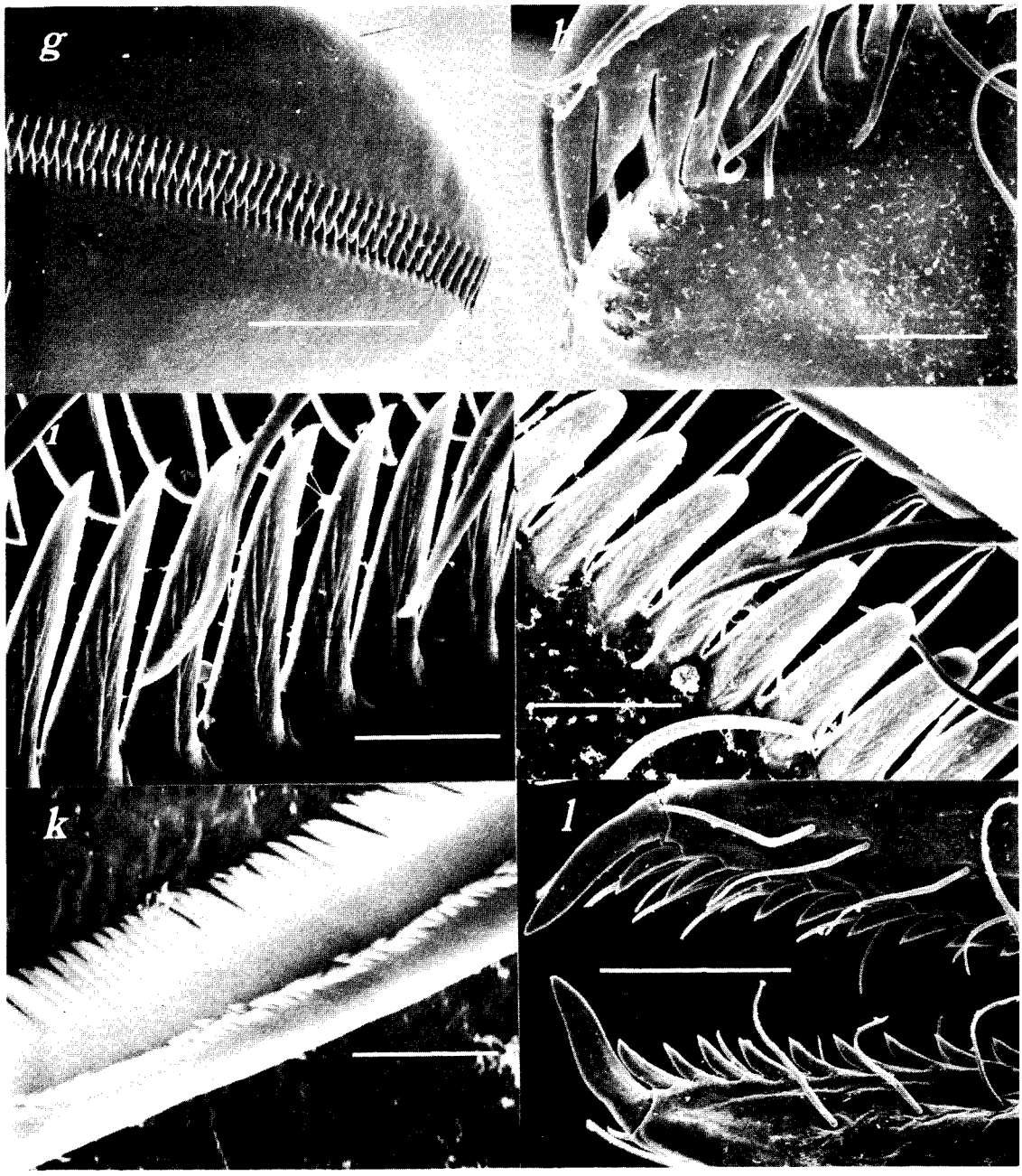

FIGURE 7.—*Continued.—Alvinocaris muricola*: fingers of large chela showing finely toothed opposed edges near tips, *g* teeth flush with convex mesial surface, *h* spooned lateral surface of same, points rounded on dactyl, acute on fixed finger; close-up lateral view of teeth and associated sensory setae, teeth of fixed finger in foreground and of dactyl in background, *i* near distal end of fingers, *j* near midlength of fingers; *k* sensory seta showing 2 rows of sensillae on concave surface. *A. markensis*: *l* fingers of small chela, mesial view of distal part. Scales: 3 μm, *k*; 20 μm, *i*; 30 μm, *j*; 50 μm, *h*; 100 μm, *l*; 200 μm, *g*.

Second pereopod (Figs. 5*h*; 7*a*, *b*) shorter and more slender than first, reaching to between midlength and end of antennal peduncle; fingers slightly longer than palm, similar in size and shape, opposed edges without gape, each pectinate with single row of teeth in distal half directed obliquely distad and increasing slightly in size to end in noticeably stronger tooth crossing opposite member when closed, but spineless proximally; carpus slender, about 1.2 longer than chela; merus and ischium unarmed.

Third to fifth pereopods (Fig. 5*i*, *j*, *k*) similar in length and structure, third reaching beyond antennal scale by about 0.3 length of propodus. Length articles of these legs in allotype ♀, mm:

	ischio-merus	*carpus*	*propodus*	*dactyl*
3rd	4.48	2.30	3.20	0.48
4th	4.89	2.18	3.39	0.48
5th	4.16	2.24	4.22	0.48

Each short dactyl armed with about 6 corneous spines on flexor surface, grading from small proximally to longest and strongest distally; carpus of each with distodorsal extension projecting as a stop along proximal part of propodal extensor surface; third leg stronger, at least in merus-ischium, than fourth and fifth; merus of third and fourth with ventral spine at 1/3 and 2/3 length, distal one strongest, fifth without spines; ischium of third with 2 spines in line with those on merus, that of fourth and fifth spineless.

Pleopods well developed, pair 1 with endopods about half length of expods in both sexes, endopod of male (Fig. 6*j*) with asymmetrical mesial extension, that of female tapering to acute tip; pair 2 with appendix masculina of male (Fig. 6*k*) bearing distal cluster of about 9 strong straight spinules extending beyond level of simple slender appendix interna.

Uropod (Fig. 5*e*) with rami subequal in length, slightly exceeding distal end of telson, lateral ramus with movable spine mesial to smaller distolateral tooth, diaeresis sinuous.

Etymology.—The name is from the Greek "stactos", oozing out or trickling, and "philos", to love, for association of the species with hydrocarbons seeping from the substrate.

Remarks.—*Alvinocaris lusca* and the three new species of *Alvinocaris* described here exhibit minor differences that are highlighted in the key to species given above, but their similarities seem far more significant; i.e., general body appearance and strength of integument, shape of rostrum (although that of *A. stactophila* sometimes lacks ventral teeth), shape and general armature of tail fan, blindness, and general structure of appendages, including mouthparts. Some minor differences that may be mentioned are features such as number of incisor teeth on the mandible, number of spines on the first maxilla, shape of the second maxilla, lack of meral spines on pereopod 5 in *A. stactophila*, unequal distribution of spines on ischia of pereopods 3–5 in the three species, and shape of the endopod of male pleopod 1 and appendix masculina (though males of *A. markensis* are not yet known).

Each of these species lives in a distinctive benthic environment, but all share similarities that suggest dependence on a chemotrophic bacteria-based food chain (Childress et al. 1986). Van Dover et al. (in press) provide evidence from morphology, behavioral and gut content analyses of the similar *Rimicaris exoculata* Williams and Rona that indicates a bacterial diet grazed from surfaces of hydrothermal chimneys, although direct observations of bacteria within the digestive tract could not confirm this. The distinctively spoon-shaped chelae of the first pereopods of both *Alvinocaris* and *Rimicaris* species, with unbroken comb of exceedingly fine teeth on the prehensile edges, could be an adaptation for scooping or sweeping bacteria toward the mouthparts. Williams and Chace (1982) described the first chelae of *A. lusca* as convex on the extensor surface and concave on the flexor surface, but they also said (p. 142) that the outer surface of the fingers is convex and the inner surface concave. The latter is misleading because in full extension the convex side of the chela is mesial and the concave side lateral. It is not yet known how these appendages are used, but certainly the chelae can be folded compactly against the leg's proximal articles, and in the related *Rimicaris exoculata* and *R. chacei* (Williams and Rona 1986) these legs seem very mobile. Sensillae flanking prehensile surfaces of the fingers seem well adapted to aid feeding on finely particulate matter. Moreover, the species of *Rimicaris* have exceedingly setose mouthparts.

In species of both genera, the second pair of pereopods have much smaller chelae with fingers bearing long sensory setae and spines on the prehensile edges that are seemingly adapted for

grasping. For mobile animals of this morphological makeup, the most likely feeding methods in the stated environments would seem to be bacterial concentration, along with secondary predation and scavenging.

ANOMURA: GALATHEIDAE

Munidopsis alvisca new species

Figure 8

Material.—USNM 234294, ♀ Holotype, USNM 234301, ♀ Paratype, Guaymas Basin, Golfo de California, 27°00′N, 111°25′W, 2,008 m, *Alvin* Dive 1616, 8 August 1985, pilots J. Hardiman and R. Wilkes, observer J. F. Grassle. From J. F. Grassle, Woods Hole Oceanographic Institution, Woods Hole, MA.

USNM 234295, ♂ Paratype, Explorer Ridge, Magic Mountain, 49°45.6′N, 130°16.16′W, 1,818 m, *Pisces IV* Dive P-1494, Coll. No. 1877, Gulati Gusher-base, 1 July 1984, pilots-observers, Witcombe, Johnson, Tunnicliffe. USNM 234296, ♀ ovig. Paratype, Explorer Ridge, Upper Magic Mountain, 49°45.5′N, 130°16.1′W, 1,812 m, *Pisces IV* Dive P-1497, Coll. No. 1873, Lunch Hour Vent, 4 July 1984, pilots-observers, Shepherd, Juniper, Johnson. USNM 234297, ♀ ovig. Paratype, same, Coll. No. 1875, Crab Vent. USNM 234298, ♀ ovig. Paratype, same, Coll. No. 1875. USNM 234299, 2 ♀ ovig. Paratypes, Juan de Fuca Ridge, Limbo Vent (= 3 m from Holland's Hillock Axial Seamount), 45°55′N, 130°03′W, 1,545 m, *Pisces IV* Dive P-1732, Coll. No. 1934, 2 August 1986, pilots-observers, K. Shepherd, R. Embley, J. Franklin. From Verena Tunnicliffe, Biology Department, University of Victoria, B.C., Canada.

Measurements in mm.—Holotype ♀, carapace length including rostrum 23.7, margin of orbit to posterior edge of carapace 18.6, maximum carapace width 15.7; Paratype ♀ 234301, same, 27.9, 20.8, 17.3; Paratype ♂ 234295, same, 13.8, 10.2, 8.4.

Description.—Carapace (Fig. 8*a*, *c*) exclusive of rostrum distinctly longer than broad, moderately arched transversely; anterior and posterior cervical grooves apparent, depression in anterior part of cardiac region; short moderately developed rugosities on each anterior branchial region, but more distinct and transversely developed rugae on each posterior branchial region, with tendency to being continuous across anterior and central part of cardiac region; posterior margin with median concavity. Rostrum narrowly triangular, concave dorsal surface smoothly curving to upturned tip exceeding eyestalks by more than twice their length, distinct carina bearing almost imperceptible scalelike rugae diminishing to obsolescence on gastric region. Frontal margin with broad angle lateral to eyestalk followed by concave raised and sparsely ornamented margin ending in antennal spine followed in turn by almost rectangular but acute anterolateral angle. Lateral plate obliquely rugose, projecting anteriorly below antennal peduncle, its rather angular tip minutely but bluntly bispinose.

Abdomen (Fig. 8*b*) unarmed; transverse ridge of segments 2 and 3 smooth, that of segment 4 obsolescent; segments 5 and 6 smooth.

Eyes (Fig. 8*a*, *c*) moderate in size; well exposed, smoothly ovate cornea cupped within broad based movable ocular peduncle extended into elongate mesiodorsal spine, directed obliquely upward at low angle and ornamented with tiny irregular obsolescent spinules, and much shorter mesioventral spine.

Basal article of antennular peduncle with distal margin irregularly crenulate, slender dorsolateral spine and broader lateral spine flanked by cluster of irregular small spinules, an obsolescent mesiodorsal spine present. Antennal peduncle with fixed basal article extended into stout, flat ventral spine and shorter crenulate lateral spine; succeeding articles short, second bearing stout lateral angle, third unarmed, fourth with scalloped distal margin, its dorsomesial projection spinelike.

Third maxilliped (Fig. 8*e*) with ischium shorter than merus, bearing mesial crest armed with finely uniform, evenly spaced corneous teeth. Basis with 2 low spines in line with crest on ischium. Merus with obsolescent spine at posteromesial corner, mesial margin usually with another at level of propodo-carpal joint, followed after an interval by an obscure tubercle, and then by a more prominent spine at base of convex distal margin; stronger spine at anterolateral corner; lateral margin broadly arched. Carpus, propodus, and dactyl folded on merus-ischium and about as long as those two articles together, dense setation on dorsal surface of each, and distally on prehensile surface of propodus and dactyl. Sternite (Fig. 8*d*) at base of third maxil-

liped with convex crenulate anterior margin on mesial lobe, lateral lobe angular.

Epipods absent from pereopods.

Chelipeds (Fig. 8*f*) subequal, ornamented with variably ciliate rugosities tending to arrangement in longitudinal tracts; ischium with mesial ridge bearing subterminal spine and obsolescent irregular subsidiary spines; merus rough, bearing 3 mesial spines, 1 distodorsal spine, and a smaller distoventral spine; carpus with 2 spines in dorsolateral row paralleled by less prominent ventrolateral row; palm with spines on prominent

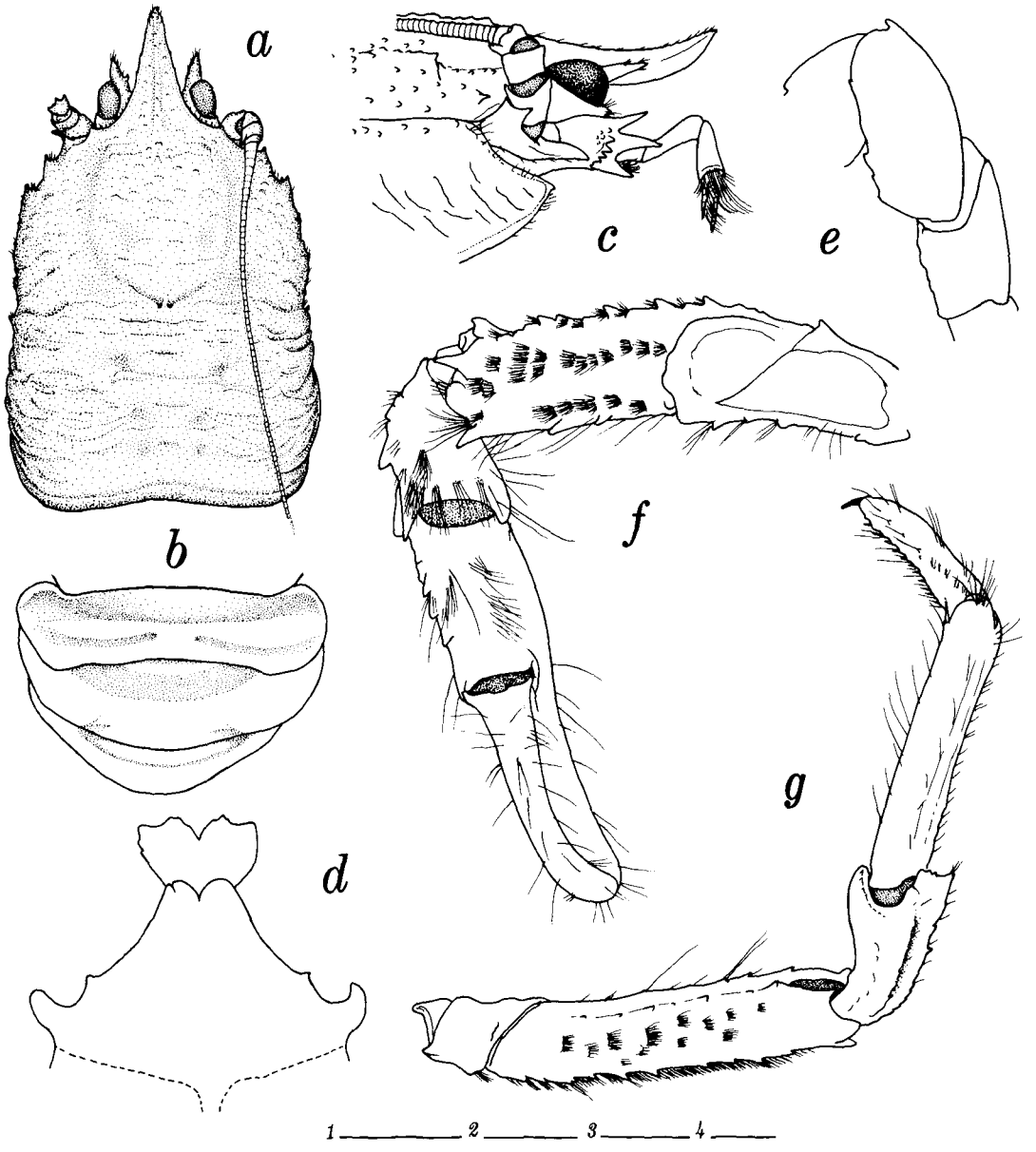

FIGURE 8.—*Munidopsis alvisca*, holotype ♀: *a* carapace, eyes and right antenna, dorsal; *b* abdomen, somites 2–4 in folded position; *c* part of cephalothorax and anterior appendages, lateral; *d* sternites at base of third maxilliped and chelipeds; *e* left third maxilliped, merus and ischium; *g* left second pereopod. Paratype ♀ 234301: *f* right cheliped. Scales: 1 (*a*, *b*) = 5 mm; 2 (*c*) = 5 mm; 3 (*f*, *g*) = 3 mm; 4 (*d*, *e*) = 1 mm.

dorsal ridge, stronger on right than on left; fingers longer than palm, spooned at tips, prehensile edges close fitting, entire, but small basal tooth of fixed finger opposed by notch in prehensile edge of dactyl.

Walking legs rather long, first walking leg (Fig. 8*g*) reaching almost to tip of chela, second and third reaching about to base of dactyl on preceding leg; corresponding articles of respective legs approximately equal in length except for meri which decrease posteriorly; each merus with rounded, rugose dorsal crest ending in distal spine; each carpus with longitudinal dorsal and dorsolateral rib ending in more or less well-developed spine, and often with secondary spine(s) on distal margin between them; each propodus slender, bearing small movable spine distolaterally at base of dactyl; each dactyl slender, acute corneous tip preceded by row of 12 or more movable spines on prehensile edge. Slender fifth leg with well-developed cleaning brush on more or less flattened dactyl opposed by similar setae on distal end of propodus.

Variation.—There is minor variation in ornamentation of the specimens available for study, but none of it is associated with the disjunct distribution in the Golfo de California and the northeastern Pacific.

Remarks.—The specimens reported here were taken around hydrothermal vent sites discussed by Canadian American Seamount Expedition (1985), ASHES Expedition (1986), and Tunnicliffe et al. (1985, 1986). *Munidopsis* has been sighted at three other sites along Juan de Fuca Ridge, but the only specimens collected are those listed above (V. Tunnicliffe[2]).

Comparisons of *Munidopsis alvisca* with previously described species of the genus are aided by reference to A. Milne Edwards (1880), Milne Edwards and Bouvier (1897), Chace (1942), Sivertsen and Holthuis (1956), and Ambler (1980). Lack of epipods on the pereopods immediately separates *M. alvisca* from species such as *M. crassa* Smith, 1885 and *M. subsquamosa* Henderson, 1885 which it superficially resembles. Both of the latter species have relatively prominent rugae and spines on the cephalothorax and legs whereas *M. alvisca* has fairly smooth ornamentation on these body parts, except for minor development of spines on the lateral carapace margin anteriorly. The rostrum of all of these species is narrowly triangular, curves moderately upward to the tip and bears a middorsal carina, but the carina in *M. alvisca* bears almost imperceptible scalelike rugae and diminishes to obsolescence on the gastric region whereas in both *M. crassa* and *M. subsquamosa* the carina is varyingly rugose, rather strongly so in the former, and maintains this ornamentation onto the gastric region. Moreover, *M. crassa* bears tiny irregular marginal spines on the rostrum.

Spination of the merus of the third maxilliped is far weaker in *M. alvisca* than in the other two species discussed, and both the anterolateral spine of the ischium and the crenulate margin of the crest on the ischium are less developed than in them. On the other hand, *M. alvisca* possesses both mesiodorsal and mesioventral eye spines whereas *M. subsquamosa* and *M. crassa* lack the mesioventral spine.

More distant comparisons seem inappropriate because of different body proportions and ornamentation, rostral width, length, elevation and spination, and structure of the eye and third maxilliped. The keys for identification by both Chace (1942) and Pequegnat and Pequegnat (1970), for example, though strictly applicable to species of the Atlantic basin, would ally *M. alvisca* with *M. aries* (A. Milne Edwards, 1880), a much larger species with broader cephalothorax and rostrum, eyes almost hidden from dorsal view, and with less transverse ornamentation. The revised version of this key by Pequegnat and Pequegnat (1971) would place *M. alvisca* in the couplet space occupied by *M. sundi* Sivertsen and Holthuis, 1956, a species with superficially similar shaped cephalothorax, but densely clothed with short setae.

Etymology.—The name is an acronym taken from names of the deep submersible vessels used in collecting the species, *Alvin* and *Pisces IV*.

BRACHYURA: BYTHOGRAEIDAE

Bythograea mesatlantica new species

Figures 9, 10

Material.—USNM 234300, Holotype ♀, Mid-Atlantic Rift Valley about 70 km south of Kane

[2]Verena Tunnicliffe, Department of Biology, University of Victoria, P.O. Box 1700, Victor, B.C., Canada V8W 2R2, pers. commun. 1987.

Fracture Zone (see: Kong et al. [1985]; Leg 106 Shipboard Scientific Party [1986]; Ocean Drilling Program Leg 106 Scientific Party [1986]), 23°22.09'N, 44°57.12'W, 3,437 m, *Alvin* Dive 1683, MARK vent, Stn. 1, scoop, 30 May 1986, pilot D. Foster, observers S. Humphris and J. Edmond. From NSF-Leg 106-Ocean Drilling Program, NSF Grant OEC-8311201 to J. F. Grassle, Woods Hole Oceanographic Institution, Woods Hole, MA.

Measurements in mm.—

Carapace		
Length	13.8	
Width	23.3	
Depth of cephalothorax	8.1	
Frontoorbital width	7.7	
Propodus lower margin	R 15.5	L 15.2
Dactyl length	8.3	8.3
Palm		
Height	7.9	7.8
Thickness	4.9	5.1

Description.—General aspect similar to that of *B. thermydron*, cancroid, depressed. Carapace (Figs. 9, 10*d*) broad, transversely elliptical, its rounded lateral angles displaced somewhat anteriorly; almost flat in middle dorsally, very slightly arched from anterior to posterior and near lateral margins; anterolateral region produced, margin not toothed; surface finely granulate anteriorly and laterally, smooth but minutely punctate to unaided eye over posterior 2/3 to 3/4; regions indistinct. Frontoorbital width ca 1/3 carapace width.

Front almost evenly rounded and somewhat deflexed, projecting over folded antennules, shallow median depression continued onto protogastric region giving faint suggestion of bilobation; margin beaded with line of fairly uniform granules, closely packed on anterior and anterolateral parts but diminishing almost to obsolescence near orbits. Arcuate tract of scattered punctations sweeping across anterolateral, hepatic, orbital, protogastric, and metagastric regions. Transverse tract of rather prominent granules at rear edge of protogastric region. Carapace with smooth part behind these anterior areas microscopically granular and punctate anteriorly, grading posteriorly into almost featureless sur-

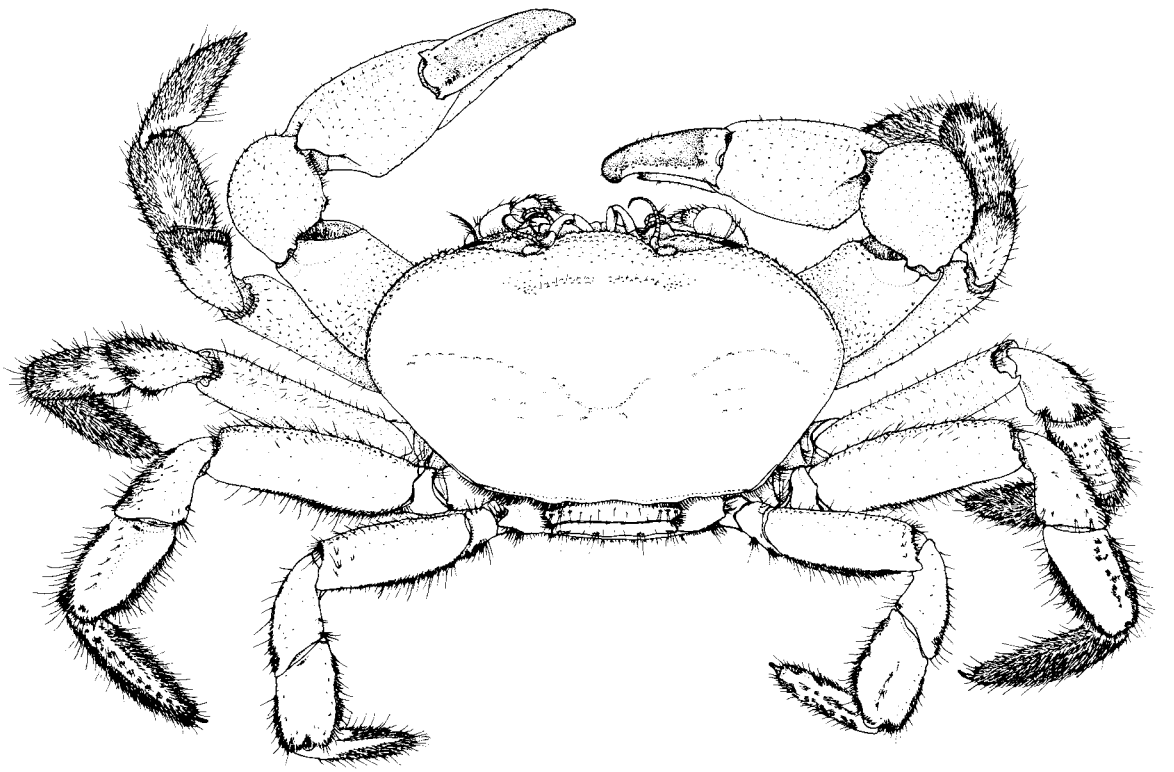

FIGURE 9.—*Bythograea mesatlantica*, holotype ♀: dorsal. Scale = 3 mm.

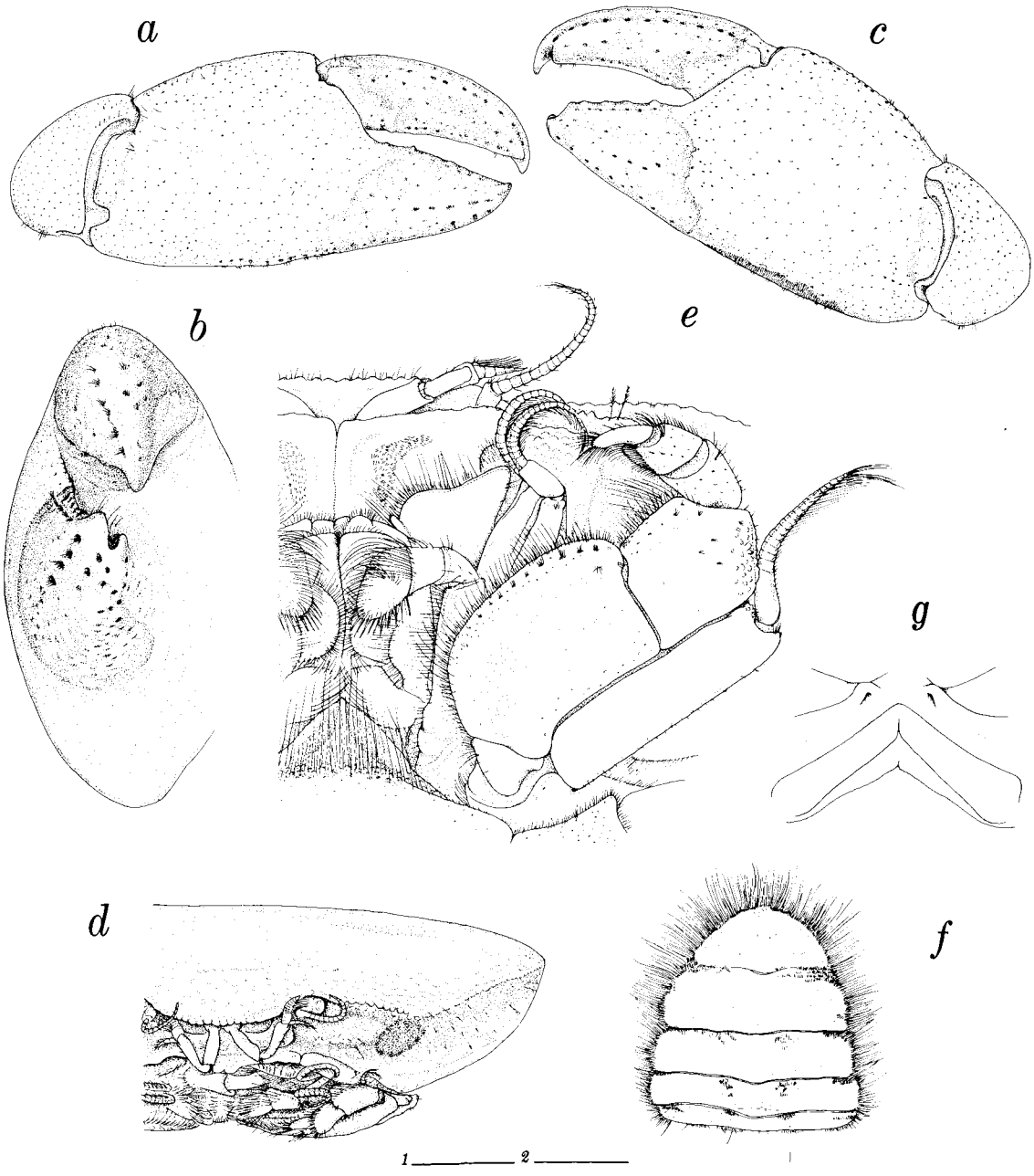

FIGURE 10.—*Bythograea mesatlantica*, holotype ♀: right chela, *a* frontal view, *b* fingers viewed from tips; *c* left chela, frontal view; *d* left side of cephalothorax in frontal view showing anterolateral pigmented spot, eye, antennules, antennae, and mouthparts in situ; *e* mouth field showing third maxilliped turned to side, second maxilliped, first maxilliped with lacinia bearing tiny "portunid lobe" at its mesial corner, partly hidden mandibles, and palate with patch of fine setae to either side of midline; *f* abdomen showing somites 3–6 and telson; *g* oviducal openings and parts of associated sternites. Scales: 1 (*a–d*, *f–g*) = 2 mm; 2 (*e*) = 1 mm.

face. Protogastric, mesogastric, metagastric, and cardiac regions poorly indicated; epibranchial line indicated by small, light colored blotches originating posterior to lateral angle at each side and arching anteromesially over branchial region, then posteromesially toward mesogastric region. Posterior margin concave and paralleled by obsolescent postmarginal groove becoming more pronounced along posterolateral margin.

Subhepatic and subbranchial areas ornamented with small granules, coarsest along upper part of hepatic region but becoming finer and more numerous near base of chelipeds.

Orbits sunk into essentially smooth transverse concavity in anterolateral region confluent laterally at either side with a prominent irregularly oval tan colored spot having very finely granulate, shallowly concave surface; somewhat inflated and irregularly granular suborbital area almost fully visible in dorsal view, reaching level of front, tilted anteroventrally from frontal plane lateral to and almost at same level as epistome.

Eyestalks projecting anterolaterad, barely movable, depressed and broadened to fit snugly in orbit; unpigmented cornea terminal, subcircular, narrower than eyestalk and anterolaterally oriented.

Epistome (Fig. 10*e*) projecting well beyond front, its anterior margin cut into 6 unequal lobes; rather narrow and advanced submedian lobes, separated by narrow deep notch, much broader intermediate lobes and somewhat less broadened lateral lobes less advanced.

Antennules folding transversely, stouter than antennae, large bulbous basal articles contiguous, concealed beneath front, interantennular septum represented by minute remnant at upper and lower edge of antennular fossa; slender penultimate and terminal articles of peduncle nearly equal in length, former slightly hollowed laterally, latter slightly longer and more slender. Flagella short; mesial 7-segmented ramus slender; slightly shorter lateral ramus curved, multisegmented, thick at base but tapering to point, dense mesial brush of long sensory setae in chord of curve.

Antennal insertion mesial to eyestalk; peduncle mesial to eyestalk, extending anteriorly or anterolaterally in situ; fixed article broad but short; first free article slender, ca 1.7 length of second article; latter broadened distally; terminal article short, its diameter only slightly greater than that of flagellar base; flagellar length exceeding midline of front.

Mouth field (Fig. 10*e*) divergent anteriorly, sides of its frame broadest posteriorly and somewhat swollen and granular at anterolateral corners, maximal inside anterior width about 1.4 minimal inside posterior width. Third maxillipeds filling mouth field except for narrow gap of nearly uniform width between ischia of endognaths and rather irregular gap anteriorly between meri-carpi of endognaths and epistome; exognaths overlapping sides of mouth frame. Endognaths with exposed surface bearing sparse, sometimes linear, setose punctations; exposed surface of ischium nearly smooth; elongate polygonal in outline but primarily rectangular, greatest (distal) width 1.1 narrowed part ca 1/2 length from base; mesial margin straight through most of its length but curved at each end, toothless, bearing many stiff straight setae, submarginal zone somewhat thickened and flanked laterally by shallow longitudinal groove; anterior margin nearly perpendicular to mesial margin except for anteriorly projecting truncate lobe at inner corner; lateral margin concave; posteromesial margin obliquely convex; basi-ischial suture line visible posterolaterally. Merus slightly narrower than ischium; low granules with tips directed anteromesially along distal margin; irregularly quadrate perimeter flanked by submarginal thickened zone and groove similar to mesial counterpart on ischium except on straight proximal side, anterolateral angle broadly rounded, anteromesial angle at insertion of palp oblique; mesial margin doubled anteriorly for reception of folded palp, its ventral (exposed) side broadly angled proximal to carpopropodal articulation; posteromesial corner fitted to projecting lobe of ischium, dorsal (hidden) side produced behind carpus, its margin setose. Palp large, dactyl reaching posteriorly about 1/4 length mesial margin of ischium. Carpus expanded distally, narrowed proximally, bent nearly at right angle near insertion and obscurely crimped inside angle; dense tuft of setae on distooral surface. Propodus wider than carpus, longer than broad, asymmetrically ovate in ventral view; distal (longest) margin convex, densely beset with rows of strong serrated setae, longest distally; distal tuft of such setae on dorsal surface. Linear dactyl slightly bent away from midline in distal part and setose as propodus, especially on prehensile edge. Exognath narrow, not extending to full length of merus; ventral surface slightly curved mesially to fit closely against lateral side of endognathal ischium, with dorsomesial flange (widest distally)

fitting beneath latter; palp conspicuous, flagellum densely beset with setae in hollow of curve.

First maxilliped with lacinia of endopod broad, its distal edge 3-lobed and conspicuously though not heavily setose; oblique mesial margin of strongly advanced anterolateral lobe confluent with broader gradually rounded and much less advanced intermediate lobe, latter in turn followed by still less advanced tiny mesial lobe, separated by a notch and directed anteromesially; tuft of setae preceding notch.

Endostome large, divided by low median sagittal ridge bifurcated somewhat anteriorly and merging into projecting endostome; each half of palate shallowly concave, crossed by low longitudinal ridge slightly offset at its midlength and trending anteromesially from near base of large mandibular palp; ridge flanked laterally by irregular patch of velvety pubescence; smooth lateral 2/3 of palate receiving large efferent branchial channels.

Chelipeds (Figs. 9, 10*a*, *b*, *c*) heavy, subequal; integument punctuate on upper and extensor surfaces, obscure granulation on upper surfaces of palms and on ridges or raised areas elsewhere; chelae inflated, lower margin of palm arched downward, its rather pronounced keel merging into fixed finger; swollen palm with shallow excavation proximally for reception of carpus in flexed position, inner surface glabrous but drawn into moderate and slightly granular elevation slightly in front of proximal excavation. Fingers tan colored in preservation (70% ethanol) and darkest proximally, color of fixed finger not extending onto palm; fingers not gaping, prehensile edges entire except for obsolescent proximal tooth on fixed finger of each hand; dactyl longer than relatively straight fixed finger, arching down distally to close in distal notch of spooned tip of fixed finger.

Carpus with extensor surface inflated, right carpus with internal margin rounded, that of left obscurely angled. Merus broadened mesially into cristate flange angled distally for reception of carpus, strong granules in single line along inner margin, outer surface rounded, strewn with obsolescent punctations and granules, latter most prominent along distoventral tract.

Walking legs rather long, flattened, length decreasing posteriorly in order 3, 2, 1, 4; each with dense patches of short darkened setae interspersed with sparer longer setae on extensor surface of carpus and propodus (as well as its lateral side on legs 1 and 2), distoventral corner of carpus, and more extensively on dactyl; fifth legs somewhat more flattened than others, propodi relatively broader and not densely setose laterally. Mean maximum length of propodi about twice width. Dactyls slightly longer than propodi, narrowly lanceolate, shallow longitudinal grooves on anterior and posterior surfaces obscured by dense setae, tip stout, corneous. Merus of each with upper margin finely granular, anterior lower margin present throughout length but posterior lower margin obsolescent proximally.

Sternum broadest between legs 1 and 2, narrower posteriorly, glabrous beyond outline of abdomen.

Abdomen (Fig. 10*f*) ovate in outline, fully segmented and densely fringed with plumose setae; somite 1 slightly arched dorsally to fit contour of adjacent carapace, somites 2–4 of about equal length, somites 5 and 6 progressively longer; abdomen with greatest width at 4; telson nearly as broad as somite 6, outline broadly arched distally. Somites 2–5 bearing large, well-developed biramous pleopods, outer curved branch lying near edge of abdomen and heavily beset with short setae laterally and mesially, inner branch more sparsely equipped with ovigerous setae and jointed.

Female openings (Fig. 10*g*) large, obscurely subtriangular in outline.

Color in preservation predominantly off-white except for fingers, matted setal tracts laden with brownish finely particulate matter.

Remarks.—Brachyuran crabs that resemble *Bythograea* were observed and reported by Rona et al. (1986).

Bythograea mesatlantica differs in several respects from Pacific members of the genus, *B. thermydron* Williams (1980) and *B. microps* de Saint Laurent (1984). Among obvious differences from *B. thermydron*, the new species has even less ornamentation on the carapace; it lacks a distinct suborbital plate separated by a suture, and the suborbital area is inflated, not flat and inclined; there is a transverse concavity lateral to each eyestalk that terminates near the very distinctive brown spot in the cuticle at either side of the carapace; the eyestalk itself is shorter and thicker than in *B. thermydron* and the shape and position of the cornea differs. The ischium of the third maxilliped is relatively shorter than in *B. thermydron* and bears only sparse setiferous punctations on the external surface, it lacks tiny granules on the truncate lobe at the anterolateral

corner, the submarginal thickened zone and groove are less distinct; the merus is not tilted dorsally in normal position, and the palp is relatively shorter and club shaped rather than curved like a knife edge along the prehensile edge. The lacinia of the first maxilliped is more angular anterolaterally and has a smaller "portunid lobe". The epistome is less lobulate than in *B. thermydron* and the concave palatal area has much less setose covering. The nearly toothless chelae have brown fingers and there is no dense patch of setae on the inner side of the palms.

Comparisons with *B. microps* are necessarily less complete because of the brief description of the latter. The eyes are certainly not slender and retracted in *B. mesatlantica*; the chelipeds are not noticeably dimorphic, and they are relatively smooth rather than strongly granular and pilose on the external surface as in *B. microps*.

The distinctive exocular spots on the carapace seem similar to those noted on the chelipeds of *Hypsophrys noar* Williams (1974, 1976) and *Munidopsis lentigo* (Williams and Van Dover 1983). Their function is unknown.

Etymology.—From the Greek "mesos", middle and "Atlantic", with reference to the Mid-Atlantic Rift habitat.

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