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ON THE STATUS OF *PAGURUS MERTENSII* BRANDT, WITH DESCRIPTIONS OF A  
NEW GENUS AND TWO NEW SPECIES FROM CALIFORNIA  
(CRUSTACEA: DECAPODA: PAGURIDAE)

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ABSTRACT: The discovery of a hermit crab identifiable with *Pagurus mertensii* Brandt [*sensu stricto*] has precipitated a review of the status of this species and its relationship to *Parapagurus mertensii* Holmes. As a result, *Pagurus mertensii* Brandt is reinstated as a distinct species and a new genus is established for the species assigned, by Holmes, to *Parapagurus* and for an additional new species from California.

Brandt (1851) described *Pagurus mertensii*, relating it to the North American species, *Pagurus splendescens* Owen. In his brief description, Brandt merely listed those characters which would distinguish *P. mertensii* from the latter species. Although the type locality was indicated by Brandt as Kamchatka, he also reported this species from California and Alaska.

Benedict (1892) placed *P. mertensii*, without description, in his subgenus *Labidochirus*, thus relating it, as Brandt had done, to *P. splendescens*. Presumably, his action was based on his misidentification of specimens from the California collections of the "Albatross" as *Eupagurus mertensii* (Brandt). Subsequently, Holmes (1900) examined a female specimen of Benedict's alleged *E. mertensii*, interpreted its gill structure to be trichobranchiate, and transferred the species to the genus *Parapagurus*.

Makarov (1938, 1962), after examining the collections of the Zoological Institute of the Academy of Sciences (USSR), including the remaining specimens of Brandt's original material, concluded that *Pagurus mertensii* [*sensu* Brandt] was synonymous with *Pagurus hirsutiunculus* (Dana). Because of the obvious distinction between *P. hirsutiunculus* and Holmes' species, Makarov accepted Holmes' assignment of the California species to the genus *Parapagurus*.

The recent discovery of a specimen identifiable with *Pagurus mertensii* Brandt [*sensu stricto*] and the reexamination of the "Albatross" collections

identified by Benedict as *Eupagurus mertensii* have shown not only that *Pagurus mertensii* Brandt *s.s.* is distinct from both *P. hirsutiunculus* (Dana) and *Parapagurus mertensii* Holmes, but that the latter species is incorrectly assigned to the genus *Parapagurus*. This conclusion regarding Holmes' species was also arrived at, independently, by de Saint Laurent (1972). This species, and a second new species from the collections of the Allan Hancock Foundation, represent a new genus of the Paguridae.

The institutions providing material for this study or which will serve as depositories for the collections are abbreviated in the text as follows: Allan Hancock Foundation (AHF); British Museum (BM); Muséum National d'Histoire Naturelle (MNHN); National Museum of Natural History, Smithsonian Institution (USNM); Rijksmuseum van Natuurlijke Historie (RMNH). The abbreviation, SL, refers to the shield length of the specimens; the symbols, ♀ and ♀♀, refer to nonovigerous and ovigerous females respectively.

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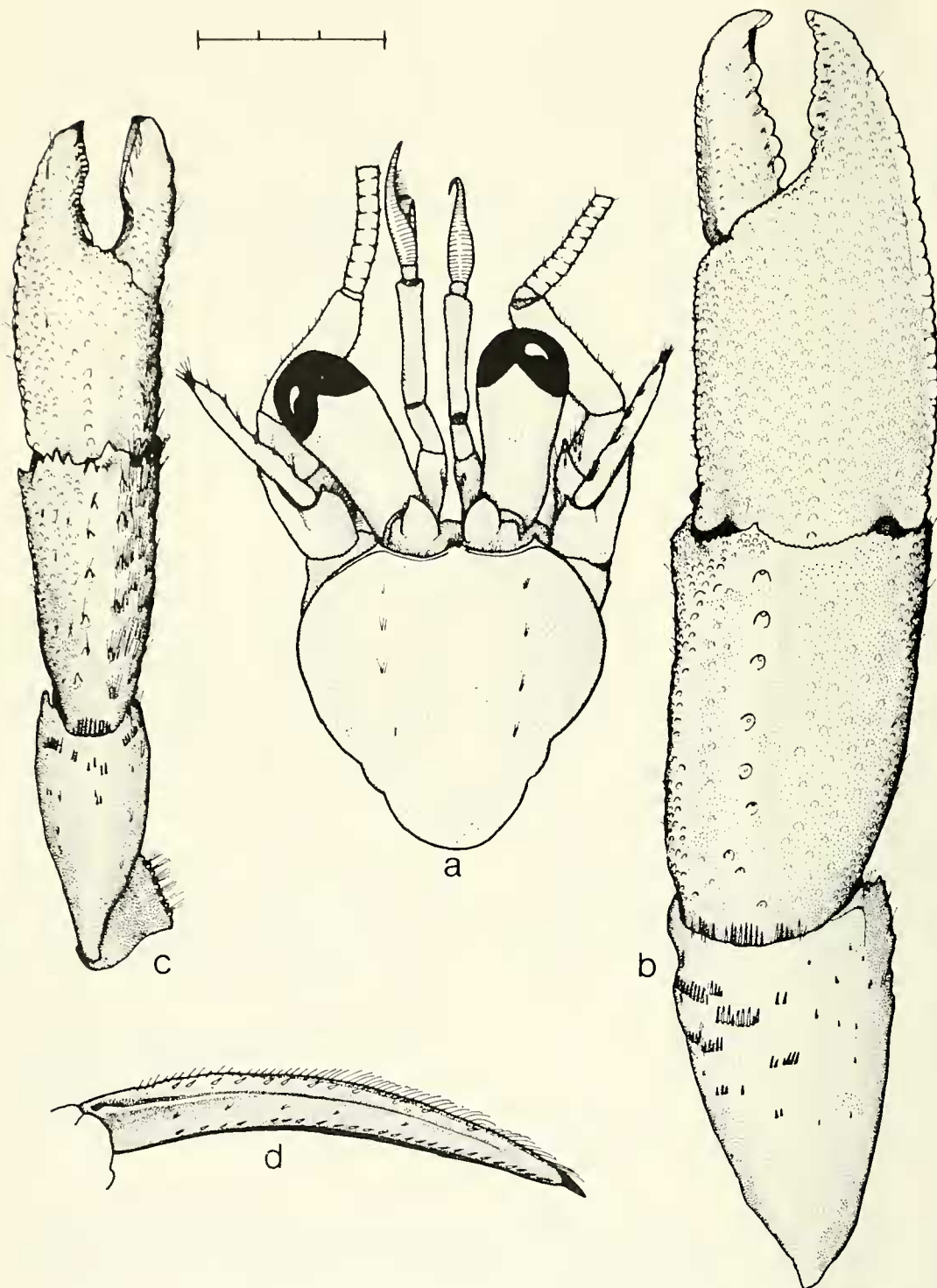


Figure 1. *Pagurus mertensii* Brandt s.s. ♂ (SL = 4.5 mm), from Pribilof Is.: a, shield; b, right cheliped (dorsal view); c, left cheliped (dorsal view); d, left P<sub>3</sub> dactyl (mesial view). Scale equals 3 mm (from McLaughlin, 1972).

## FAMILY PAGURIDAE

*Pagurus mertensii* Brandt [sensu stricto]

Figures 1-3

*Pagurus Mertensii* Brandt, 1851 [in part], p. 112  
[type locality (by implication): "Kamtschatka"].

*Eupagurus mertensii*: Doflein, 1900, p. 341.

*Parapagurus mertensii*: Alcock, 1905 [in part], p. 172.—Gordan, 1956 [in part], p. 338 (see discussion).

*Pagurus mertensii*: Williams, 1915, p. 477.

*Pagurus hirsutiuseculus*: Makarov, 1938 [in part], p. 181; 1962 [in part], p. 171 (see discussion).

not *Eupagurus Mertensii*: Stimpson, 1857, p. 483; 1858, p. 237 [= *Pagurus hirsutiuseculus hirsutiuseculus* (Dana, 1851)].

not *Eupagurus (Labidochirus) mertensii*: Benedict, 1892, p. 2 [by implication] [= *Parapagurodes makarovi* n. sp.].

not *Eupagurus mertensii*: Lenz, 1901, p. 444 [= *Pagurus hirsutiuseculus hirsutiuseculus* (Dana, 1851)].

not *Eupagurus mertensii*: Stimpson, 1907, p. 216 [= *Pagurus hirsutiuseculus hirsutiuseculus* (Dana, 1851)].

**DIAGNOSIS.**—Shield longer than broad; rostrum short, obtusely rounded; ocular peduncles short, stout, with corneae noticeably dilated. Right cheliped elongate, slender; chela with dorsal surface convex, granular; carpus with dorsal surface granular, midline with irregular row of small tubercles. Left cheliped elongate, slender; chela with dorsal surface convex, granular, with short row of tubercles in midline proximally. Ambulatory legs with dactyls moderately long, broad, strongly twisted. Fourth pereopods each with strong spine at dorsodistal margin of carpus. Males with coxae of fifth pereopods symmetrical, gonopores paired, no sexual tubes. Pleopods unpaired,  $pl_3$  to  $pl_5$  with exopodites well developed, endopodites rudimentary.

**MATERIAL EXAMINED.**—1 ♂ (SL = 4.5 mm), Saint Paul I., Alaska, 1897. B. A. Stevens collection, USNM 143006.

**DISTRIBUTION.**—Kamchatka (Brandt); Alaska, Pribilof Islands; depth unknown.

**DISCUSSION.**—As previously indicated, Brandt's (1851) description of *Pagurus mertensii* consisted only of those characters which would distinguish his species from Owen's (1839) *P. splendescens*. Although Brandt implied that Kamchatka was the type locality of *P. mertensii*, he included Alaska and California in its range, on the basis of specimens collected by Wosensenski. At that time Dana's (1851) work on the collections of the United States Exploring Expedition had not been published and Brandt was unaware of Dana's description of *P. hirsutiuseculus*,

a highly variable and superficially somewhat similar species. From the evidence presented by Makarov (1938, 1962) it would appear that Brandt confounded *P. mertensii* and *P. h. hirsutiuseculus*, and that his Kamchatkan specimen is no longer extant. In a study of northwestern North American pagurids, a specimen has been found which is clearly identifiable with *P. mertensii* s.s. A complete description of this species is given by McLaughlin (in press); it is here proposed that the name *Pagurus mertensii* Brandt be restricted to the species exemplified, in part, by Brandt's (1851, p. 112) description, and by the specimen herein diagnosed and illustrated. Reexamination of the "Albatross" California collections, including those identified by Benedict as *Eupagurus mertensii* (Brandt), while confirming Makarov's conclusion that Holmes' *Parapagurus mertensii* is distinct from Brandt's species, has shown that Holmes' species is incorrectly assigned to *Parapagurus* and is herein transferred to a new genus.

As may be seen from the synonymy of *Pagurus mertensii* s.s., and the exclusions therefrom, most records of this species should be referred to *P. h. hirsutiuseculus*. The records of Alcock (1905) and Gordan (1956) are merely citations from the literature and must be considered to include both *P. mertensii* s.s. and *P. h. hirsutiuseculus*, as well as *Parapagurodes makarovi* n. sp.

*Parapagurodes*, new genus

*Parapagurus*: Holmes, 1900 [in part], p. 155 [not *Parapagurus* Smith, 1879].

Type Species: *Parapagurodes makarovi*, new species (see p. 119). Gender: Masculine.

**DEFINITION.**—Eleven pairs of phyllobranchiate gills. Third maxilliped with basis-ischium fusion incomplete; ischium with crista dentata well developed, one accessory tooth; merus and carpus each with spine at dorsodistal margin. Maxillule with proximal endite tapered; endopodite with external lobe moderately well-developed, not recurved. Ocular peduncles short or moderately short, stout, with corneae dilated. Ocular acicles slender to moderately broad, triangular or subtriangular, terminal spine submarginal. Antennular peduncles with one or two short setae on dorsodistal surface of ultimate segment. Chelipeds unequal, right larger than left. Second and third pereopods with dactyls moderately elongate, slender, not strongly twisted. Fourth pereopods subchelate or not subchelate; dactyls usually with preungual process (cf. de Saint Laurent, 1970a) on lateral face; propodal rasp weakly or moderately well-developed. Males with coxae of fifth pereopods symmetrical, right with

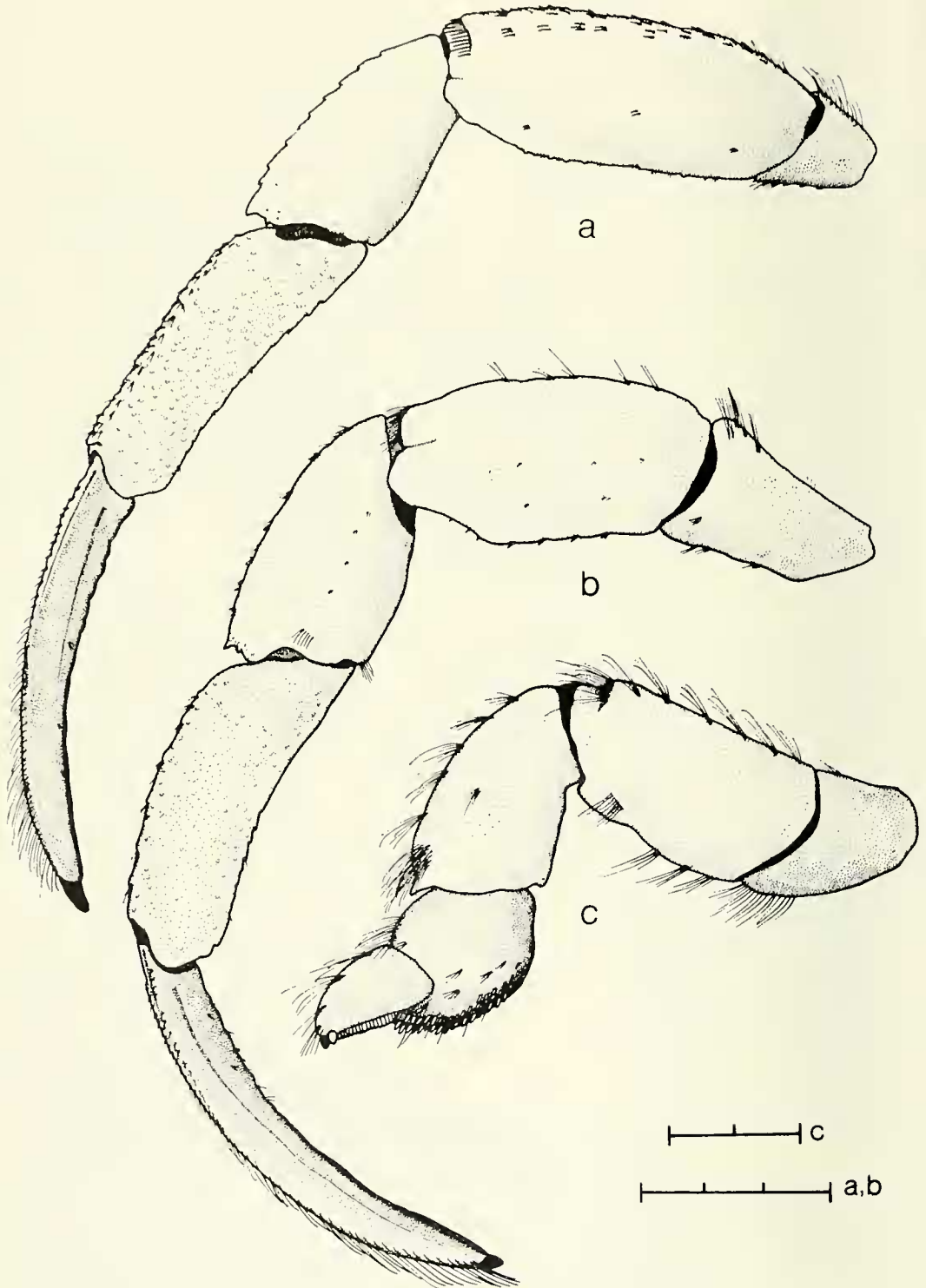


Figure 2. *Pagurus mertensii* Brandt s.s. ♂ (SL = 4.5 mm), from Pribilof Is.: a, left P<sub>2</sub> (lateral view); b, left P<sub>3</sub> (lateral view); c, left P<sub>4</sub> (lateral view). Scales equal 3 mm (a,b) and 1 mm (c) (from McLaughlin, 1972).

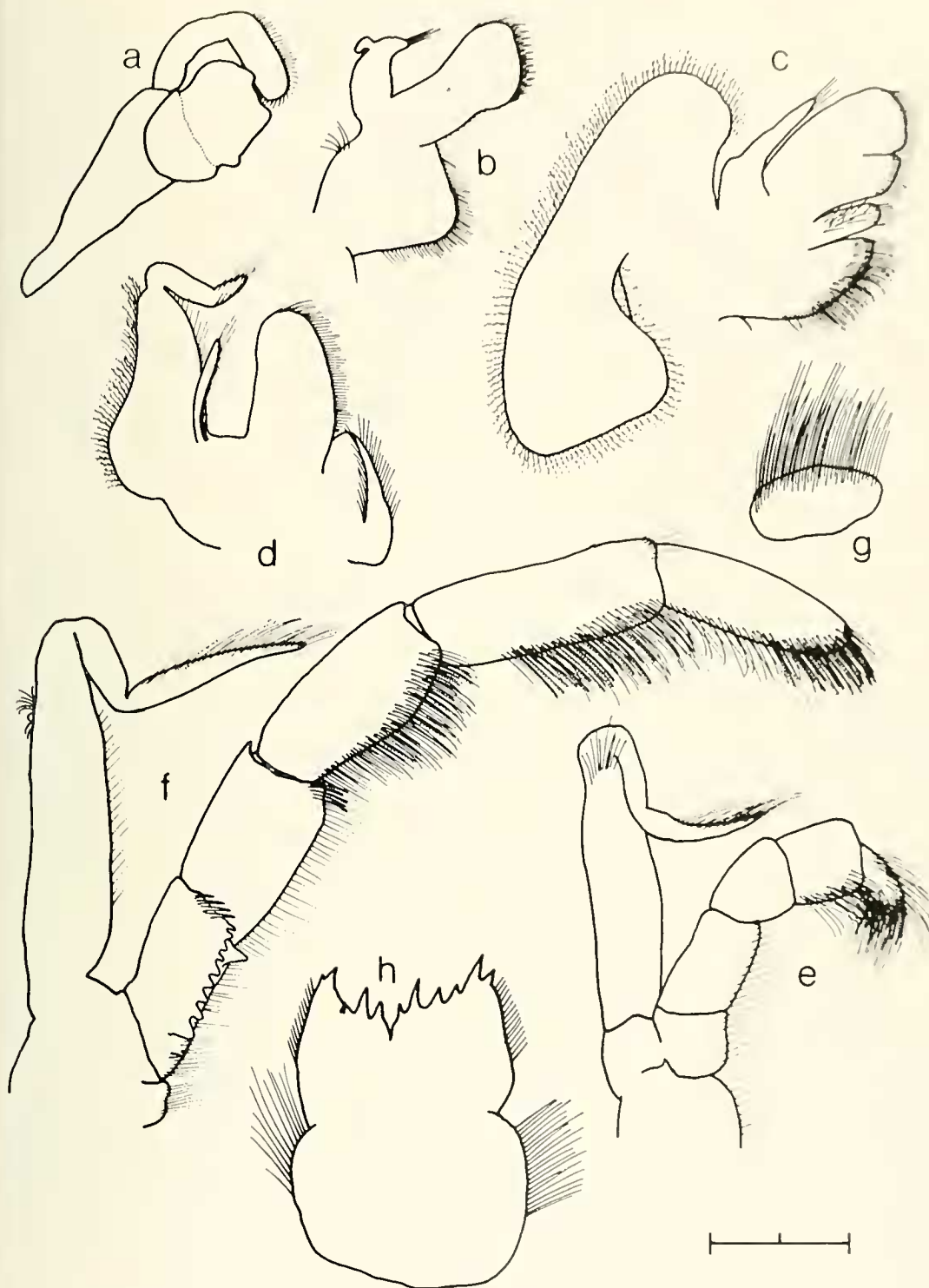


Figure 3. *Pagurus mertensii* Brandt s.s. ♂ (SL = 4.5 mm), from Pribilof Is., a-f, mouthparts (left, internal face): a, mandible; b, maxillule; c, maxilla; d, mxp; e, mxp; f, mxp; g, sternite P<sub>3</sub>; h, telson. Scale equals 1 mm (from McLaughlin, 1972).

TABLE 1. Comparative Diagnostic Characters of *Parapagurodes*, *Pagurodes*, and *Acanthopagurus*

Character	<i>Parapagurodes</i>	<i>Pagurodes</i>	<i>Acanthopagurus</i>
Branchial lamellae	phyllobranchiate	trichobranchiate	phyllobranchiate
Ocular acicles	moderately broad, triangular or subtriangular; terminal spine submarginal	narrowly triangular; terminal spine marginal or submarginal	moderately narrow, triangular; terminal spine marginal
Antennular peduncle, dorsodistal surface ultimate segment	naked or with 1 or 2 setae	row of stiff setae	row of stiff setae
Maxillule, external endopodal lobe	moderately well-developed, not recurved	vestigial or absent	moderately well-developed, not recurved
Sternite P <sub>1</sub> , anterior margin	unarmed	with few small spines	with few small spines
Coxae P <sub>3</sub> ♂	symmetrical	symmetrical	asymmetrical
Sexual tubes	right, short	right, moderately long	right, short
Pleopods ♂	absent or weakly developed	weakly developed	well-developed
Telson Posterior lobes	terminal margins straight or slightly concave, with small spines and spinules	terminal margins strongly oblique, with several strong spines	terminal margins somewhat oblique, with few small spines or spinules

short sexual tube; no paired pleopods, pleopods pl<sub>1</sub> to pl<sub>2</sub> biramous with rami weakly developed, or absent. Females with paired gonopores; no paired pleopods, biramous pleopods, pl<sub>2</sub> to pl<sub>4</sub> weakly or moderately well-developed, pl<sub>1</sub> weakly developed or absent. Uropods asymmetrical. Telson with terminal margins generally straight, slightly concave, or slightly oblique, with row of small spines or spinules. Sternite of third pereopods with anterior margin unarmed.

**AFFINITIES.**—*Parapagurodes* appears most closely related to the genera *Pagurodes* Henderson, 1888, as restricted by de Saint Laurent (1969) to the type species, *Pagurodes inarmatus* Henderson, and *Acanthopagurus* de Saint Laurent, 1968. Comparative studies of *Acanthopagurus* (de Saint Laurent, personal communication) and of two syntypes of *Pagurodes inarmatus* (BM) have shown that although these three genera share many characters of gross morphology in common, several diagnostic characters justify their distinctness (see Table 1). In addition, the prezoae of the two species of *Parapagurodes*, as determined from dissections of eggs nearing hatching, show that the larval development of this genus differs distinctly from that of *Acanthopagurus*, as described by de Saint Laurent (1969) for *Acanthopagurus dubius* (A. Milne-Edwards and

Bouvier). The condition of these prezoae was too poor to permit full descriptions of the stage; however, three distinctions between the larvae of the two genera can be made. The larvae of *Parapagurodes* lack the prominent posterolateral spines present on the carapace of *A. dubius*; the rostrum, at least in *P. makarovi*, is considerably longer than that of *A. dubius*; and the telsons of the two species of *Parapagurodes* (Figs. 4a, b) are distinctly different from that of *A. dubius* (cf. de Saint Laurent, 1969, fig. 18).

**VARIATIONS.**—Among the characters recommended for generic evaluations within the Paguridae (cf. de Saint Laurent-Dehancé, 1966; de Saint Laurent, 1970b), particular significance has been placed on the presence or absence of sexual tubes. In those genera possessing sexual tubes, either paired or unpaired, additional significance has been attached to the relative length of the tube, its orientation, *i.e.*, curved toward the interior or exterior, or directed anteriorly or posteriorly; and in those species having unpaired tubes, the occurrence of the tube on the right or the left coxa. In the two species of *Parapagurodes*, the males exhibited considerable variation, particularly in the orientation of the sexual tube. Although approximately one-half

of the specimens had sexual tubes on the right coxae which were oriented toward the exterior, the remainder had tubes oriented to the posterior, anterior, or interior. In a few instances the tubes were much shorter than would have been expected for mature animals, and in one instance (*P. makarovi*, Fig. 7c) a specimen was found to have paired sexual tubes, both oriented toward the exterior. There is little doubt that the possession of sexual tubes is of generic significance in the Paguridae; however, it must be pointed out that considerable variation does occur, both within species and within genera. Whether such observed variation is the result of normal variation within a population or is the result of artifacts of preservation has not yet been ascertained.

Variation in the number of unpaired pleopods in both males and females is also characteristic of *Parapagurodes*. Most frequently, males of *P. makarovi* lacked any vestige of pleopods; however, small males of this species often were observed with vestigial pleopods. Similarly, females of this species normally possessed weakly developed pleopods,  $pl_2$  to  $pl_4$ , with  $pl_5$  absent. Small specimens, however, occasionally had vestigial fifth pleopods. In contrast, males of *Parapagurodes laurentae* n. sp. normally were observed with biramous pleopods,  $pl_3$  to  $pl_5$ , weakly developed; only rarely were the pleopods absent. The females of this species usually had well developed, biramous pleopods,  $pl_2$  to  $pl_4$ , with  $pl_5$  reduced, as in the males; however, occasionally, specimens were observed with poorly developed pleopods,  $pl_2$  to  $pl_4$ , and with  $pl_5$  vestigial or absent. Both species had a relatively high percentage of specimens infected with an abdominal bopyrid parasite, *Stegophryxus* n. sp. (Markham, in press); however, no correlation between parasitic infestation and pleopod variation could be determined.

A third variable character of this genus is seen in the fourth pereopods. Typically, in *P. makarovi* the fourth pereopods are not subchelate, whereas in *P. laurentae* they are weakly subchelate; however, occasionally specimens of *P. makarovi* were observed with subchelate fourth pereopods, and conversely, specimens of *P. laurentae*, infrequently had fourth pereopods which were not subchelate.

DISCUSSION.—As previously indicated, Holmes (1900) placed the species, identified by Benedict as *Eupagurus mertensii* (Brandt), in the genus *Parapagurus*. His generic designation was

based upon his examination of a single female specimen which he believed possessed trichobranchiate branchial lamellae. All recent efforts to locate the specimen upon which Holmes based this conclusion have been unsuccessful. The remainder of Benedict's identified specimens have been reexamined, and none have been found with trichobranchiate branchial lamellae. Neither do the females have the single gonopore, nor the males the paired first and second pleopods usually characteristic of species of *Parapagurus*. It has been necessary, therefore, to establish a new genus, *Parapagurodes*, for Holmes' species and one additional new species from California. The genus is so named because of its close affinity with Henderson's (1888) genus *Pagurodes*.

*Parapagurodes makarovi*, new species

Figures 4a, 5–8

*Eupagurus (Labidochirus) mertensii*: Benedict, 1892, p. 2 [by implication] [not *Pagurus Mertensii* Brandt, 1851].

*Parapagurus Mertensii* Holmes, 1900, p. 155.

*Parapagurus mertensii*: Rathbun, 1904, p. 162, pl. 5, fig. 6; 1910, p. 162, pl. 5, fig. 6.—Alcock, 1905 [in part], p. 172.—Schmitt, 1921, p. 146, pl. 16, fig. 5.—Makarov, 1938, p. 226, fig. 75; 1962, p. 214, fig. 75.—Gordan, 1956 [in part], p. 338 (see discussion).

not *Parapagurus mertensii*: Taylor, 1912, p. 205.—Hart, 1940, p. 103. [? = *Pagurus hirsutiunculus hirsutiunculus* (Dana, 1851)].

HOLOTYPE.—♂ (SL = 4.0 mm), USNM 16709.

PARATYPES.—See table 2.

TYPE LOCALITY.—Off Anacapa I., California, "Albatross" station 2946, 33° 58' 00" N, 119° 30' 45" W, 274 m.

DESCRIPTION.—Shield length equalling or slightly exceeding width, or rarely, width slightly exceeding length; anterolateral margins sloping; anterior margin between rostrum and lateral projections straight, sloping, or slightly concave; posterior margin rounded or roundly truncate; dorsal surface usually convex, slightly rugose anteriorly, and usually with few scattered tufts of short setae, occasionally moderately setose; anterolateral angle produced, blunt or with small spine or spinule. Rostrum usually elongate or moderately elongate, considerably exceeding lateral projections, triangular, slender or moderately broad; terminating subacutely or with small spinule; frequently slightly elevated in midline to form very weak keel, tip often depressed. Lateral projections broadly rounded or obtusely triangular, or infrequently obsolete, with very small submarginal spine or spinule or less frequently, unarmed.

Ocular peduncles short, equalling or slightly ex-

TABLE 2. *Parapagurodes makarovi*, n. sp., Material Examined

Locality	Depth (m)	Station	Date	Sex			SL (mm)
		Deposition		♂	♀	♀♀	
<i>California</i>							
36°52'00"N, 122°11'00"W	119	Albatross 3125 (USNM 52506)	13/3/90	1			3.3
36°26'40"N, 122°00'05"W	141	Albatross 3184 (USNM 16711)	3/4/90	1			5.0
Point Pinos Light	119-554	Albatross 4471 (USNM)	14/5/04	1			4.0
Point Pinos Light	137-198	Albatross 4523 (USNM)	26/5/04	1			4.5
34°06'45"N, 120°18'00"W	101	Albatross 2959 (USNM 42612)	9/2/89	1			3.3
34°02'30"N, 119°21'10"W	86-141	Velero III 1420-41 (AHF)	17/9/41	1			2.4
34°01'55"N, 119°26'40"W	82-86	Velero III 1419-41 (AHF)	17/9/41	1			3.5
34°01'30"N, 119°21'00"W	82	Velero III 874-38 (AHF)	1/8/38	1			3.1
E. Pt., San Nicholas I.	620	Albatross 4423 (USNM)	13/4/04			1	4.6
E. Pt., San Nicholas I.	532	Albatross 4421 (USNM)	12/4/04			1	3.1
33°58'00"N, 119°30'45"W	274	Albatross 2946 (USNM 16709; 42631)	7/2/89	2	2		3.0-4.0
33°56'00"N, 119°40'30"W	238-421	Velero III 992-39 (AHF)	10/8/39	2	2	1	1.8-4.0
33°55'40"N, 119°47'07"W	117-252	Velero III 1195-40 (AHF)	31/10/40	1	1	1	2.3-2.7
33°55'30"N, 119°41'30"W	486	Albatross 2948 (USNM 16710)	7/2/89	10	8	1	3.1-4.6
33°46'20"N, 119°58'15"W	196-229	Velero III 1393-41 (AHF)	26/8/41		1		3.1
33°43'30"N, 119°09'20"W	128	Velero III 983-39 (AHF)	29/5/39	1			3.5
33°40'55"N, 119°50'10"W	130-139	Velero III 1385-41 (RMNH)	25/8/41	3		1	3.0-4.0
Brockway Pt. Santa Rosa I.	75	Albatross 4431 (USNM 52507)	15/4/04			1	2.5
33°37'45"N, 119°08'02"W	146-148	Velero III 982-39 (AHF)	29/5/39			1	2.1
33°34'40"N, 119°00'15"W	139-159	Velero III 981-39 (AHF)	29/5/39	5	1		2.5-3.3
33°33'27"N, 119°04'00"W	256-296	Velero IV 2062-51 (AHF; MNHN)	18/10/51		3	2	2.5-3.3
33°29'30"N, 119°06'45"W	183	Velero III 1176-40 (AHF)	9/9/40	1			3.2
33°26'00"N, 118°21'35"W	262-406	Velero III 1434-41 (AHF)	26/10/41	1			3.1
33°24'30"N, 118°21'10"W	165-185	Velero III 1000-39 (AHF)	12/8/39	1			1.6
33°24'15"N, 117°59'35"W	208-240	Velero III 1213-40 (AHF)	30/11/40	1			3.1
33°23'45"N, 118°20'15"W	73-146	Velero III 908-39 (AHF)	28/1/39			1	2.5
33°23'30"N, 118°19'20"W	221-475	Velero III 1029-39 (RMNH)	10/12/39	1	1		2.1-3.5



TABLE 2. (Continued)

Locality	Depth (m)	Station		Date	Sex			SL (mm)
		Deposition			♂	♀	♀ ♀	
33°20'20"N, 118°16'10"W	179-212	Velero III 1150-40 (AHF)		4/7/40	2	2	1	2.4-3.1
33°18'25"N, 118°15'30"W	152-229	Velero III 1028-39 (AHF)		10/12/39	1		1	2.3-2.4
33°16'55"N, 118°13'55"W	197-210	Velero III 1173-40 (AHF)		20/8/40	1	1		3.4-3.6
33°16'00"N, 118°13'55"W	187-205	Velero IV 2136-52 (AHF)		24/7/52	3	1		2.9-3.5
33°16'00"N, 118°16'40"W	183-192	Velero III 1322-41 (AHF)		18/5/41	1			2.8
33°15'55"N, 118°13'50"W	214-234	Velero III 1151-40 (MNHN)		5/7/40	6			1.9-3.1
33°15'30"N, 118°12'25"W	265-274	Velero III 1172-40 (BM)		20/8/40	2			3.0-3.1
33°15'00"N, 118°11'35"W	265-283	Velero III 1188-40 (AHF)		29/9/40	1	1		2.1-2.9
33°03'10"N, 118°40'30"W	247-274	Velero III 1020-39 (AHF)		24/11/39	1	1	2	2.1-3.1
33°01'10"N, 118°32'10"W	110-247	Velero III 1016-39 (AHF)		23/11/39	1			2.1
33°00'45"N, 118°42'00"W	91-274	Velero III 1018-39 (BM)		23/11/39	4		1	1.8-2.4
33°00'30"N, 120°29'00"W	329	Albatross 2898 (USNM 16708)		6/1/89	1			2.6
33°00'20"N, 118°33'10"W	110-155	Velero III 911-39 (AHF)		18/2/39	2	1	2	2.3-2.8
32°59'30"N, 118°38'25"W	216-384	Velero III 1026-39 (AHF)		9/12/39	4	1	1	2.4-3.2
Point Loma Light	[91]	Albatross 4311 (USNM)		4/3/04			1	3.3
<i>West Coast Baja California, Mexico</i>								
28°12'05"N, 115°33'20"W	130-174	Velero III 1010-39 (AHF)		20/9/39	1		1	2.4-2.9
28°12'00"N, 115°33'33"W	159-174	Velero III 1119-40 (AHF)		19/2/40		1		3.1
28°00'00"N, 115°28'43"W	115-119	Velero III 1254-41 (AHF)		26/2/41	1			2.5

ceeding one-half shield length, stout; strongly inflated basally with corneae dilated; surface with scattered tufts of short setae. Ocular acicles prominent, triangular or subtriangular, narrow or moderately broad, with dorsal surface slightly concave; terminating acutely or subacutely, with strong submarginal spine; separated basally by one to two times basal width of one acicle.

Antennular peduncles long, exceeding ocular peduncles by one-third to one and one-third length of ultimate segment; ultimate segment with one or two short setae on dorsal surface distally; penultimate segment with few scattered, short setae; basal segment with strong, acute spine at ventrodistal margin, dorsolateral margin with small spine.

Antennal peduncles moderately long, exceeding

ocular peduncles by one-third to two-thirds length of ultimate segment; with supernumerary segmentation (cf. McLaughlin and Provenzano, in press). Fifth segment usually unarmed, occasionally with minute spinule on midventral margin, and with scattered tufts of short, stiff setae. Fourth segment unarmed, with few tufts of stiff setae. Third segment with very strong spine at ventrodistal margin and tufts of stiff setae. Second segment with dorsolateral distal angle produced, terminating in strong, simple or occasionally small bifid spine, lateral and mesial margins usually unarmed, occasionally mesial margin with small spine or spinule; dorsomesial distal angle with strong spine, mesial face with few stiff setae and often with two or three small spinules. First segment with spine on lateral surface distally;

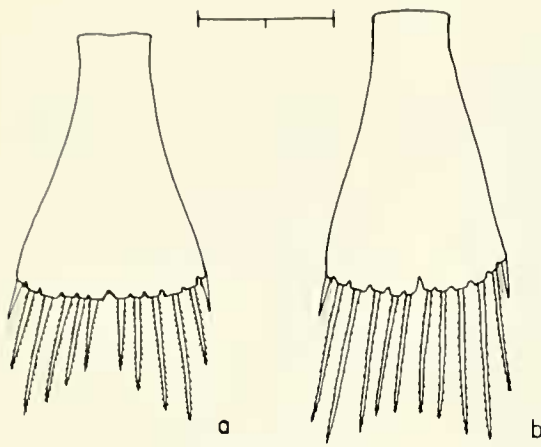


Figure 4. Telson of prezoetal stage: a. *Parapagurodes makarovi*, n. sp.; b. *Parapagurodes laurentae*, n. sp. Scale equals 0.2 mm.

ventral margin produced, usually with one to four moderately strong spines laterally, occasionally unarmed. Antennal acicle long, considerably exceeding length of ocular peduncles and frequently equalling length of antennal peduncles; terminating in strong, acute spine; mesial margin and dorsal surface with tufts of stiff setae. Antennal flagella long, equalling or overreaching tip of right cheliped; naked or with intermittent, short bristles.

Mandible without distinctive characters. Maxillule with proximal endite tapered distally; endopodite with one or two bristles on weakly produced internal lobe, external lobe usually moderately well-developed, not recurved. Maxilla with endopodite approximately equalling scaphognathite in distal extension, distally tapered. First maxilliped with flagellum of exopodite very short, slender. Second maxilliped with basis-ischium fusion apparently incomplete. Third maxilliped with basis-ischium fusion incomplete; basis usually with one to four moderately strong spines, occasionally unarmed; merus with strong spine at dorsodistal margin, ventral margin with one strong spine, or rarely unarmed; carpus with strong spine at dorsodistal margin. Sternite of  $mxp_3$  with one or less frequently two spines on either side of midline, and with row of long setae.

Right cheliped elongate, moderately slender, particularly in large specimens; surfaces usually with scattered tufts of short to moderately long setae. Dactyl moderately long, one-half to three-fourths length of palm, set at slightly oblique angle to palm; terminating in small corneous claw; cutting edge with row of strong, calcareous teeth, often replaced distally by short row of small, corneous teeth; slightly overlapped by fixed finger; dorsomesial margin with row of small spinules or spinulose tubercles, decreasing in size distally, dorsal

surface elevated proximally into weak ridge or keel with irregular row of small spinules or tubercles becoming obsolete distally, often also with few scattered, small spinules or tubercles mesiad of keel proximally; mesial and ventral surfaces usually unarmed. Palm elongate, slightly shorter than or equalling length of carpus, moderately slender, particularly in large specimens, moderately inflated dorsoventrally; dorsal surface usually strongly convex, proximally unarmed or with low protuberances or spinules, more prominent laterally and mesially, and with small, simple or multidenticulate spinules or spinulose tubercles distally and on fixed finger; dorsomesial margin with row of small spines or spinulose tubercles; dorsolateral margin with row of small spines or spinulose tubercles increasing in size on fixed finger, occasionally obsolete proximally, lateral face with few scattered, low protuberances; ventral surface somewhat concave mesiad of midline and with irregular rows of low protuberances; mesial face usually unarmed. Carpus long, equalling or frequently exceeding length of merus, moderately slender; dorsomesial margin with row of usually strong, acute spines, dorsal surface generally convex, with row of small to strong spines mesiad of midline and extending from proximal margin distally one-third to two-thirds length of carpus and with second, longitudinal row of usually small spines laterad of midline extending from distal margin proximally one-half to two-thirds, or occasionally entire length of surface, distal margin usually with few small spines or spinules; dorsolateral margin not delimited or with single or double, irregular row of small spinules or tubercles, often obsolete proximally; lateral face often with scattered, small, usually multidenticulate tubercles or protuberances, distal margin occasionally with few small denticles; mesial face unarmed or with few small spinules dorsally; ventral surface usually with scattered, small spines or spinulose protuberances, occasionally unarmed, ventromesial margin frequently with row of small, often multidenticulate spinules or tubercles. Merus subtriangular; dorsal surface with irregular rows of transverse, occasionally multidenticulate protuberances, distal margin with one to several small spines and spinules; mesial face usually with few transverse, occasionally spinulose ridges dorsally and transverse rows of moderately prominent spines ventrally, ventromesial margin with row of moderately strong or strong spines; ventral surface unarmed or with one or two strong spines; lateral face with transverse, multidenticulate ridges or protuberances, distal margin usually with one moderately prominent spine and numerous denticles or spinules dorsally and small spines or spinulose tubercles ventrally, ventrolateral margin with row of strong, acute spines, increasing in size distally. Ischium with or frequently without row of small spines on ventromesial margin, ventrolateral margin usually with one or

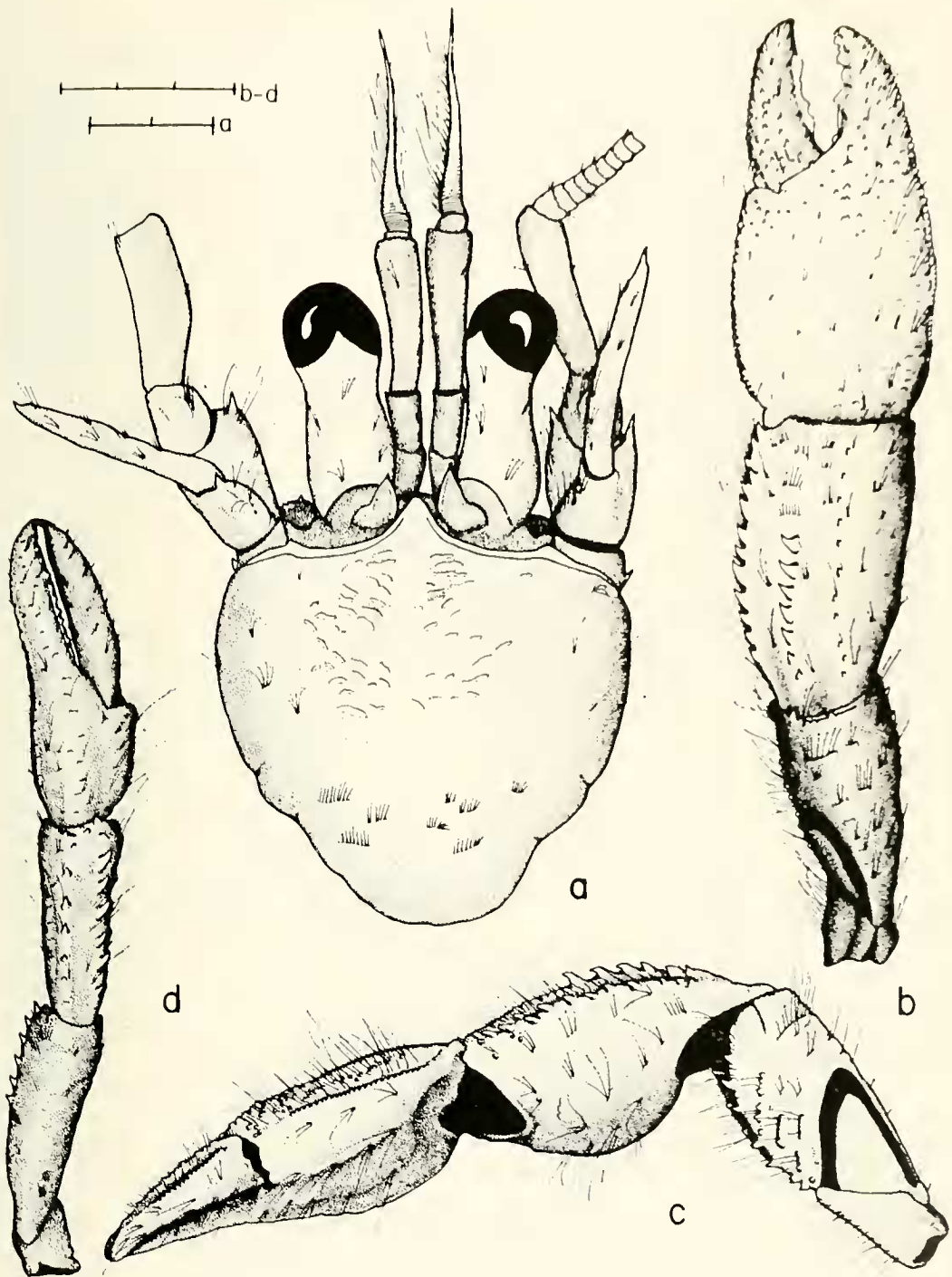


Figure 5. *Parapagurodes makarovi*, n. sp. ♂ (SL = 3.5 mm), "Velero IV" sta. 2136-52: a, shield; b, right cheliped (dorsal view); c, right cheliped (mesial view); d, left cheliped (dorsal view). Scales equal 1 mm (a) and 3 mm (b-d).

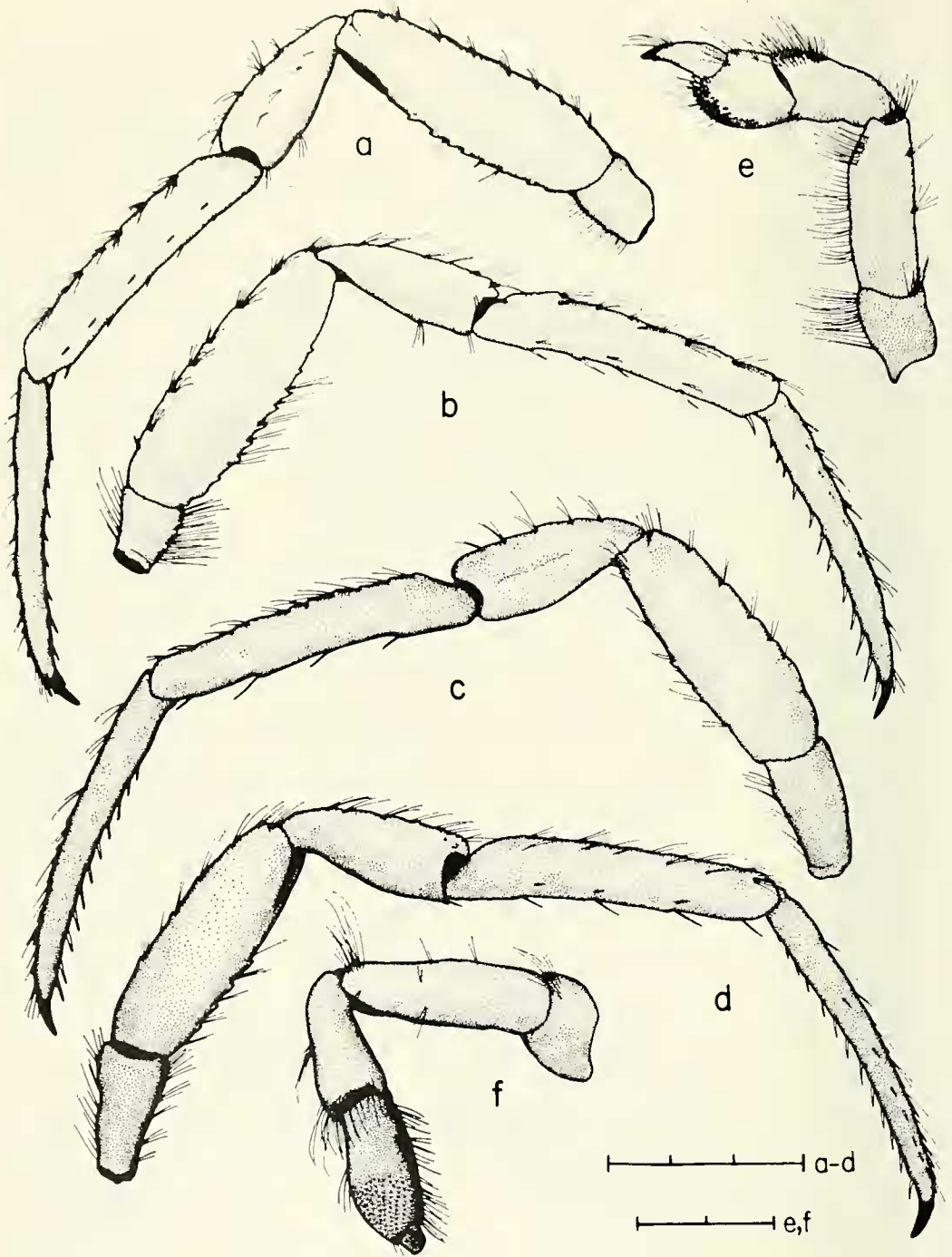


Figure 6. *Parapagurodes makarovi*, n. sp. ♂ (SL = 3.5 mm) "Velero IV" sta. 2136-52, a, b, P<sub>2</sub>: a, lateral view; b, mesial view.—c,d, P<sub>3</sub>: c, lateral view; d, mesial view.—e, P<sub>4</sub>, lateral view; f, P<sub>5</sub>, lateral view. Scales equal 3 mm (a-d) and 1 mm (e,f).

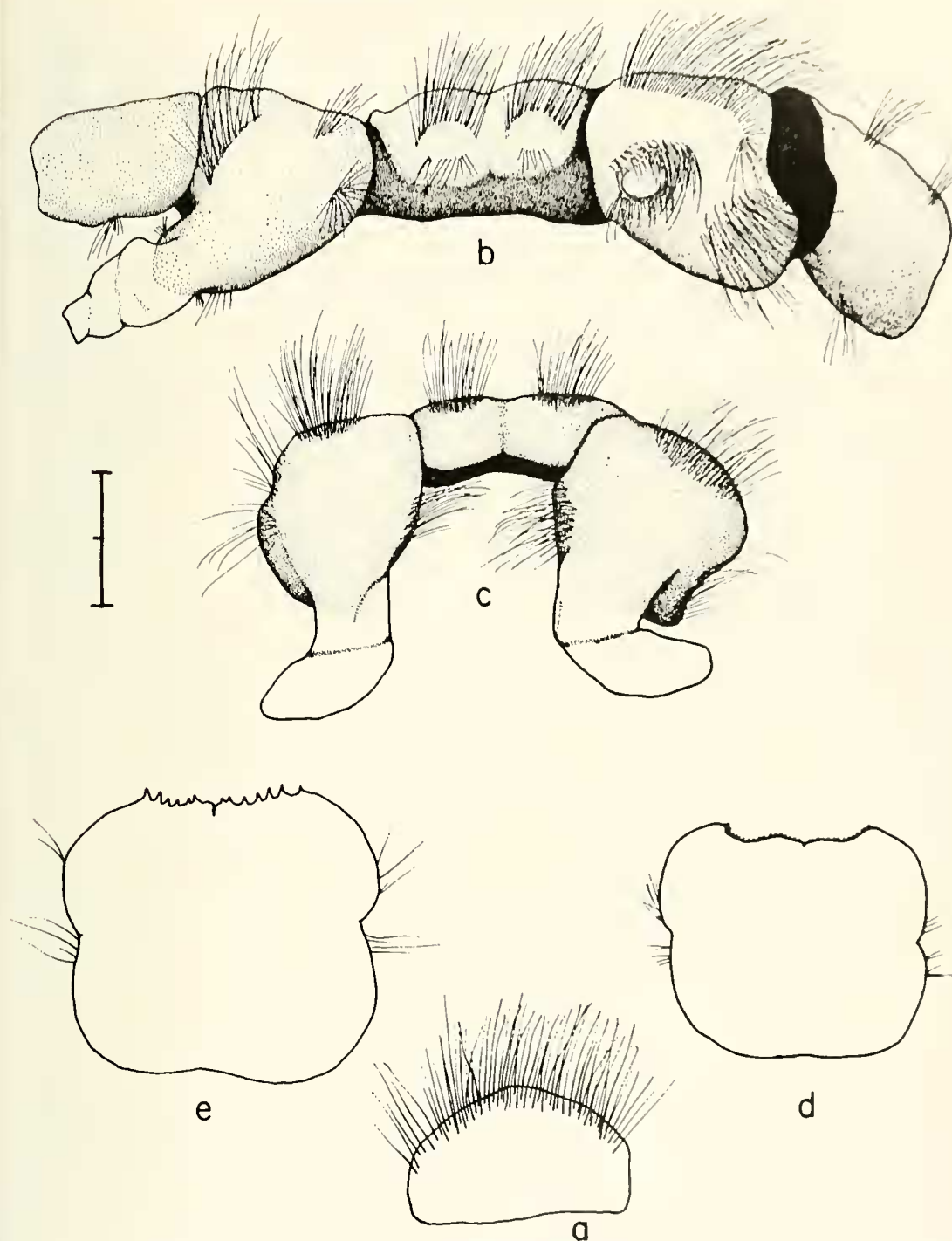


Figure 7. *Parapagurodes makarovi*, n. sp.: a,b,d, ♂ (SL = 3.5 mm). "Velero IV" sta. 2136-52; a, sternite P<sub>3</sub>; b, coxae and sternite P<sub>3</sub>; d, telson.—c: ♂ (SL = 3.6 mm). "Albatross" sta. 2948, USNM 16710, coxae and sternite P<sub>3</sub>.—e: holotype, ♂ (SL = 4.0 mm). "Albatross" sta. 2946, USNM 16709, telson. Scale equals 0.5 mm.

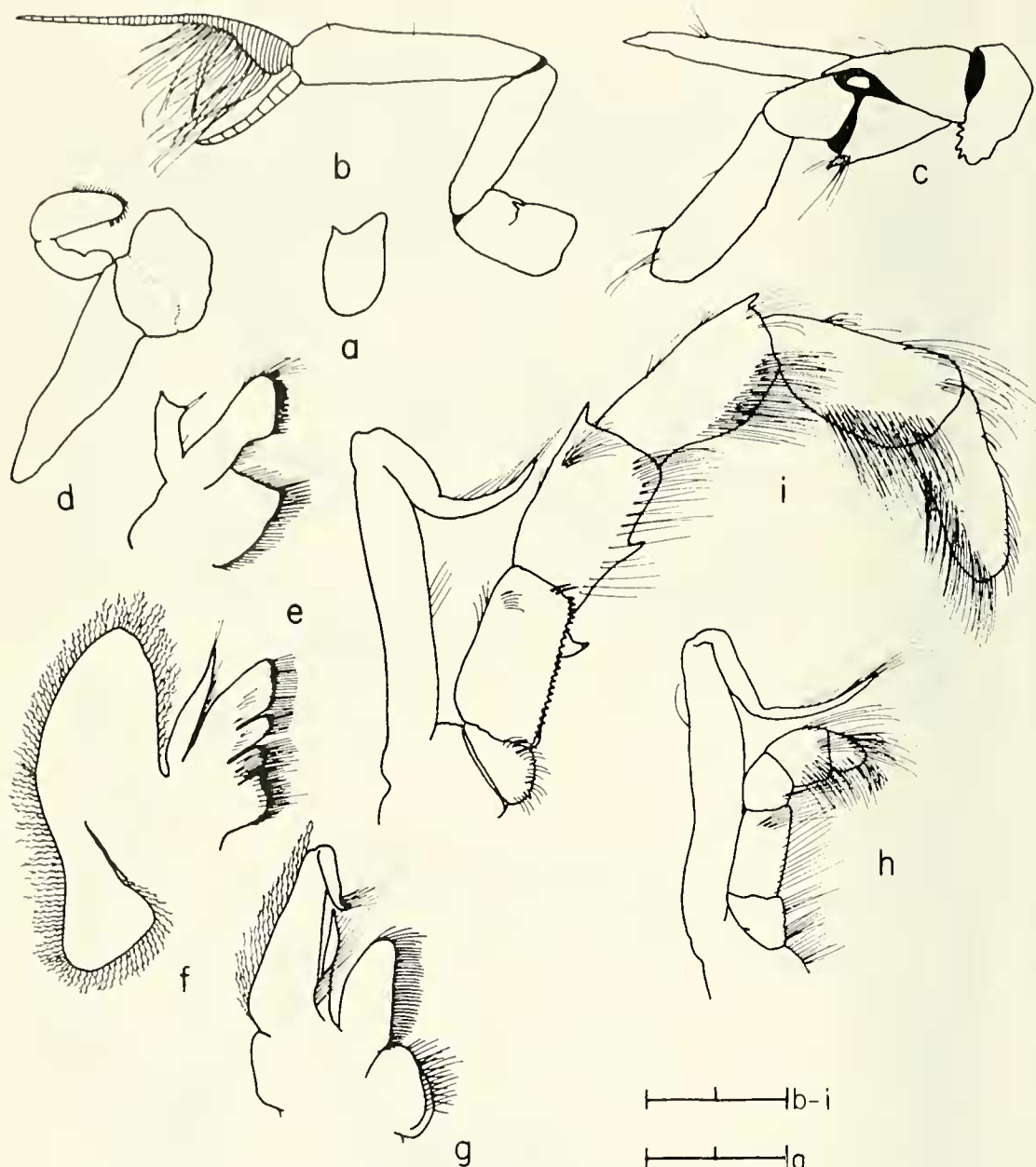


Figure 8. *Parapagurodes makarovi*, n. sp.: a-c ♂ (SL = 3.5 mm), "Velero IV" sta. 2136-52; a, branchial lamella; b, antennular peduncle; c, antennal peduncle.—d-i. ♀ (SL = 4.5 mm), "Albatross" sta. 2894, mouthparts (internal face): d, mandible; e, maxillule; f, maxilla; g, mxp<sub>1</sub>; h, mxp<sub>2</sub>; i, mxp<sub>3</sub>. Scales equal 0.5 mm (a) and 1 mm (b-i).

two short, transverse rows of small spinules, extending onto lateral face ventrally. Coxa unarmed.

Left cheliped elongate, usually reaching to distal half of right, slender; dactyl and fixed finger, in dorsal view, frequently skewed laterally and strongly arched ventrally; surfaces with scattered tufts of moderately long setae. Dactyl long, two to two and

one-half times length of palm; terminating in strong, corneous claw; cutting edge with row of small, corneous teeth; slightly overlapped by fixed finger; dorsomesial margin unarmed or occasionally with few minute spinules proximally, dorsal, mesial, and ventral surfaces unarmed. Palm moderately long, one-half to two-thirds length of carpus; dorsal sur-

face convex, elevated in midline proximally, unarmed or with very small spinules or spinulose protuberances; dorsolateral margin with row of small spines or tubercles, increasing in size on fixed finger but becoming obsolete distally, dorsomesial margin with single or double row of minute spinules or unarmed; lateral, mesial, and ventral surfaces unarmed. Carpus moderately long, two-thirds to three-fourths length of merus, subrectangular; dorsolateral and dorsomesial margins each with row of moderately strong spines, usually strongest mesially, distal margin with one or two moderately strong spines; lateral face with longitudinal row of small spinules or denticles dorsally, ventrolateral margin usually with one to several small spinules; mesial face with irregular, transverse rows of spinulose protuberances or tubercles, ventromesial margin with irregular row of small spinules; ventral surface occasionally with one or two small spinules. Merus subtriangular; dorsal surface with irregular row of transverse ridges, distal margin unarmed or with one moderately small spine; lateral face usually slightly spinulose or denticulate, ventrolateral margin with single or double row of moderately strong or strong spines; mesial face often with transverse rows of spinules or spinulose protuberances ventrally, ventromesial margin with row of moderately strong spines, decreasing in size distally. Ischium usually with row of small spinules or denticles on ventromesial margin, ventral surface often with few small spinules. Coxa unarmed.

Second and third pereopods elongate, usually reaching to base of dactyl of right cheliped, occasionally reaching to tip, slender, somewhat laterally compressed; dorsal surfaces and ventral margins of meri and ischia usually with tufts of long, stiff setae. Dactyls moderately long, two-thirds to one and one-third length of propodi; in lateral view, straight or slightly curved ventrally; in dorsal view, straight; terminating in strong, corneous claw; dorsal surfaces frequently each with few, small, corneous spines; lateral faces each usually with row of small, corneous spinules dorsally; mesial faces unarmed; ventral margins each with row of strong, corneous spines, increasing in size distally. Propodi elongate, one and one-third to one and one-half times length of carpi; dorsal surfaces each with row of low, occasionally spinulose protuberances; lateral and mesial faces unarmed or often with row of small, corneous spinules ventrally; ventral margins each frequently with row of long, corneous spines or spinulose bristles and one or two corneous spines distally. Carpi moderately short, one-half to two-thirds length of meri; dorsal surfaces each with small spine or spinule distally, and frequently with row of low protuberances; lateral, mesial, and ventral surfaces usually unarmed, occasionally ventral surfaces with minute spinules. Meri laterally compressed; dorsal margins each with row of low, occasionally spinulose protuberances; mesial and

lateral faces usually unarmed; ventral margin with single or double row of moderately strong spines ( $P_2$ ) or row of small spines, or unarmed ( $P_1$ ). Ischia unarmed or with row of small spines or denticles. Coxae unarmed.

Fourth pereopods usually not subchelate, occasionally weakly subchelate. Dactyls with very small preungual process on lateral face; propodal rasp with one to three irregular rows of corneous scales.

Fifth pereopods chelate; coxae symmetrical.

Sternite of third pereopods subsemicircular or semicircular, anterior margin with row of long, stiff setae.

Males with well developed, short sexual tube on right, occasionally with vas deferens of left slightly produced, rarely with well developed short sexual tube also on left. No paired pleopods, unpaired pleopods usually absent in adults, occasionally with weakly developed, biramous pleopods  $pl_1$  and  $pl_2$ .

Females with paired gonopores; no paired pleopods, unpaired pleopods,  $pl_1$  to  $pl_4$ , usually weakly developed,  $pl_5$  absent or infrequently rudimentary.

Uropods asymmetrical. Telson with posterior lobes generally symmetrical; separated by very small, shallow, median cleft; terminal margins straight or somewhat concave, each with several to numerous small or very small spines or spinules, lateral margins with tufts of moderately long setae; anterior lobes unarmed, margins with tufts of setae.

**COLORATION.**—Living color unknown. In preservative; Body and appendages straw-colored.

**DISTRIBUTION.**—Southern California, Monterey Bay, to west coast of Baja California peninsula, Mexico; 75 to 574 meters.

**AFFINITIES.**—*Parapagurodes makarovi*, although having a superficial similarity with *Pagurus mertensii* s.s., is most closely related to *Parapagurodes laurentae*, n. sp. It may be distinguished from this latter species by the absence of strong spines on the dorsal surfaces of the palms of the left and right chelipeds.

**ETYMOLOGY.**—This species is named for the Russian carcinologist, V. V. Makarov, who first distinguished this species from *Pagurus mertensii* Brandt.

**DISCUSSION.**—As previously indicated, Holmes (1900) incorrectly assigned the California species misidentified by Benedict as *Eupagurus mertensii* (Brandt) to the genus *Parapagurus*. It is obvious that both Benedict and Holmes considered this species synonymous with that described by Brandt. Makarov (1938, 1962) interpreted Brandt's species to be synonymous with *P. h. hirsutiusculus* (Dana) and chose to submerge the name *mertensii* out of preference for Dana's more commonly used, junior synonym. As this species differed significantly from Holmes' *Parapagurus mertensii*, Makarov retained the latter species without

TABLE 3. *Parapagurodes laurentae* n. sp., Material Examined

Locality	Depth (m)	Station		Date	Sex			SL (mm)
		Deposition			♂	♀	♀ ♀	
<i>California</i>								
34°03'50"N, 119°45'25"W	66-86	Velero III	1303-41 (AHF)	12/4/41	1		1	1.4-1.9
34°01'32"N, 119°27'10"W	69-79	Velero IV	1937-50 (AHF)	24/3/50	3		4	1.5-2.3
33°53'10"N, 119°55'00"W	93-97	Velero III	1290-41 (AHF)	11/4/41	1			2.9
33°34'40"N, 119°00'15"W	139-159	Velero III	981-39 (AHF)	29/5/39	5	10		2.0-3.2
33°29'10"N, 119°00'00"W	66-88	Velero III	1146-40 (AHF)	1/7/40	3			1.9-3.4
33°29'N, 119°01'W	73	Velero III	895-38 (AHF)	12/8/38	2			3.4-3.5
33°27'35"N, 119°02'35"W	38-51	Velero III	978-39 (AHF)	28/5/39	2	3	1	1.9-3.4
33°27'20"N, 118°35'35"W	73-91	Velero III	1311-41 (AHF)	4/5/41	1			2.4
33°25'30"N, 118°22'55"W	141-210	Velero III	1371-41 (AHF)	20/7/41	2			1.8-1.9
33°25'15"N, 118°21'30"W	199-262	Velero IV	1618-48 (AHF)	16/10/48	3	2	4	1.6-3.0
33°24'30"N, 118°21'10"W	165-185	Velero III	1000-39 (AHF)	12/8/39	3	1	2	1.5-2.4
33°24'15"N, 117°59'35"W	208-240	Velero III	1213-40 (AHF)	30/11/40			1	2.7
Off Santa Catalina I.	152	—————		15/8/51			1	1.3
33°23'40"N, 118°19'50"W	183-198	Velero III	1359-41 (AHF)	13/6/41	1			1.5
33°23'30"N, 118°19'20"W	221-475	Velero III	1029-39 (AHF)	10/12/39	4	1		2.1-3.5
Santa Catalina I.	16-20	Velero IV	1648-48 (AHF)	1/12/48	1			1.9
33°20'20"N, 118°16'10"W	179-212	Velero III	1150-40 (AHF)	4/7/40	3	4	2	1.7-3.3
33°20'35"N, 118°17'15"W	150-161	Velero III	1149-40 (AHF)	4/7/40	2		1	1.4-1.6
33°18'25"N, 118°14'45"W	194-201	Velero III	1355-41 (AHF)	12/6/41	1	1		2.1-3.1
33°18'25"N, 118°15'30"W	152-229	Velero III	1028-39 (AHF)	10/12/39	8	6		1.9-3.5
33°18'10"N, 119°22'15"W	177-190	Velero III	1125-40 (AHF)	12/4/40			1	3.1
33°17'20"N, 118°14'00"W	187-212	Velero III	1353-41 (BM)	12/6/41	3		2	1.8-3.0
33°16'55"N, 118°13'55"W	197-210	Velero III	1173-40 (AHF)	20/8/40			1	2.4
33°16'30"N, 118°17'00"W	110-146	Velero III	1354-41 (AHF)	12/6/41	1	1		1.6-1.9
33°16'20"N, 118°15'20"W	159-174	Velero III	1429-41 (AHF 4127; RMNH; BM; MNHN; USNM 143007)	25/10/41	52	42		1.4-3.7
33°16'00"N, 118°13'55"W	187-205	Velero IV	2136-52 (RMNH; MNHN; AHF)	24/7/52	9	5		2.6-3.4



TABLE 3. (Continued)

Locality	Depth (m)	Station Deposition	Date	Sex			SL (mm)
				♂	♀	♂♀	
33°15'55"N, 118°13'50"W	214-234	Velero III 1151-40 (USNM 143010)	5/7/40	5		2	2.4-2.4
33°15'30"N, 118°15'05"W	190-247	Velero IV 1848-49 (AHF)	12/6/49		1	1	1.9-2.4
33°15'00"N, 118°11'35"W	265-283	Velero III 1188-40 (AHF)	29/9/40		1	1	2.1-2.3
33°14'15"N, 118°10'00"W	278-366	Velero III 1430-41 (AHF)	25/10/41	3	1	1	2.2-3.4
33°00'45"N, 118°42'00"W	91-274	Velero III 1018-39 (AHF)	23/11/39	6	3		1.9-3.3
33°00'30"N, 118°32'20"W	95-112	Velero III 1239-41 (AHF)	22/2/41		1		2.9
33°00'20"N, 118°33'10"W	110-155	Velero III 911-39 (AHF)	18/2/39	9	1	1	1.7-3.6
32°59'30"N, 118°38'25"W	216-384	Velero III 1026-39 (AHF)	9/12/39	1			3.1
32°46'30"N, 118°21'15"W	143-391	Velero III 914-39 (AHF)	19/2/39	4	2		2.4-3.1
32°45'55"N, 118°26'10"W	100-126	Velero III 1012-39 (AHF; USNM 143008)	9/11/39	7	3	2	1.6-2.6
32°35'00"N, 119°11'45"W	165-201	Velero III 1343-41 (AHF)	10/6/41	4	1		1.9-3.5
32°33'15"N, 117°22'05"W	143-148	Velero III 1240-41 (AHF)	23/2/41			3	1.9-2.5
<i>West coast Baja California, Mexico</i>							
28°12'35"N, 115°33'15"W	121-148	Velero III 1251-41 (AHF)	26/2/41	1			1.7
28°12'05"N, 115°33'20"W	130-174	Velero III 1010-39 (AHF)	20/9/39		1		1.4
28°05'45"N, 115°31'00"W	117-119	Velero III 1253-41 (AHF)	26/2/41	1			2.5
26°16'17"N, 113°41'03"W	99	Velero IV 1710-49 (AHF; USNM 143009)	7/3/49	12	1	3	1.8-2.7
<i>Gulf of California</i>							
28°00'02"N, 111°24'40"W	201	Velero III 735-38 (AHF)	29/3/37	1		2	2.4-2.9

change. In accordance with the Rules of Zoological Nomenclature (article 49), the name *mertensii* cannot be retained for Holmes' species even though it is now being transferred to yet another genus.

The references of both Alcock (1905) and Gordan (1956) refer, in part, to *Parapagurodes makarovi* and, in part, to *Pagurus mertensii* [sensu lato]. The distributions recorded by Rathbun (1904, 1910) and Schmitt (1921) of Kamchatka, Alaska and British Columbia are erroneous, and reflect the misidentification of this species by Benedict and Holmes. Taylor's (1912) record of *Parapagurus mertensii* from southern

British Columbia, which was repeated by Hart (1940), was most probably based on misidentifications of specimens of *Pagurus h. hirsutiussculus*.

#### *Parapagurodes laurentae*, new species

Figures 4b, 9-11

?*Pagurus* [sp]: Menzies and Miller, 1954, p. 153 (see discussion).

HOLOTYPE.—♂ (SL = 3.5 mm). AHF 4127.

PARATYPES.—See table 3.

TYPE LOCALITY.—2½ mi SE of Seal Rocks, Santa Catalina I., California, 33° 16' 20" N, 118° 15' 20" W, Velero III station 1429-41, 159-174 m.

DESCRIPTION.—Shield slightly longer than broad, or less frequently, length equalling width.

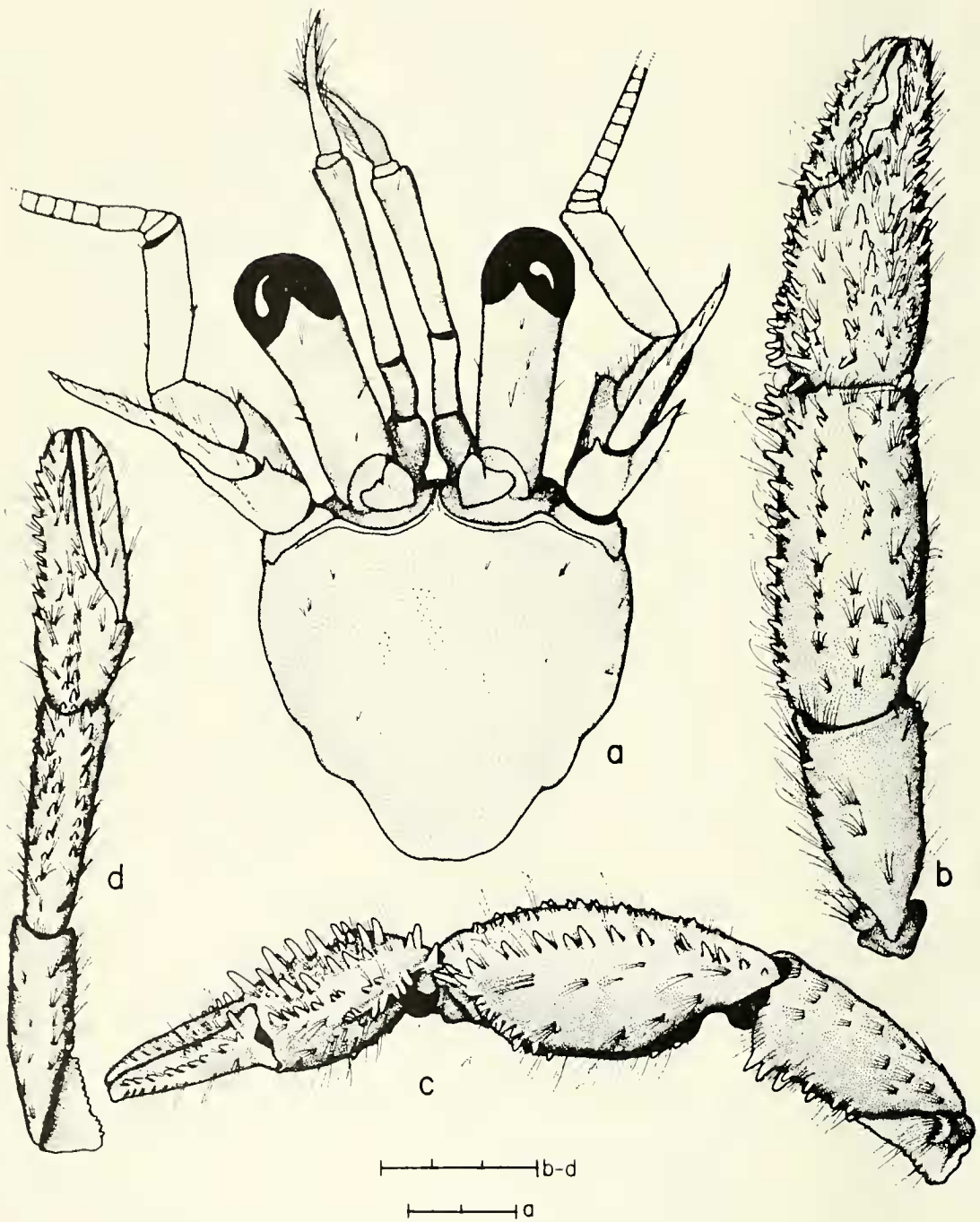


Figure 9. *Parapagurodes laurentae*, n. sp., paratype, ♂ (SL = 3.2 mm), "Velero III" sta. 1429-41: a, shield; b, right cheliped (dorsal view); c, right cheliped (mesial view); d, left cheliped (dorsal view). Scales equal 1 mm (a) and 3 mm (b-d).

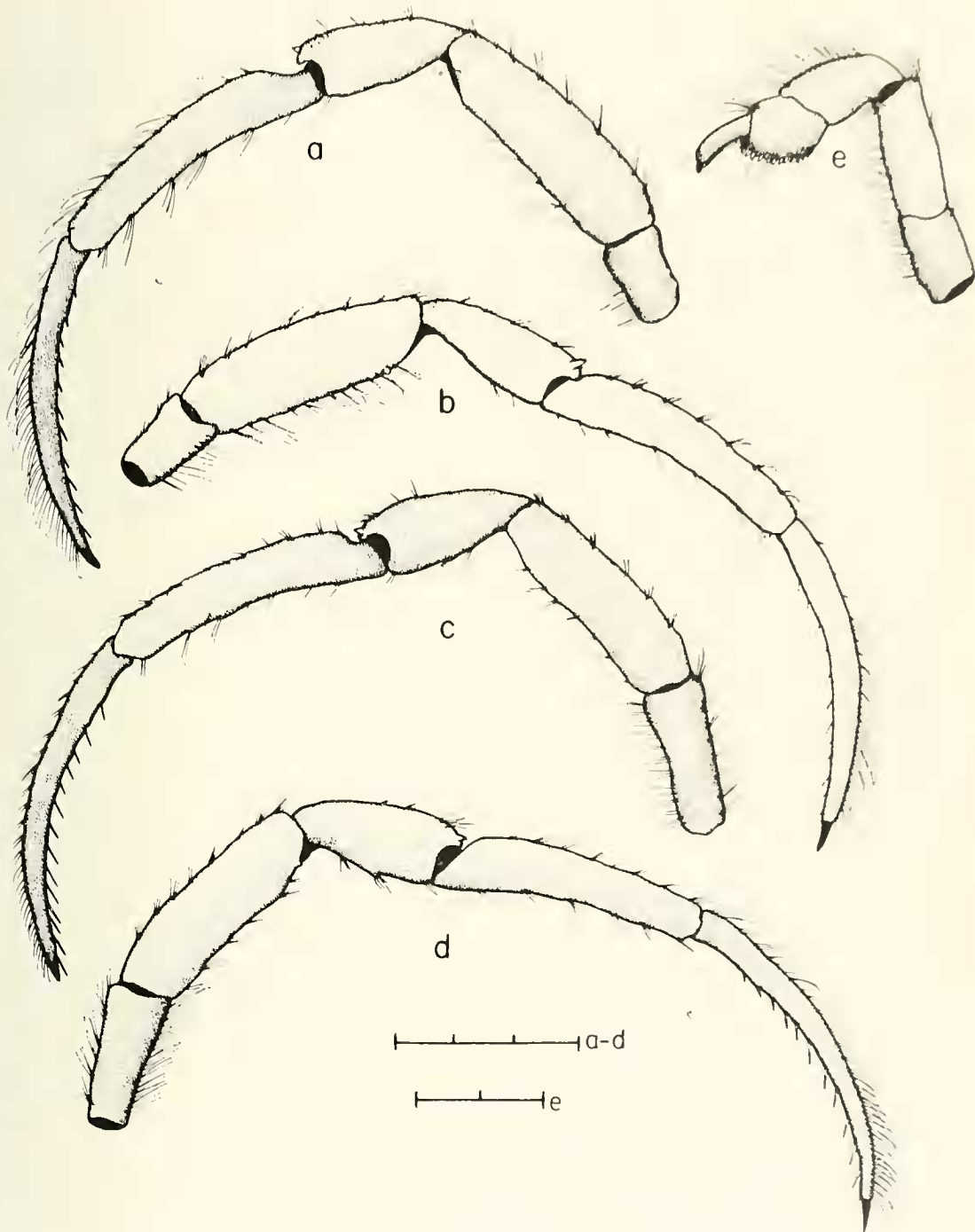


Figure 10. *Parapagurodes laurentae*, n. sp., paratype, ♂ (SI = 3.2 mm). "Velero III" sta. 1429-41, a,b, P<sub>3</sub>: a, lateral view; b, mesial view.—c,d, P<sub>4</sub>: c, lateral view; d, mesial view.—e, P<sub>4</sub>, lateral view. Scales equal 3 mm (a-d) and 1 mm (e).

rarely slightly broader than long; anterolateral margins sloping; anterior margin between rostrum and lateral projections somewhat concave or occasionally straight; posterior margin truncate or roundly truncate; dorsal surface slightly inflated, convex, usually with few scattered tufts of short setae; anterolateral angle produced, blunt or with small spine or spinule. Rostrum moderately long, or less frequently, short, usually exceeding lateral projections, depressed distally; triangular, usually slender, occasionally moderately broad, frequently with weak median keel; terminating acutely or subacutely, often with small spine and few moderately long setae. Lateral projections obtusely triangular, unarmed or occasionally with submarginal spinule.

Ocular peduncles moderately short, one-half to two-thirds length of shield, stout; slightly inflated basally and with corneae dilated; dorsal surface with irregular row of tufts of short setae. Ocular acicles triangular or subtriangular, narrow or moderately broad, with dorsal surface frequently slightly concave; terminating subacutely with strong, submarginal spine; separated basally by one to one and one-half times basal width of one acicle.

Antennular peduncles moderately long, exceeding ocular peduncles by three-fourths to entire length of ultimate segment. Ultimate segment with one or two short setae on dorsal surface distally; penultimate segment often with few short setae; basal segment with small spine on dorsolateral margin, ventrodistal margin often with small spinule and tuft of setae.

Antennal peduncles moderately long, exceeding ocular peduncles by one-fourth to three-fourths length of ultimate segment; with supernumerary segmentation. Fifth segment unarmed, usually with few stiff setae or bristles dorsally and ventrally. Fourth segment unarmed, with few tufts of short setae. Third segment with strong spine at ventrodistal margin, partially obscured by tuft of setae. Second segment with dorsolateral distal angle produced, terminating in strong spine, dorsal surface and mesial margin occasionally with one or two small spines or spinules and tufts of short to long setae, lateral margin with scattered short setae; dorsomesial distal angle with strong spine, mesial margin with short, stiff setae. First segment with small spine or spinule on lateral face distally; ventrodistal margin produced, with one to several spines laterally. Antennal acicle moderately long, slightly shorter than or equalling length of ocular peduncles, and usually exceeding proximal third of ultimate peduncular segment; terminating in strong, acute spine; dorsal surface and mesial margin with tufts of stiff setae. Antennal flagella long, equalling or exceeding tip of right cheliped; naked or with intermittent, short bristles.

Mandible without significant characters. Maxillule with proximal endite slightly tapered; endopodite with one bristle on moderately well-developed in-

ternal lobe, external lobe moderately well-developed, not recurved. Maxilla with endopodite long, exceeding scaphognathite in distal extension, slightly reflexed. First maxilliped with flagellum of exopodite short, slender. Second maxilliped with basis-ischium fusion incomplete. Third maxilliped with basis-ischium fusion incomplete; basis with one to three strong teeth; ischium with crista dentata well-developed, one accessory tooth; merus and carpus each with spine at dorsodistal margin. Sternite of mxp. with prominent spine and row of long setae on either side of midline.

Right cheliped usually long, moderately slender, particularly in large specimens; surfaces usually with scattered tufts of long, stiff setae. Dactyl moderately long, two-thirds to three-fourths length of palm, occasionally equalling or slightly exceeding length of palm; set at slightly oblique angle to palm; terminating in small, corneous claw, slightly overlapped by fixed finger; cutting edge with calcareous teeth on proximal one-half to two-thirds, replaced distally by row of small, corneous teeth; usually with prominent, longitudinal hiatus; dorsomesial margin with row of moderately strong, blunt, or, in small specimens, acute, tubular spines, dorsal surface slightly elevated in midline, usually with one or two strong, tubular spines and frequently short longitudinal row of small spines or tubercles not extending beyond proximal half; mesial and ventral surfaces unarmed. Palm usually elongate, one-half to two-thirds length of carpus, moderately slender, particularly in large specimens, somewhat inflated dorsoventrally; dorsal surface convex, with four or five, widely spaced, irregular rows of tubular spines, usually very prominent in large specimens, not extending beyond proximal half of fixed finger; dorsomesial margin with row of moderately short spines, mesial face proximally produced into prominent shelf, marginally armed with strong, tubular spines, distally with irregular row of small spines or tubercles; dorsolateral margin with row of small spines, increasing in size and becoming tubular on fixed finger, lateral face usually unarmed; ventral surface with scattered small tubercles or spines. Carpus very elongate, considerably exceeding length of merus; dorsomesial margin with row of strong, slender spines, increasing in size distally, dorsal surface with row of moderately strong spines slightly mesial of midline extending from distal margin proximally two-thirds to three-fourths length of segment, rarely extending to proximal margin, and with usually short row of small spines laterad of midline, distal margin usually with one or two subacute spines; dorsolateral margin not delimited or with irregular row of small spines or spinulose protuberances, lateral face unarmed or slightly spinulose; ventrolateral margin with short row of small to moderately strong spines distally, ventral surface unarmed or with few low, occasionally spinulose protuberances; mesial face with scattered, often spinulose pro-

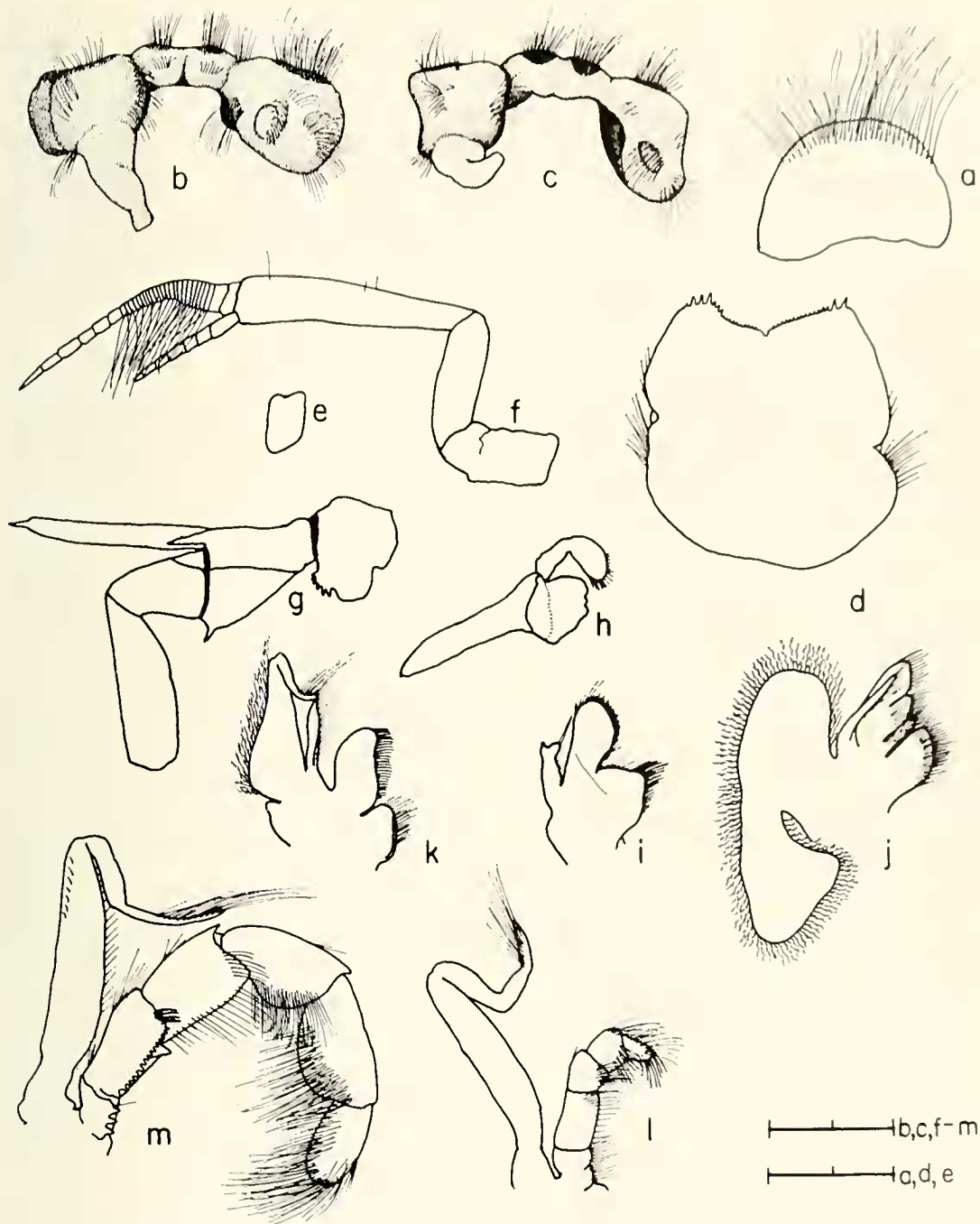


Figure 11. *Parapagurodes laurentae*, n. sp., a,b, d-g, paratype, ♂ (SL = 3.2 mm), "Velero III" sta. 1429-41: a, sternite, P<sub>3</sub>; b, coxae and sternite P<sub>3</sub>; d, telson; e, branchial lamella; f, antennular peduncle; g, antennal peduncle.—c, h-m, ♂ (SL = 3.4 mm), "Velero III" sta. 895-38: c, coxae and sternite, P<sub>3</sub>—h-m, same, mouthparts (left internal face): h, mandible; i, maxillule; j, maxilla; k, mxp<sub>1</sub>; l, mxp<sub>2</sub>; m, mxp<sub>3</sub>. Scales equal 0.5 mm (a,d,e) and 1 mm (b,c,f-m).

tubercles, ventromesial margin with irregular row of moderately strong spines, increasing in size distally. Merus subtriangular; dorsal surface with irregular rows of low, occasionally spinulose protuberances; mesial and lateral faces usually unarmed, ventromesial and ventrolateral margins each with single or double row of spines, strongest mesially. Ischium with row of small spines on ventromesial margin, mesial face often with prominent protuberance dorsally. Coxa unarmed.

Left cheliped moderately long, usually reaching to base of dactyl of right, slender; surfaces usually with tufts of long, stiff setae. Dactyl long, one and one-half to more than twice length of palm; cutting edge with row of small, corneous teeth; terminating in broad, corneous claw; often with slender, longitudinal hiatus; dorsal surface usually unarmed, occasionally with few, low, spinulose protuberances proximally. Palm moderately short, one-fourth to one-third length of carpus; dorsal surface convex, with irregular, single or double row of tubular spines, usually not extending onto fixed finger, dorsomesial margin with row of strong, tubular spines, becoming obsolete distally on fixed finger; dorsolateral margin not delimited or with irregular row of small spines or spinulose protuberances, lateral, mesial, and ventral surfaces unarmed. Carpus elongate, usually exceeding length of merus, subrectangular; dorsomesial and dorsolateral margins each with row of moderately strong or strong spines; mesial and lateral faces usually with few, scattered, low protuberances, ventromesial, and ventrolateral margins each with row of small spines, or less frequently with only few low protuberances. Merus subtriangular; dorsal surface with two irregular, longitudinal rows of low protuberances; mesial and lateral faces usually unarmed, or occasionally with few low protuberances, ventromesial and ventrolateral margins each with single or double row of moderately strong spines. Ischium with row of small spines on ventromesial margin. Coxa unarmed.

Second and third pereopods long, usually equalling or overreaching tip of right cheliped; dorsal and ventral surfaces usually with tufts of moderately long, stiff setae. Dactyls elongate or moderately elongate, equalling or somewhat exceeding length of propodi; in lateral view, curved ventrally; in dorsal view, usually straight; terminating in strong corneous claws; dorsal margins each with row of widely spaced, low protuberances; mesial and lateral faces unarmed; ventral margins each with row of strong, corneous spines, increasing in size distally. Propodi elongate, one and one-half to twice length of carpi; dorsal surfaces each usually with row of low protuberances; mesial and lateral faces unarmed; ventral margins each with one or two small, corneous spines or spinules distally. Carpi moderately short, two-thirds to three-fourths length of meri; dorsal surfaces each usually with small spine at distal margin; lateral and mesial faces unarmed; ventral

margins each frequently with small, occasionally spinulose protuberance. Meri laterally compressed; dorsal surfaces each with row of low, occasionally spinulose protuberances; lateral faces unarmed, mesial faces each with small spine on ventral margin distally; ventral margins usually with row of small spines ( $P_2$ ) or unarmed ( $P_3$ ). Ischia and coxae unarmed.

Fourth pereopods usually weakly subchelate, occasionally not subchelate. Dactyls with very small, preungual process on lateral face; propodal rasp with one to three rows of corneous scales.

Fifth pereopods chelate; coxae symmetrical.

Sternite of third pereopods subsemicircular; anterior margin with long, stiff setae.

Males with well developed, short sexual tube on right, occasionally with vas deferens of left slightly produced. No paired pleopods, unpaired pleopods,  $pl_1$  to  $pl_5$ , biramous, weakly developed, occasionally pleopods absent.

Females with paired gonopores; no paired pleopods, unpaired pleopods,  $pl_2$  to  $pl_4$ , with both rami moderately well-developed, or infrequently weakly developed;  $pl_5$  usually rudimentary, occasionally absent.

Uropods asymmetrical. Telson with posterior lobes generally symmetrical; separated by very shallow median cleft; terminal margins concave or slightly oblique, each with row of very small spinules and one to four small spines at extrolateral angles, lateral margins with few short setae; anterior lobes unarmed, margins with long setae.

COLORATION.—Living color unknown. In preservative: Body and appendages straw-colored.

DISTRIBUTION.—Southern California, Channel Islands, to west coast of Baja California, Mexico; Gulf of California; 16 to 475 meters.

AFFINITIES.—Although *Parapagurodes laurentae* is most closely related to *P. makarovi*, its superficial resemblance to an undescribed species of *Pagurus* that has come to our attention, may cause mistakes in identification. In addition to the presence of sexual tubes in the males, the lack of spines on the distal portions of the dorsal surfaces of the dactyls of the chelipeds, the moderately long and relatively slender dactyls of the second and third pereopods, and the lack of regular setation on the articles of the antennal flagella are characters which distinguish *P. laurentae*.

ETYMOLOGY.—*Parapagurodes laurentae* is named in honor of Michèle de Saint Laurent, the French carcinologist who has contributed so greatly to pagurid systematics.

DISCUSSION.—As previously mentioned, both species of *Parapagurodes* were often found infested with *Stegophryxus sp.* The questionable inclusion of *Pagurus [sp.]* in the synonymy of *Parapagurodes laurentae* is based on the fact that this record of Menzies and Miller (1954) is

the only other report of this hoplyrid genus from western North America. It is improbable that these authors would not have been able to recognize their pagurid host had it been *P. makarovi*, as this species has been well illustrated under the name *Parapagurus mertensii* (Rathbun, 1904, 1910; Schmitt, 1921; Makarov, 1938). In contrast, *Parapagurodes laurentae* is not only an undescribed species, but it does bear a strong, superficial resemblance to some species of *Pagurus*.

### Key to the Species of *Parapagurodes*

- Palm of right cheliped with dorsal surface unarmed proximally, and with scattered small spinules or spinulose tubercles distally and on fixed finger. Palm of left cheliped with dorsal surface unarmed or with minute spinules ..... *P. makarovi*, n. sp.
- Palm of right cheliped with dorsal surface armed proximally with four or five irregular rows of widely spaced, strong, tubular spines, not extending onto fixed finger. Palm of left cheliped with dorsal surface with single or double row of strong tubular spines ..... *P. laurentae*, n. sp.

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