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BENTHIC AMPHIPODA OF MONTEREY BAY, CALIFORNIA

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The fauna of benthic subintertidal Amphipoda in Monterey Bay, California is compared to that of southern California south of Point Conception. This study of northern Amphipoda complements a study of southern Amphipoda of Baja California (Barnard, 1964a). The two surveys have been conducted in order to determine the affinities of various Amphipoda of southern California.

The extrinsic distributions of southern California Amphipoda are poorly known except for those species from Baja California reported by Shoemaker (1925, 1942), Barnard (1964a), and those from Oregon, Washington, and British Columbia reported by Calman (1898), Walker (1898), Thorsteinson (1941), Barnard (1954), Bousfield (1958), and Mills (1961, 1962). Most of the cited papers have treated only intertidal species. Although Monterey Bay has not been considered to be a typical cold-temperate area, the present analyses indicate the cold-temperate character of several California Amphipoda.

I am indebted to Dr. R. E. Stevenson of Florida State University, formerly of the Allan Hancock Foundation, who directed the California State Water Pollution Control Board survey of California.

G. F. Jones, aboard the RV/*Velero IV*, was instrumental in collecting and processing the samples. Captain Fred C. Ziesenhenné identified the ophiuroids dominating the bottom samples. Dr. Joel W. Hedgpeth of Pacific Marine Station loaned specimens of a new species of *Protomedeia*. The Beaudette Foundation and the Smithsonian Institution supported the project and the National Science Foundation provided funds for illustration (grant G-10750).

Methods and Data

The benthos of Monterey Bay, in water depths of 15 to 116 m (table 1) is represented by those 46 samples charted in figure 1. They are relatively evenly distributed in proportion to bathymetry. The coastal benthos of southern California is represented by 348 samples evenly proportioned to depths between 10 and 200 m. The two groups of samples, although disparate, are roughly proportional in number to their respective bottom areas. Any comparisons between the Amphipoda of the two areas must be viewed with caution.

Samples of sediment and fauna were collected with an orange-peel grab taking a surface area of 0.25 m². Barnard and Jones (1960) have considered the average mechanical efficiency of the grab to be about 80 percent if large numbers of samples are taken on diverse substrates. The efficiency decreases on hard-packed sand bottoms and increases on soft silty bottoms. Calculations of frequencies of Amphipoda in the 348 southern California samples employed the 80 percent efficiency rule. Those of Monterey Bay employed a 100 percent efficiency rule. All sedimentary samples from Monterey Bay, with one exception, exceeded 1.5 m³, the mark of 100 percent efficiency. Presumably differences in depth of penetration of the grab in those samples of 100 percent areal efficiency would not affect tallies of Amphipoda except for those listriellas inhabiting deep burrows of polychaetes and echiuroids.

Sedimentary samples were washed through meshes of 0.7 mm square openings and the residues preserved in a mixture of seawater and formaldehyde. Amphipoda and those other animals considered to be dominants in the samples were removed to alcohol in the laboratory. The remaining materials were represerved and stored in the collections of the Allan Hancock Foundation. Thorson's (1957) methods were used to determine standing-crop dominance.

Planning and conducting of the surveys were based on USHO charts contoured in English fathoms, but the bathymetric data have been converted to meters herein. Hence the depth classifications of benthic areas in southern California, quoted in meters, are not in standard intervals of 10, 20, 30 m, etc., but are in converted intervals of 10, 20, 30, etc., fms.

Geographic Positions and Environments

The region of southern California, with a median latitude of 33° N, extends from Point Conception on the north to the international border between California and Mexico on the south. The coastal length is approximately 300 km. Monterey Bay, with a latitude of approximately 36.5° N, lies 275 km north of Point Conception. The bay occurs near the southern end of the cold-temperate Oregonian zoogeographic province and is within the Montereyan subprovince. Monterey Bay is broad, semilunar, and about 30 km wide. Its shelf is narrow and cut by the shoreward ends of the Monterey Canyon complex occurring just north of the area shown in figure 1. The benthic environment, except for intertidal areas, has been scarcely explored, but several known environmental differences between Monterey Bay and southern California are explained below.

Surface waters of Monterey Bay are dominated by the upwelling of cool subsurface layers (California Cooperative Fishery Investigations, 1952–1964). Sea-surface temperatures vary between 10° and 14° C. The average sea-surface temperature of southern California, at 33° N during 1957–1960, was about 17.5° , and the range was 14° to 23° C (Jones and Barnard, 1963). Upwelling occurs from place to place and is especially prominent in the Gulf of Santa Barbara, where waters are entrained by the California current.

The shelf of the southern part of Monterey Bay lies in greater water depths than do Santa Monica Bay (Hartman, 1956) and San Pedro Bay (Barnard and Ziesenhenné, 1961) of southern California. Very little of Monterey Bay is shallower than 37 m (20 fms). Those southern bays have a large share of benthic area in the 27–46 m (15–25 fms) depth interval. As a result, the benthic fauna of Monterey Bay is dominated by deep-water ophiuroid communities, whereas the southern bays are dominated by shallow-water ophiuroid communities or nonophiuroid communities. The distribution of the communities in Monterey Bay is shown in figure 1. Contours are necessarily diagrammatic because of low sampling frequencies. The principal ophiuroids are *Amphiodia urtica* (Lyman), *Amphipholis squamata* (Delle Chiaje), *Amphiura arcystata* H. L. Clark, and *Amphioplus strongyloplax* (H. L. Clark). The southern bays are dominated principally by the *Amphioplus hexacanthus* H. L. Clark community (Barnard and Ziesenhenné, 1961), which occurs only on the inshore margins of Monterey Bay. The deep-water *Amphiodia urtica* is the common dominant of the outer shelf of southern California. The prevalence of *A. strongyloplax*, *A. amphacantha*, and *A. arcystata* in depths of less than 100 m in Monterey Bay is a reflection of the northern emergence of communities occurring in southern California.

only on coastal slopes in depths exceeding 120 m. These communities have not been sampled frequently in southern California because of steeply sloping bottoms and diffuse sampling grids.

The headland of Monterey Peninsula has a rocky substrate but to the northeast a long, slightly concave shoreline is composed of sand beach. A community dominated by the polychaete *Nothria* species occurs on inshore sand bottoms in depths of less than 30 m; presumably it is similar to that described from southern California by Barnard (1963).

The Amphipod Fauna

Because most of the Monterey shelf lies in depths exceeding 50 m, the station grid embraces only 13 samples in depths of 10 to 50 m. Those few samples have little comparative significance to samples from southern California. Thus, this discussion is confined to the 33 samples from depths of 50 to 139 m. The Amphipoda occurring in Monterey Bay are listed in rank in table 2, with their frequencies of individuals and their limitations to depths of 50 to 139 m. They are compared with rankings of species from similar depths in southern California (tables 3, 4, 5, 6).

Half of the 20 most abundant species occurring in southern Californian depths of 94–183 m (table 6) also occur in the first 20 of Monterey Bay in depths of 50–139 m (table 2). Those southern California species not found in the list of abundant Monterey species are *Ampelisca pacifica*, *Westwoodilla caecula*, *Ampelisca brevisimulata*, *Orchomene decipiens*, *Nicippe tumida*, *Ampelisca pugetica*, *Lysianassa holmesii*, *Paraphoxus robustus*, *Pardisynopia synopiae*, and *Lysianassa oculata* (the latter is number 22 in Monterey Bay). Because all of those species do occur in low frequency in Monterey Bay, this poor comparison is probably a circumstance of low sampling frequency. These data also indicate that shallow waters of Monterey Bay, despite the occurrence of upwelling, are too warm for the occurrence of deep-water species.

A 50 percent correspondence in predominant species occurring both on the Monterey deep shelf and in southern California depths of 75 to 92 m also occurs (table 5). Some deep-water species, i.e., *Nicippe tumida* and *Pardisynopia synopiae*, occur dominantly in the southern California section but not in Monterey Bay.

Only 8 of the 20 predominant species occurring in depths of 57 to 73 m also predominate in Monterey Bay. Similarly, neither *Nicippe tumida* nor *Urothoe varvarini* are abundant in Monterey Bay (table 4). The same is true in depths of 39 to 55 m (table 3).

These poor faunal congruencies may result from the low densities of the individual species in the Monterey samples. For instance,

the 20 species of Monterey Bay occurring most frequently (1–21, less 3) tally 220 individuals per m², whereas they tally 493 individuals in southern California depths of 75–92 and 94–183 m. The frequency of the 20th most abundant species in Monterey Bay is 2.4 individuals whereas the 20th of southern California is about 7.0 individuals per m². Fifty-eight species occur on the deep shelf of Monterey but more than 110 species occur in depths of 75 to 183 m in southern California. Of the 110 southern California species, 12 have frequencies of less than 0.2 individuals per m² and 39 have less than 1.0 individuals. This demonstrates the influence of sampling frequency.

All 58 species of the Monterey deep shelf occur in southern California except for *Centromedon pavor* and *Protomedeia penates*. In shallow waters, only *Eohaustorius sencillus* (of 23 species not found in the deep zone) is not recorded from southern California. This strong relationship is a result of the extreme intermixture of northern and southern elements in the fauna of southern California. Perhaps the intermixture results from southward range extensions of northern species inhabiting areas of upwelling.

On the other hand, many of the Amphipoda of Monterey Bay were not collected in the survey of Baja California (Barnard, 1964a). Thirty-seven open-sea samples were collected there, an effort comparable to that of Monterey Bay. A comparison of Monterey Bay and Baja California probably suffers the effects of small numbers of samples more than would a comparison between a large and a small number. The sampling stations of Baja California were scattered throughout 300 km of the coastal length and occurred in a variety of environments. Approximately 113 species occur in the fauna of Monterey Bay and Baja California, but only 61 species occur in both areas. The remaining species are listed in groups of northern and southern species in tables 7 and 8.

These data provide an estimate of the northern or southern affinities of more than 100 of the 167 species of Amphipoda occurring on the benthos of southern California. A large share of the species occurs in all three areas. Records from the literature supply information for some of the other Amphipoda, and a few species are assigned to regions by determining the general distribution of their genera. Facts and approximations are combined in a checklist of species from southern California (table 9). Only those species with detectable affinities are annotated with appropriate statements. The southern California fauna is estimated to be comprised of 24 percent northern or cold-water species, 13 percent southern or warm-water species, 5 percent bathyal affinity, and 58 percent interregional or poorly known distribution. Northern species occur generally in deep water, southern species in shallow water, and ubiquitous species in one or

both. The percentages support the conclusion that southern California lies at the northern end of the warm-temperate province but that the deep-water shelf is inhabited primarily by submergent cold-temperate species.

Presumably 16 species of table 8, marked with asterisks, represent northeastern Pacific endemic boreal elements which may be found throughout the Oregon province (in shallow depths in the northern portion). Approximately 28 (35 percent) of the 81 known species of Monterey Bay are of cold-temperate distribution. Purely tropical influence is small. The remaining species are of presumed warm-temperate affinities.

The intertidal zone of California north of Point Conception has several cold-temperate species (Barnard, MS), whereas the middepths of Monterey Bay and southern California have very few, if any, of these elements. These facts indicate that amphipodan distributions are strongly controlled by temperature and that a wide latitude of ecothermic response is possible for mud-bottom species through submergence because of substrate similarities between shallow and deep waters. The floral substrates of intertidal waters have a narrow range of submergence owing to the absence of illumination in deep waters. Thus phycophilous Amphipoda cannot submerge to the extent of their mud-bottom congeners. The thermal tolerances of the cold-temperate intertidal species must therefore be greater than those of mud dwellers. The temporal evolution of these intertidal distributions may be favorably controlled by the occurrence of a wide variety of available niches and an extensive food supply.

Northwestern Pacific Relationships

Only 12 of the 81 species of Monterey Bay have been found in the northwestern Pacific region embracing the Japan Sea, Okhotsk Sea, and Bering Sea (table 10). Two of those species, *Argissa hamatipes* and *Nicippe tumida*, may be cosmopolitan in cold water. They may submerge to great depths in the tropics, the former possibly occurring even in shallow tropical seas. *Leucothoe spinicarpa* is a eurybathic cosmopolite occurring in sponges. The genus *Anonyx* is enormously diverse in the northwestern Pacific region but declines in diversity by southerly increments. Only 2 species of *Anonyx* occur in California, south of Monterey Bay. *Corophium uenoi* rarely occurs in the open sea of California, but it is abundant in lagoons and estuaries (Newport Bay, Morro Bay) and may have been introduced from Japan in oyster transplants. The remaining 7 species of table 10, with the exception of *Ampelisca macrocephala* and *Paraphoxus obtusidens*, are scarce on the Monterey shelf. Probably they submerge or are depleted to the south of southern California. *Ampelisca macrocephala*

is an extremely abundant deep-shelf species in California and is replaced in bathyal depths by its anoculate subspecies, *A. m. unsocalae*. *Paraphoxus obtusidens* is a paneastern Pacific eurythermal species ranging from the subarctic into the tropics. It scarcely submerges to the south, but it may occur in warm latitudes primarily in areas of upwelling.

TABLE 1.—Metric depths of stations in Monterey Bay shown in figure 1 (uncorrected for tidal levels).

Station	Depth	Station	Depth	Station	Depth
6425	24	6444	17	6459	84
6426	54	6445	25	6460	87
6427	63	6446	52	6462	85
6428	61	6447	63	6463	87
6429	73	6448	55	6464	82
6430	78	6449	35	6465	93
6431	93	6450	34	6466	106
6432	98	6451	56	6469	109
6433	107	6452	53	6471	139
6435	116	6453	24	6474	115
6438	97	6454	15	6477	107
6439	67	6455	76	6478	101
6440	19	6456	77	6479	96
6442	24	6457	75	6480	103
6443	38	6458	80		

TABLE 2.—Frequency of 58 species of Amphipoda in Monterey Bay in depths of 50–139 m, with percent of restriction of each species to this depth zone (third species, based on 33 samples, eliminated in all calculations described in text; NSS = not statistically significant).

Name of species	Individuals per m ²	Percent of specimens collected between 50 and 139 m	Present in no. of samples
<i>Paraphoxus fatigans</i>	73	76	18
(kind 1)	(13)	(39)	(6)
(kind 2)	(61)	(94)	(17)
<i>Paraphoxus bicuspidatus</i>	24	100	17
<i>Kermystheus ociosa</i> NSS	14	100	4
<i>Phoxocephalus homilis</i>	13	100	6
<i>Photis lacia</i>	12	100	8
<i>Paraphoxus similis</i>	12	87	12
<i>Photis californica</i>	11	100	2
<i>Ampelisca macrocephala</i>	10	96	19
<i>Heterophoxus oculatus</i>	9.7	95	15
<i>Byblis veleronis</i>	9.6	100	22
<i>Ampelisca romigi</i>	8.8	100	2
<i>Metaphoxus frequens</i>	7.3	80	15
<i>Paraphoxus obtusidens</i>	4.4	94	10
<i>Ampelisca compressa</i>	4.1	100	10
<i>Paraphoxus variatus</i>	3.9	60	4
<i>Aoroides columbiae</i>	3.6	27	6
<i>Ampelisca cristata</i>	3.2	70	7
<i>Synchelidium</i> sp. A	2.9	100	9

TABLE 2.—Frequency of 58 species of Amphipoda in Monterey Bay in depths of 50–139 m, with percent of restriction of each species to this depth zone (third species, based on 33 samples, eliminated in all calculation described in text; NSS=not statistically significant)—Continued

Name of species	Individuals per m ²	Percent of specimens collected between 50 and 139 m	Present in no. of samples
<i>Anonyx adoxus</i>	2.7	100	1
<i>Urothoe varvarini</i>	2.6	100	4
<i>Protomedeia articulata</i>	2.4	73	9
<i>Lysianassa oculata</i>	2.3	100	9
<i>Hippomedon denticulatus</i>	2.1	88	6
<i>Synchelidium</i> sp. G	2.1	82	6
<i>Ampelisca pacifica</i>	2.0	100	6
<i>Ampelisca pugetica</i>	2.0	21	7
<i>Monoculodes emarginatus</i>	2.0	100	6
<i>Paraphoxus robustus</i>	2.0	100	6
<i>Listriella goleta</i>	1.8	92	10
<i>Orchomene pacifica</i>	1.7	100	2
<i>Nicippe tumida</i>	1.5	100	5
<i>Pardisynopia synopiae</i>	1.5	100	3
<i>Dexamonica reduncans</i>	1.4	100	3
<i>Orchomene decipiens</i>	1.4	100	4
<i>Westwoodilla caecula</i>	1.2	100	6
<i>Ampelisca hancocki</i>	1.1	100	4
<i>Photis brevipes</i>	1.1	6	4
<i>Opisa tridentata</i>	0.9	100	2
<i>Melita desdichada</i>	0.8	100	2
<i>Ampelisca brevisimulata</i>	0.6	100	3
<i>Metaphoxus fultoni</i>	0.6	50	1
<i>Paraphoxus epistomus</i>	0.6	100	1
<i>Ampelisca milleri</i>	0.5	100	1
<i>Acidostoma hancocki</i>	0.3	100	1
<i>Lysianassa holmesi</i>	0.3	100	2
<i>Centromedon pavor</i>	0.3	100	1
<i>Lepidepecreum gurjanovae</i>	0.3	100	2
<i>Maera danae</i>	0.3	100	1
<i>Pachynus barnardi</i>	0.3	100	1
<i>Prachynella lodo</i>	0.3	100	2
<i>Synchelidium shoemakeri</i>	0.3	100	1
<i>Anonyx carinatus</i>	0.2	100	1
<i>Argissa hamatipes</i>	0.2	100	1
<i>Microdeutopus schmitti</i>	0.2	0+	1
<i>Photis macrotica</i>	0.2	100	1
<i>Protomedeia penates</i>	0.2	100	1
<i>Stenothoe freccanda</i>	0.2	100	1
<i>Synchelidium</i> sp. E	0.2	100	1

Other species from Monterey Bay found in shallow water: *Ampelisca lobata*, *Amphilocheus picadurus*, *Bathymedon roquedo*, *Corophium uenoi*, *Eohaustorius sencillus*, *Erichthonius brasiliensis*, *Eurystheus thompsoni*, *Ischyrocerus litotes*, *Leucothoe alata*, *Leucothoe spinicarpa*, *Liljeborgia kinahani*, *Listriella diffusa*, *Maera simile*, *Megaluropus longimerus*, *Megamphopus mamolus*, *Metopella aporpis*, *Monoculodes norvegicus*, *Monoculodes spinipes*, *Panoploea rickettsi*, *Parapleustes pugettensis*, *Photis bifurcata*, *Podocerus cristatus*, *Tiron biocellata*.

TABLE 3.—The most abundant species in depths of 39–55 m in southern California.

Species	Individuals per m ²	Species	Individuals per m ²
<i>Ampelisca brevisimulata</i>	68	<i>Listriella goleta</i>	14
<i>Heterophoxus oculatus</i>	58	<i>Paraphoxus obtusidens</i>	14
<i>Paraphoxus bicuspidatus</i>	44	<i>Ampelisca pacifica</i>	14
<i>Amphideutopus oculatus</i>	41	<i>Paraphoxus epistomus</i>	14
<i>Paraphoxus similis</i>	36	<i>Ampelisca pugetica</i>	11
<i>Metaphoxus frequens</i>	33	<i>Ampelisca compressa</i>	11
<i>Ampelisca cristata</i>	32	<i>Byblis veleronis</i>	8. 0
<i>Photis brevipes</i>	19	<i>Lysianassa oculata</i>	7. 7
<i>Photis californica</i>	19	<i>Podocerus cristatus</i>	7. 3
<i>Photis lacia</i>	17	<i>Paraphoxus stenodes</i>	7. 0

TABLE 4.—The most abundant species in depths of 57–73 m in southern California.

Species	Individuals per m ²	Species	Individuals per m ²
<i>Paraphoxus bicuspidatus</i>	134	<i>Amphideutopus oculatus</i>	12
<i>Ampelisca brevisimulata</i>	63	<i>Ampelisca indentata</i>	11
<i>Heterophoxus oculatus</i>	51	<i>Photis lacia</i>	11
<i>Paraphoxus similis</i>	45	<i>Ampelisca cristata</i>	9. 8
<i>Metaphoxus frequens</i>	35	<i>Lysianassa oculata</i>	9. 6
<i>Ampelisca pacifica</i>	31	<i>Ampelisca macrocephala</i>	9. 0
<i>Ampelisca pugetica</i>	21	<i>Nicippe tumida</i>	8. 8
<i>Byblis veleronis</i>	15	<i>Urothoe varvarini</i>	8. 6
<i>Photis brevipes</i>	15	<i>Paraphoxus robustus</i>	8. 3
<i>Protomedeia articulata</i>	13	<i>Lysianassa holmesi</i>	7. 4

TABLE 5.—The most abundant species in depths of 75–92 m in southern California.

Species	Individuals per m ²	Species	Individuals per m ²
<i>Paraphoxus bicuspidatus</i>	125	<i>Photis lacia</i>	24
<i>Metaphoxus frequens</i>	35	<i>Byblis veleronis</i>	15
<i>Ampelisca macrocephala</i>	34	<i>Lysianassa holmesi</i>	11
<i>Ampelisca pacifica</i>	33	<i>Photis californica</i>	11
<i>Ampelisca brevisimulata</i>	31	<i>Lysianassa oculata</i>	11
<i>Heterophoxus oculatus</i>	27	<i>Paraphoxus obtusidens</i>	10
<i>Ampelisca pugetica</i>	26	<i>Phoxocephalus homilis</i>	10
<i>Paraphoxus similis</i>	25	<i>Ampelisca hancocki</i>	8. 6
<i>Paraphoxus robustus</i>	25	<i>Pardisynopia synopiae</i>	8. 6
<i>Urothoe varvarini</i>	25	<i>Nicippe tumida</i>	8. 3

TABLE 6.—The most abundant species in depths of 94–183 m in southern California.

Species	Individuals per m ²	Species	Individuals per m ²
<i>Paraphoxus bicuspidatus</i>	98	<i>Orchomene decipiens</i>	12
<i>Ampelisca macrocephala</i>	84	<i>Nicippe tumida</i>	11
<i>Ampelisca romigi</i>	45	<i>Ampelisca pugetica</i>	10
<i>Heterophoxus oculatus</i>	35	<i>Protomedeia articulata</i>	9.6
<i>Metaphoxus frequens</i>	33	<i>Lysianassa holmesi</i>	9.2
<i>Photis lacia</i>	27	<i>Paraphoxus similis</i>	8.6
<i>Ampelisca pacifica</i>	21	<i>Paraphoxus robustus</i>	8.3
<i>Phoxocephalus homilis</i>	19	<i>Urothoe varvarini</i>	8.1
<i>Westwoodilla caecula</i>	16	<i>Pardisynopia synopiae</i>	7.1
<i>Ampelisca brevisimulata</i>	13	<i>Lysianassa oculata</i>	6.5

TABLE 7.—Amphipoda of Baja California not recorded from Monterey Bay (species marked with asterisks probably occur in both areas but were absent in the collections).

<i>Acuminodeutopus heteruropus</i>	<i>Megamphopus martesia</i> (intertidal N of Point Conception)
<i>Ampelisca indentata</i>	* <i>Melphisana bola</i>
<i>Ampelisca mexicana</i>	<i>Metopa dawsoni</i>
<i>Ampelisca shoemakeri</i>	<i>Monoculodes hartmanae</i>
<i>Ampelisca venetiensis</i>	<i>Ocosingo borlus</i> (intertidal N of Point Conception)
<i>Amphideutopus oculatus</i>	<i>Orchomene magdalenensis</i>
<i>Ampithoe ramondi</i>	<i>Paraphoxus stenodes</i>
<i>Cheiriphotis megacheles</i>	<i>Photis viuda</i>
<i>Chevalia aviculae</i>	<i>Platyischnopus metagracilis</i>
<i>Elasmopus antennatus</i>	<i>Platyischnopus viscana</i>
<i>Eusiroides monoculoides</i>	<i>Podocerus brasiliensis</i>
<i>Gaviota podophthalma</i>	<i>Pontogeneia quinsana</i>
<i>Gitana calitemplado</i>	<i>Pseudokoroga rima</i>
* <i>Listriella albina</i>	<i>Rudilemboides stenopropodus</i>
* <i>Listriella eriopisa</i>	<i>Stenopleustes monocuspis</i>
* <i>Listriella melanica</i>	<i>Stenothoides bicoma</i>
<i>Lembos audbetti</i>	
<i>Lysianassa dissimilis</i>	
<i>Megaluropus ?agilis</i>	
<i>Megamphopus effrenus</i> (intertidal N of Point Conception)	

TABLE 8.—Amphipoda of Monterey Bay not recorded from coastal shelf of Baja California; some species may occur on the slope in depths exceeding 100 m (asterisks mark possible northeastern Pacific cold-temperate species of the coastal shelf).

<i>Anonyx adoxus</i>	<i>Monoculodes norvegicus</i>
* <i>Anonyx carinatus</i>	* <i>Monoculodes spinipes</i>
* <i>Centromedon pavor</i>	* <i>Opisa tridentata</i>
<i>Corophium uenoi</i>	<i>Orchomene pacifica</i>
* <i>Dexamonica reduncans</i>	* <i>Paraphoxus similis</i>
* <i>Eohaustorius sencillus</i>	* <i>Parapleustes pugettensis</i>
* <i>Kermystheus ociosa</i>	* <i>Photis lacia</i>
* <i>Lepidepcreum gurjanovae</i>	* <i>Stenothoe freccanda</i>
* <i>Lysianassa holmesi</i>	* <i>Protomedeia penates</i>
* <i>Lysianassa oculata</i>	<i>Urothoe varvarini</i>
* <i>Megamphopus mamolus</i>	

TABLE 9.—Benthic Amphipoda of the coastal shelf of southern California in depth classes of 9–18, 19–37, 38–55, 56–73, 74–92, and 93–183 m, from a survey of 348 samples (occurrences of the species in the surveys of Monterey Bay and Baja California are shown; other significant records are listed for various species, and the presumed affinities where significant, are stated).

Name of species	Monterey	Baja California	Literature records	Probable affinity	Southern California metric depth class
<i>Acidostoma hancocki</i>	x	sp. x		Northern	18–183
<i>Acuminodeutopus heteruopus</i>		x		Southern	18–92
<i>Allorchestes angustus</i>			Oregon	Northern	18
<i>Ampelisca brevisimulata</i>	x	x			18–183
<i>Ampelisca compressa</i>	x	x			18–183
<i>Ampelisca cristata</i>	x	x			18–183
<i>Ampelisca furcigera</i>			Okhotsk, Bering	Northern	183
<i>Ampelisca hancocki</i>	x	x			18–183
<i>Ampelisca indentata</i>		x		Southern	37–92
<i>Ampelisca lobata</i>	x	x			18–92
<i>Ampelisca macrocephala</i>	x	x	Cold-temperate	Northern	18–183
<i>Ampelisca milleri</i>	x	x			37–183
<i>Ampelisca pacifica</i>	x	x			18–183
<i>Ampelisca pugetica</i>	x	x			18–183
<i>Ampelisca romigi</i>	x	x			37–183
<i>Amphideutopus oculatus</i>		x		Southern	18–183
<i>Amphilochus neapolitanus</i>		x	Tropicopolitan	Southern	18
<i>Amphilochus picadurus</i>		x			18–37
<i>Ampithoe plumulosa</i>					18
<i>Ampithoe simulans</i>			Oregon	Northern	18
<i>Anonyx carinatus</i>	x			Northern	55–183
<i>Aoroides columbiae</i>	x	x			18–183
<i>Argissa hamatipes</i>		x			18–183
<i>Atylus tridens</i>			British Columbia	Northern	18
<i>Batea transversa</i>				Southern	18–37
<i>Bathymedon pumilus</i>				Bathyal	73–183
<i>Bathymedon roquedo</i>				Bathyal	92–183
<i>Bruzelia tuberculata</i>			Cold-temperate	Northern	183
<i>Byblis veleronis</i>	x	x			37–183
<i>Ceradocus spinicaudus</i>			Oregon	Northern	18
<i>Cerapus tubularis</i>		x			18–55
<i>Cheiriphotis megacheles</i>		x	Tropicopolitan	Southern	18
<i>Chevalia aviculae</i>		x	Tropicopolitan	Southern	18
<i>Corophium acherusicum</i>					18

TABLE 9.—Benthic Amphipoda of the coastal shelf of southern California in depth classes of 9–18, 19–37, 38–55, 56–73, 74–92, and 93–183 m, from a survey of 348 samples (occurrences of the species in the surveys of Monterey Bay and Baja California are shown; other significant records are listed for various species, and the presumed affinities where significant, are stated)—Continued

Name of species	Monterey	Baja California	Literature records	Probable affinity	Southern California metric depth class
<i>Corophium baconi</i>		x			18–55
<i>Corophium uenoi</i>	x		Japan	Northern	18
<i>Deramonica reduncans</i>	x			Northern	55–183
<i>Dulichia monacantha</i>			Cold-temperate	Northern	92
<i>Elasmopus antennatus</i>		x			18–73
<i>Eohaustorius sencillus</i>	x			Northern	18
<i>Eohaustorius washingtonianus</i>				Northern	18–37
<i>Ericthonius brasiliensis</i>	x	x			18–183
<i>Ericthonius hunteri</i>			Cold-temperate	Northern	73–183
<i>Eurystheus thompsoni</i>	x	x			18–183
<i>Garosyrroe bigarra</i>					55
<i>Gaviota podophthalma</i>		x		Southern	18–73
<i>Gitana calitemplado</i>		x			18–55
<i>Gitanopsis vilordes</i>					18
<i>Haploops spinosa</i>			Cold-temperate	Northern	183
<i>Harpiniopsis epistomata</i>				Bathyal	92–183
<i>Harpiniopsis fulgens</i>				Bathyal	183
<i>Harpiniopsis galera</i>				Bathyal	92–183
<i>Heterophilias seclusus</i>			American tropical	Southern	18
<i>Heterophoxus oculatus</i>	x	x			18–183
<i>Hippomedon denticulatus</i>	x	x	Cold-temperate	Northern	18–183
<i>Hyale rubra frequens</i>					18
<i>Ischyrocerus litotes</i>	x	x			18–183
<i>Ischyrocerus pelagops</i>		x			18–37
<i>Jassa falcata</i>					18
<i>Kermystheus ociosa</i>	x				37–183
<i>Lembos audbetti</i>		x		Southern	55–92
<i>Lembos concavus</i>				Southern	18
<i>Lepidepcreum garthi</i>				Northern	92–183
<i>Lepidepcreum gurjanovae</i>	x			Northern	18–183
<i>Leucothoe alata</i>	x	x			18
<i>Leucothoe spinicarpa</i>	x	x			18–183
<i>Leucothoides pacifica</i>				Southern	18
<i>Liljeborgia brevicornis</i>				Northern	18
<i>Listriella albina</i>		x			18–183
<i>Listriella diffusa</i>	x	x			18–92
<i>Listriella eriopisa</i>		x			18–183
<i>Listriella goleta</i>	x	x			18–183
<i>Listriella melanica</i>		x			18–183
<i>Lysianassa dissimilis</i>		x			18
<i>Lysianassa holmesi</i>	x				18–183
<i>Lysianassa oculata</i>	x				18–183
<i>Maera danae</i>	x		Cold-temperate	Northern	183
<i>Maera simile</i>	x	x	Oregon	Northern	18–183
<i>Mandibulophorus uncistrostratus</i>			Indo-Pacific	Southern	18
<i>Megaluropus longimerus</i>	x	x			18–37
<i>Megamphopus mamolus</i>	x				18
<i>Megamphopus marteia</i>		x		Southern	18
<i>Melita dentata</i>			Cold-temperate	Northern	18
<i>Melita desdichada</i>	x	x			55, 183
<i>Melphisana bola</i>		x			18–73
<i>Metaceradocus occidentalis</i>				Southern	18–73
<i>Metaphorus frequens</i>	x	x			18–183
<i>Metaphorus fultoni</i>	x	x			18–183
<i>Metopa dawsoni</i>		x			55–183

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Name of species	Monterey	Baja California	Literature records	Probable affinity	Southern California metric depth class
<i>Metopella aorpiis</i>	x	x			92–183
<i>Microdeutopus schmitti</i>	x	x			18–55
<i>Monoculodes emarginatus</i>	x	x			55–183
<i>Monoculodes hartmanae</i>		x			18–183
<i>Monoculodes murrius</i>					18–92
<i>Monoculodes norvegicus</i>	x		Cold-temperate	Northern	37–183
<i>Najna ?consiliorum</i>			Japan Sea	Northern	18
<i>Neomegamphopus roosevelti</i>			Baja California	Southern	18
<i>Netamelita cortada</i>					18
<i>Nicippe tumida</i>	x	x		Bathyal	37–183
<i>Ocosingo borlus</i>		x			"Shallow"
<i>Opisa tridentata</i>	x			Northern	18–183
<i>Orchomene anaquela</i>					37–92
<i>Orchomene decipiens</i>	x	x(sp.)			18–183
<i>Orchomene magdalenensis</i>		x		Southern	18
<i>Orchomene pacifica</i>	x		Northwest Pacific	Northern	55–183
<i>Pachynus barnardi</i>	x	x			18–183
<i>Panaploea rickettsi</i>	x	x			183
<i>Parajassa angularis</i>					18
<i>Parametopella ninis</i>					18–183
<i>Paraphoxus abronius</i>					18–92
<i>Paraphoxus bicuspidatus</i>	x	x			18–183
<i>Paraphoxus cognatus</i>					Pelagic
<i>Paraphoxus daboius</i>					18–183
<i>Paraphoxus epistomus</i>	x	x			18–183
<i>Paraphoxus fatigans</i>	x	x			18–183
<i>Paraphoxus floridanus</i>			Florida	Southern	18–55
<i>Paraphoxus heterocuspidatus</i>					18–55
<i>Paraphoxus jonesi</i>					18
<i>Paraphoxus lucubrans</i>					18–92
<i>Paraphoxus obtusidens</i>	x	x			18–183
<i>Paraphoxus oculatus</i>			Cold-temperate	Northern	183
<i>Paraphoxus robustus</i>	x	x			18–183
<i>Paraphoxus similis</i>	x				18–183
<i>Paraphoxus spinosus</i>					18–183
<i>Paraphoxus stenodes</i>		x			18–92
<i>Paraphoxus tridentatus</i>					18–37
<i>Paraphoxus variatus</i>	x	x			18–92
<i>Parapleustes oculatus</i>				Northern	183
<i>Parapleustes pugettensis</i>					18–183
<i>Pardaliscella symmetrica</i>				Bathyal	92–183
<i>Pardisynopia synopiae</i>	x	x		Bathyal	55–183
<i>Photis bifurcata</i>	x	x			18–92
<i>Photis brevipes</i>	x	x			18–183
<i>Photis californica</i>	x	x			18–92
<i>Photis lacia</i>	x			Northern	18–183
<i>Photis macrotica</i>	x	x			55–183
<i>Phoxocephalus homilis</i>	x	x			73–183
<i>Platyschnopus viscana</i>		x	Baja California	Southern	18
<i>Pleustes platypa</i>			Rare So. Calif.	Northern	18
<i>Podocerus brasiliensis</i>		x	Tropicopolitan	Southern	18
<i>Podocerus cristatus</i>	x	x			18–183
<i>Polycheria antarctica</i>					18
<i>Pontogeneia rostrata</i>			Northwest Pacific	Northern	18
<i>Prachynella lodo</i>	x	x			37–183

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Name of species	Monterey	Baja California	Literature records	Probable affinity	Southern California metric depth class
<i>Protomedeia articulata</i>	x	x		Northern	18–183
<i>Pseudokoroga rima</i>		x		Southern	18
<i>Rhachotropis inflata</i>			Cold-temperate	Northern	183
<i>Rhachotropis oculata</i>	x		Cold-temperate	Northern	73–183
<i>Rudilemboides stenopropodus</i>					18–73
<i>Schisturella cocula</i>				Bathyal	183
<i>Socarnes illudens</i>		x		Northern	183
<i>Stenopleustes monocuspis</i>		x		Southern	73–183
<i>Stenothoe freccanda</i>	x				55–183
<i>Stenothoides bicoma</i>		x			18–183
<i>Stenula modosa</i>					73–183
<i>Sympleustes subglaber</i>			Genus northern	Northern	18–183
<i>Synchelidium rectipalmmum</i>					18–183
<i>Synchelidium shoemakeri</i>	x				18–183
<i>Synchelidium</i> sp. A	x				18–183
<i>Synchelidium</i> sp. E	x				18–183
<i>Synchelidium</i> sp. G	x				18–183
<i>Tiron biocellata</i>	x	x			18–183
<i>Uristes entalladurus</i>			Baja California		18
<i>Urothoe varvarini</i>	x		North Pacific	Northern	37–183
<i>Westwoodilla caecula</i>	x	x	Cold-temperate	Northern	18–183

TABLE 10.—Amphipoda of Monterey Bay recorded from the northwestern Pacific Ocean.

Depths of 15–49 m	Depths of 50–139 m
<i>Corophium uenoi</i>	<i>Ampelisca macrocephala</i>
<i>Leucothoe spinicarpa</i>	<i>Argissa hamatipes</i>
<i>Monoculodes norvegicus</i>	<i>Hippomedon denticulatus</i>
	<i>Maera danae</i>
	<i>Nicippe tumida</i>
	<i>Orchomene pacifica</i>
	<i>Paraphoxus obtusidens</i>
	<i>Westwoodilla caecula</i>
	<i>Urothoe varvarini</i>

Family Acanthonotozomatidae

Panoploea rickettsi Shoemaker

Panoploea rickettsi Shoemaker, 1931, pp. 1–5, figs. 1, 2.—Barnard, 1964a, p. 212.

Material: 6425 (1).

Distribution: Monterey Bay to San Quintin Bay, Baja California, 10–92 m.

Family Ampeliscidae

Ampelisca brevisimulata Barnard

Ampelisca brevisimulata Barnard, 1954a, pp. 33–35, pls. 23, 24; 1964a, p. 212.

Material: 6433 (1), 6435 (2), 6471 (1).

Distribution: Caribbean Sea and eastern Pacific Ocean from Panama to Monterey Bay, 11–172 m.

Ampelisca compressa Holmes

Ampelisca compressa.—Barnard, 1960a, pp. 31–32; 1964a, p. 213.

Material: 6427 (1), 6428 (4), 6429 (2), 6430 (3), 6435 (1), 6447 (9), 6448 (2), 6451 (1), 6452 (2), 6471 (2).

Distribution: Western Atlantic Ocean, Caribbean Sea, eastern Pacific Ocean from Panama to Puget Sound, Washington, 1–266 m.

Ampelisca cristata Holmes

Ampelisca cristata.—Barnard, 1954a, pp. 26–28, pls. 17, 18; 1964a, p. 213.

Material: 6426 (3), 6427 (7), 6428 (1), 6429 (5), 6430 (2), 6446 (1), 6447 (2), 6449 (2), 6450 (1), 6453 (5).

Distribution: Caribbean Sea and eastern Pacific Ocean from Ecuador to Tomales Bay, California, 6–152 m.

Ampelisca hancocki Barnard

Ampelisca hancocki Barnard, 1954a, pp. 37–38, pl. 26; 1964a, p. 213.

Material: 6433 (1), 6451 (1), 6465 (1), 6471 (2), 6474 (2).

Distribution: Eastern Pacific Ocean from Monterey Bay to Costa Rica, 9–157 m.

Ampelisca lobata Holmes

FIGURE 2a

Ampelisca lobata.—Barnard, 1954a, pp. 11–14, pls. 5, 6; 1964a, p. 214.

Material: 6425 (24).

Distribution: Caribbean Sea, eastern Pacific Ocean from Ecuador and the Galapagos Islands to Monterey Bay, 0–183 m.

Ampelisca macrocephala (Liljeborg)

Ampelisca macrocephala.—Barnard 1954a, pp. 41–43, pl. 29; 1960a, pp. 28–30, fig. 7; 1964a, p. 214.

Material: 6426 (1), 6427 (2), 6428 (1), 6430 (3), 6431 (2), 6432 (4), 6433 (9), 6435 (14), 6438 (2), 6443 (2), 6446 (2), 6450 (1), 6451 (1), 6455 (2), 6460 (1), 6464 (3), 6465 (1), 6466 (3), 6470 (4), 6471 (12), 6478 (1).

Distribution: Subarctic-boreal in the North Atlantic and North Pacific Oceans, submerging in waters of low latitudes, 5–1686 m.

Ampelisca milleri Barnard

Ampelisca milleri Barnard, 1954a, pp. 9–11, pls. 3, 4; 1964a, p. 215.

Material: 6474 (3).

Distribution: Eastern Pacific Ocean from Ecuador and the Galapagos Islands to San Francisco Bay, California, 15–187 m in the open sea, from shallow water in San Francisco Bay.

Ampelisca pacifica Holmes

Ampelisca pacifica.—Barnard 1954a, pp. 31–33, pls. 21, 22; 1964a, p. 215.

Material: 6432 (3), 6458 (4), 6466 (2), 6471 (2), 6477 (1), 6478 (1).

Distribution: Caribbean Sea, eastern Pacific Ocean from Panama to Monterey Bay, California, 24–183 m.

Ampelisca pugetica Stimpson

Ampelisca pugetica.—Barnard 1954a, pp. 49–51, pls. 35, 36; 1960a, p. 31, fig. 9; 1964a, p. 215.

Material: 6425 (46), 6426 (1), 6427 (3), 6428 (2), 6430 (2), 6447 (3), 6452 (1), 6463 (1).

Distribution: Caribbean Sea, eastern Pacific Ocean from Peru to Puget Sound, Washington, 9–183 m.

Ampelisca romigi Barnard

Ampelisca romigi Barnard, 1954a, pp. 18–20, pls. 10, 11; 1960a, p. 34; 1964a, pp. 215–216.

Material: 6471 (10), 6474 (48).

Distribution: Caribbean Sea, eastern Pacific Ocean from Ecuador to Monterey Bay, 3–504 m.

Byblis veleronis Barnard

Byblis veleronis Barnard, 1954a, pp. 52–54, pls. 37, 38; 1964a, p. 216.

Material: 6426 (1), 6428 (3), 6429 (2), 6430 (4), 6431 (2), 6432 (8), 6433 (2), 6435 (2), 6438 (2), 6447 (1), 6451 (5), 6452 (3), 6455 (4), 6458 (2), 6462 (1), 6464 (2), 6465 (1), 6466 (6), 6470 (2), 6471 (3), 6474 (6), 6480 (1).

Distribution: Monterey Bay to the Gulf of California, 31–422 m.

Family Amphilochidae

Amphilochus picadurus Barnard

Amphilochus picadurus Barnard, 1962c, pp. 126–129, fig. 4; 1964a, p. 217.

Material: 6425 (4).

Distribution: Monterey Bay to southern California, 33° N., 4–41 m.

Family Aoridae

Aoroides columbiae Walker

Aoroides columbiae Barnard, 1961, p. 180; 1964a, pp. 217–218.

Material: 6425 (57), 6432 (2), 6433 (2), 6435 (2), 6440 (1), 6445 (8), 6470 (1), 6471 (6), 6474 (11).

Distribution: Puget Sound, Washington to San Quintin Bay, Baja California, 0–180 m.

Microdeutopus schmitti Shoemaker

Microdeutopus schmitti Shoemaker, 1942, pp. 18–21, fig. 6; 1959a, pp. 32–33, pl. 9; 1961, p. 180; 1964a, p. 218.

Material: 6425 (419), 6425 (1).

Distribution: Monterey Bay to Cape San Lucas, Baja California, 0–43 (65?) m.

Family Corophiidae

Corophium uenoi Stephensen

Corophium uenoi Stephensen, 1932, pp. 494–498, figs. 3, 4.—Barnard, 1952, pp. 28–32, pls. 8, 9; 1959a, p. 39.—Nagata, 1960, p. 178.—Barnard, 1961, p. 183; 1964b, p. 112, chart 16.

Material: 6425 (3).

Distribution: Japan; eastern Pacific Ocean from Monterey Bay at 24 m depth, to San Quintin Bay, Baja California, rarely occurring in the open sea, more often in lagoons or estuaries such as Morro Bay, Newport Bay, and San Quintin Bay, intertidal to 2 m.

Erichthonius brasiliensis (Dana)

Erichthonius brasiliensis.—Barnard 1955a, pp. 37–38; 1959a, p. 39; 1961, p. 183; 1964a, p. 219.

Material: 6425 (69), 6445 (2).

Distribution: Cosmopolitan in tropical, warm-temperate and some boreal seas, 0–130 m.

Family Dexaminidae

Dexamonica reduncans Barnard

Dexamonica reduncans Barnard, 1958, pp. 130–132, pls. 26, 27.

Material: 6433 (2), 6471 (6), 6474 (1).

Distribution: Monterey Bay to southern California, 33° N, in Monterey Bay from 107 to 139 m in depth, in southern California from about 55 to 183 m.

Family Eusiridae

Rhachotropis oculata (Hansen)

FIGURES 2b-f

Rhachotropis oculata.—Stephensen, 1944, pp. 97-98.—Gurjanova, 1951, pp. 712-713, fig. 496.

Stebbing (1906) stated that the rostrum of this species is small. Although the heads of the specimens at hand resemble Hansen's figure reproduced by Gurjanova (1951), the rostra are long and hidden from lateral view by the first antennae. Article 3 of antenna 1 is not as short as or indistinct as that described by Stebbing or figured by Hansen. Small specimens, difficult to separate from *R. inflata* Sars, may be distinguished by the produced corner of the second pleonal epimeron.

Material: Hancock *Velero* stations 1027 (2), 1149 (4), 4753 (1), 4772 (1), 4824 (1), 5615 (1), 5760 (1), 6001 (1), 6006 (1).

Records: Coastal shelf of southern California and Santa Catalina Island, 64-274 m, caught in benthic grabs and dredges, probably a demersal species infrequently collected in benthic closing devices.

Distribution: North Atlantic and North Pacific Oceans, Bering Sea, Okhotsk Sea, Japan Sea, 20-274 m. These are the southernmost records of this species in the eastern Pacific Ocean.

Family Gammaridae

Maera danae (Stimpson)

Maera danae.—Shoemaker, 1955, pp. 53-54 (with references).—Barnard, 1964b, pp. 108-109.

Maera loveni.—J. L. Barnard, 1962b, p. 103, fig. 19 (not Bruzelius).

Material: 6462 (2), 85 m.

Additional record: 4770 (1), southern California, 33°21' N., 117°34' W., 15 m.

Remarks: According to Shoemaker (1955) this species lacks an articulated spine at the palmar defining corner of gnathopod 2, but a spine is present on the specimens at hand, yet the second articles of pereopods 3-5 are broad, not slender as in *M. loveni*, and distinct eyes are present. Regardless of the gnathopodal spine, the specimens are identified as *M. danae*.

Distribution: North Atlantic and North Pacific Oceans, in the North Pacific known as far south as San Quintin Bay in shallow water but primarily a subarctic species submerging with depth toward the tropics, rather rare in southern California and usually occurring in depths of about 200 m.

***Maera simile* Stout**

Maera simile.—Barnard, 1959a, pp. 24–25, pl. 4; 1964a, p. 222.

Material: 6425 (1).

Distribution: Coos Bay, Oregon to San Quintin Bay, Baja California, 0–43 m.

***Megaluropus longimerus* Schellenberg**

Megaluropus longimerus.—Barnard, 1962b, p. 103, figs. 20, 21; 1964a, p. 224.

Material: 6440 (3), 6442 (3).

Distribution: Lagos, Nigeria; in the eastern Pacific Ocean from Monterey Bay to San Ramon Bay, Baja California, 10–108 m.

***Melita desdichada* Barnard**

Melita desdichada Barnard, 1962b, p. 110, fig. 22; 1964a, p. 224.

Material: 6455 (4), 6460 (1).

Distribution: Monterey Bay to San Ramon Bay, Baja California, 10–108 m.

Family Haustoriidae***Eohaustorius sencillus* Barnard**

Eohaustorius sencillus Barnard, 1962f, pp. 249–252, figs. 1, 2.

Material: 6444 (19), 6445 (1), 6454 (28).

Distribution: Monterey Bay to Point Conception, California, 14–25 m.

***Urothoe varvarini* Gurjanova**

Urothoe varvarini Gurjanova, 1953, pp. 219–221, figs. 3, 4.—Barnard, 1957, pp. 82–84.—Gurjanova, 1962, pp. 426–428, fig. 142.

Material: 6433 (1), 6438 (1), 6471 (6), 6474 (9).

Distribution: Northwestern Pacific Ocean, Japan Sea, Okhotsk Sea, 5–13 m; California from Monterey Bay to southern California at 33° N, 40–200+ m.

Family Isaeidae (=Photidae)***Eurystheus thompsoni* (Walker)**

Eurystheus thompsoni.—Barnard, 1959a, p. 36; 1961, p. 182; 1964a, p. 237.

Material: 6425 (44), 6445 (1).

Distribution: Puget Sound, Washington to Magdalena Bay, Baja California, 0–135 m.

***Kermystheus ociosa* Barnard**

Kermystheus ociosa Barnard, 1962a, p. 23, fig. 8.

Material: 6432 (2), 6435 (2), 6471 (7), 6474 (81).

Distribution: Monterey Bay to the coastal shelf of southern California between Point Conception and San Diego, 27–165 m.

***Megamphopus mamolus* Barnard**

Megamphopus mamolus Barnard, 1962a, pp. 23-26, fig. 9.

Material: 6425 (68), 6445 (9).

Distribution: Monterey Bay to Point Conception, California, at the latter in a red algal *Diopatra* bed, 16 m; at Monterey in depths of 24-25 m.

***Photis bifurcata* Barnard**

Photis bifurcata Barnard, 1962a, pp. 30-31, fig. 10; 1964a, p. 240.

Material: 6425 (332), 6445 (15).

Distribution: Monterey Bay to San Cristobal Bay, Baja California, 11-93 m.

***Photis brevipes* Shoemaker**

Photis brevipes Shoemaker, 1942, pp. 25-27, fig. 9.—Barnard, 1962a, pp. 31-33, fig. 11; 1964a, pp. 240-241.

Material: 6425 (58), 6445 (7), 6471 (2), 6477 (5).

Distribution: Coos Bay, Oregon to Magdalena Bay, Baja California, 0-135 m.

***Photis californica* Stout**

Photis californica.—Barnard, 1962a, pp. 33-36, figs. 12, 13; 1964a, p. 241.

Material: 6471 (12), 6474 (58).

Distribution: Monterey Bay to San Cristobal Bay, Baja California, 10-98 m, in southern California; maximum depth in Monterey Bay 139 m.

***Photis lacia* Barnard**

Photis lacia Barnard, 1962a, pp. 42-44, fig. 18.

Material: 6425 (4), 6430 (?), 6432 (2), 6433 (9), 6465 (1), 6469 (3), 6471 (34), 6474 (24), 6477 (2).

Distribution: Monterey Bay to southern California, 32° N, 9-146 m, abundant on the shelf in depths of 73-92 m (38 individuals per m²).

***Photis macrotica* Barnard**

Photis macrotica Barnard, 1962a, p. 44, fig. 19; 1964a, p. 241.

Material: 6474 (1).

Distribution: Monterey Bay to San Cristobal Bay, Baja California, 55-157 m.

***Protomedeia articulata* Barnard**

Protomedeia articulata Barnard, 1962a, pp. 48-50, fig. 21; 1964a, p. 242.

Material: 6426 (1), 6429 (1), 6438 (1), 6445 (6), 6455 (6), 6456 (1), 6457 (2), 6458 (2), 6466 (1), 6471 (?).

Distribution: Monterey Bay to San Quintin Bay, Baja California, 18-200+ m.

Protomedeia penates, new species

FIGURE 3

Diagnosis of male: Article 2 of gnathopod 1 lacking posterodistal swelling; article 7 of gnathopod 1 overlapping palm by more than 75 percent of its length, palm with triangular process and defined by one stout spine; palm of gnathopod 2 with defining tooth exceeding transverse palm and bearing small basal tooth anterior to it; inner ramus of uropod 3 slightly shorter than outer ramus.

Female: Gnathopods with oblique palms defined by large spines.

Notes: Article 2 of pereopod 5 has a small dorsoposterior tooth; pleonal epimeron 3 bears lateral setae, variable in extent and often absent, especially in males.

Holotype: Allan Hancock Foundation no. 5923, male 6.0 mm.

Type locality: White Gulch, Tomales Bay, California, sta. 1-59-10, June 29, 1959, depth of 48 feet, on dark sand and mud, associated with *Chone* and *Pectinaria*, collected by Dr. Joel W. Hedgpeth and Dr. Ralph G. Johnson, 8 specimens.

Material: 6455 (4).

Relationship: Morphologically, this species is most closely related to *Protomedeia fasciatoides* Bulycheva (1952) but differs in having a longer palmar tooth of male gnathopod 2 and oblique palms on the female gnathopods. The absence of a posterodistal prominence on article 2 of gnathopod 1 distinguishes *P. penates* from *P. fasciata* Krøyer (Sars, 1895, pl. 196), a species having a distinctive aspect as illustrated by Gurjanova (1951). The largest male, 7.0 mm, from station 6455, is obviously fully mature and lacks the gnathopodal prominence. *Protomedeia popovi* Gurjanova (1951) is also similar to *P. penates*, but the male has a more oblique gnathopodal palm lacking the subsidiary palmar tooth.

Distribution: Tomales Bay to Monterey Bay, California, 15-76 m.

Family Ischyroceridae*Ischyrocerus litotes* (Barnard)

Ischyrocerus litotes—Barnard, 1962a, pp. 53-56, figs. 23, 24; 1964a, pp. 226-227.

Material: 6425 (1).

Remarks: I may have been in error in removing this species from its original position in *Microjassa* because of the slight difference in size of coxae 5 and 6. As in *Microjassa*, coxa 1 of this species is small in contrast to members of *Ischyrocerus*. Both genera probably should be emended to permit *I. litotes* to be included with

Microjassa. *Ischyrocerus litotes* at least forms a bridge between the two concepts. Its small size, very shiny, slick body, and poor pigment in alcohol make it highly distinctive from other species of *Ischyrocerus*.

Distribution: Monterey Bay to San Cristobal Bay, Baja California, 1–157 m.

Family Leucothidae

Leucothoe alata Barnard

Leucothoe alata Barnard, 1959a, pp. 19–20, pl. 1; 1962c, p. 132, figs. 7, D, E, F; 1964a, p. 227.

Material: 6425 (5).

Distribution: Monterey Bay to San Ramon Bay, Baja California, 0–24 m.

Leucothoe spinicarpa (Abildgaard)

Leucothoe spinicarpa—Sars, 1895, p. 100, pl. 101, fig. 1—Barnard, 1962c, p. 132, figs. 7, A, B, C; 1964a, p. 227.

Material: 6425 (2).

Distribution: Cosmopolitan, 0–1505 m.

Family Liljeborgiidae

Liljeborgia kinahani (Bate)

Liljeborgia kinahani.—Sars, 1895, pp. 532–533, pl. 188, fig. 1.—Chevreux and Fage, 1925, p. 157, fig. 157.—Barnard, 1964a, p. 228.

Material: 6425 (5).

Distribution: Possibly bipolar, rare in southern California, in the eastern Pacific Ocean known as far south as off San Quintin Bay, Baja California, 24–41 m.

Listriella diffusa Barnard

Listriella diffusa Barnard, 1959b, pp. 18–20, figs. 3–5; 1964a, p. 228.

Material: 6440 (1).

Distribution: Monterey Bay to San Cristobal Bay, Baja California, 12–172 m.

Listriella goleta Barnard

Listriella goleta Barnard, 1959b, pp. 20–22, figs. 5–7; 1964a, p. 229.

Material: 6427 (1), 6428 (2), 6429 (1), 6431 (1), 6446 (1), 6448 (1), 6450 (1), 6451 (2), 6466 (1), 6477 (1), 6480 (1).

Distribution: Monterey Bay to San Cristobal Bay, Baja California, 12–200+ m.

Family Lysianassidae

Acidostoma hancocki Hurley

Acidostoma hancocki Hurley, 1963, pp. 37–40, figs. 9, 10.

Material: 6429 (2).

Distribution: Monterey Bay to southern California, 33° N, 22–73 m.

Anonyx adoxus Hurley

FIGURE 4

Anonyx adoxus Hurley, 1963, pp. 108–112, figs. 35, 36.

Diagnosis: Eyes dark, rather small for genus, forming an elongated oval of even dimensions, not expanded at either end; epistome and upper lip not differentially produced; coxa 1 rounded ventrally; gnathopod 1 with article 6 concave posteriorly, narrowing distally, palm short, coarsely serrate, dactyl strongly overlapping palm; palm of gnathopod 2 short, slightly produced, dactyl short, fitting palm perfectly; pereopods 1 and 2 with hooked, unstriated spine at base of article 7; all pereopods with large spines on sixth articles; inner ramus of uropod 2 not abnormally shortened, bearing small constriction on dorsal margin; rami of uropod 3 subequal in length, article 2 of outer ramus very small (see figure); first pleonal epimeron differing on the two sides of the adult specimen, on the left side with the anterior edge straight, on the right side produced anteriorly (see figures); second pleonal epimeron with rounded anteroventral corner, posterior corner with small, blunt tooth; third pleonal epimeron rounded at anteroventral corner, posterior corner with moderately slender, medium-sized tooth; body lacking sculpture or minute ornamentation.

Material: 6432, female, 10.0 mm, and 17 hatched juveniles.

Remarks: This adult specimen has the special characteristics noted by Hurley in his key (1963, p. 103), but it differs slightly in the configuration of its epistome-labrum complex, the accessory flagellum is shorter, and marginal spines are absent from the telsonic lobes. The weakly hooked, blunt distal spines of the sixth articles on pereopods 1–2 are small, as shown by Hurley. However, the minute ornamentation of the spines has the appearance of the large spines of the *A. liljeborgi* group of the genus.

Anonyx adoxus most closely resembles *Anonyx nugax* (Phipps) and its varieties as arranged by Gurjanova (1962), but the eyes of *A. adoxus* are not differentially widened. The following species, references to which may be found in Gurjanova (1962), differ from the specimen at hand in the morphology of the parts and appendages listed: *A. liljeborgi*, upper lip and uropod 2, third pleonal epimeron; *A. affinis*, *A. minimus*, uropods 2 and 3; *A. validus*, third pleonal

epimeron; *A. kurilicus*, *A. magnus*, uropod 2; *A. ampulloides*, *A. laticoxae*, uropod 2 and eyes; *A. ochoticus*, eyes and epistome; *A. compactus* and *A. oculatus*, eyes and spines of pereopods 1 and 2.

Distribution: Monterey Bay (type locality), 18–98 m.

Anonyx carinatus (Holmes)

Lakota carinata Holmes, 1908, pp. 498–500, fig. 9.—Gurjanova, 1962, pp. 302–303, fig. 100.

Anonyx carinatus.—Hurley, 1963, pp. 103–108.

Material: 6477 (1).

Distribution: Monterey Bay to southern California, 33° N., 69–200 m.

Centromedon pavor, new species

FIGURE 5

Diagnosis: Lateral cephalic lobes short, rounded terminally, separated from large rostral area by deep concavity; antenna 1 very stout, articles 2 and 3 short, telescoped into article 1, article 1 of flagellum heavily armed with aesthetes; coxa 5 with well-defined posterior lobe; urosomite 1 bulbous dorsally.

Holotype: Allan Hancock Foundation no. 5922, female, 2.9 mm.

Type locality: Station 6459, Monterey Bay, California, 84 m, September 1959.

Material: Two specimens from the type locality and 6462 (1), 6477 (1).

Relationship: The genus *Centromedon* became monotypic when Barnard (1962d) removed all but its type species to the genus *Uristes*. *Centromedon pumilus* (Liljeborg) differs from *C. pavor* in having very acute, projecting lateral cephalic lobes, slender first antennae, a symmetrically lobed fifth coxa, and a poorly ornamented first urosomite. As the specimens at hand and that figured by Sars are females, these differences cannot be attributed to sexual dimorphism. The mouthparts of *C. pavor* correspond to those figured for *C. pumilus* by Sars (1895, pl. 34, fig. 2).

Hippomedon denticulatus (Bate)

Hippomedon denticulatus.—Hurley, 1963, pp. 137–140, fig. 45.—Barnard, 1964a, p. 230; 1964b, pp. 80–82.

Material: 6426 (1), 6430 (1), 6445 (2), 6447 (1), 6471 (4), 6474 (2), 6477 (5).

Distribution: Subarctic-boreal of North Atlantic and North Pacific Oceans, 0–924 m; in the eastern Pacific its southern record is off San Cristobal Bay, Baja California.

Lepidepecreum gurjanovae Hurley

Lepidepecreum gurjanovae Hurley, 1963, pp. 49–53, figs. 13, 14.

Material: 6469 (1), 6474 (1).

Distribution: In the northeastern Pacific Ocean from about 33° N to about 49° N, 109–1740 m.

***Lysianassa holmesi* (Barnard), new combination**

Aruga holmesi Barnard, 1955b, p. 100, pls. 27, 28.—Gurjanova, 1962, pp. 299–301, figs. 98, 99.

Lysianopsis holmesi.—Hurley, 1963, pp. 74–75, fig. 21b.

Material: 6431 (1), 6474 (1).

Distribution: Monterey Bay to Ecuador, 1–183 m.

Remarks: I am carrying Hurley's synthesis of various lysianassid genera one more step by fusing *Lysianopsis* Holmes, along with *Aruga* Holmes, *Shoemakerella* Pirlot, *Arugella* Pirlot, and *Pronannonyx* Schellenberg to *Lysianassa*. This procedure is discussed in another paper (Barnard, MS).

***Lysianassa oculata* (Holmes), new combination**

Aruga oculata Holmes, 1908, pp. 505–507, figs. 14, 15.—Barnard, 1955b, p. 98, pl. 29, figs. a-f, h, j.—Gurjanova, 1962, pp. 294–296, fig. 96.

Lysianopsis oculata.—Hurley, 1963, p. 74, fig. 21c.

Material: 6426 (1), 6428 (1), 6429 (1), 6431 (6), 6438 (1), 6439 (1), 6448 (1), 6451 (2), 6455 (1).

Distribution: Monterey Bay to southern California, 32° N, 18 to ?300 m, generally shallower than 100 m.

***Opisa tridentata* Hurley**

Opisa tridentata Hurley, 1963, pp. 26–30, figs. 4, 5.

Material: 6435 (1), 6471 (3), 6474 (2).

Distribution: Monterey Bay to southern California, 33° N, 44–183 m.

***Orchomene decipiens* Hurley, new combination**

Orchomenella decipiens Hurley, 1963, pp. 127–130, figs. 43, 44.

Orchomene species.—Barnard, 1964a, p. 231.

Material: 6435 (1), 6471 (5), 6474 (2), 6477 (1).

Distribution: Monterey Bay to San Cristobal Bay, Baja California, 35–180 m.

Remarks: Barnard (1964b) synonymized *Orchomenella* Sars with *Orchomene* Boeck.

***Orchomene pacifica* (Gurjanova)**

Orchomenella pacifica Gurjanova, 1938, pp. 252–254, fig. 3; 1951, p. 287, fig. 155; 1962, pp. 174–177, figs. 52, 53.

Orchomene pacifica.—Barnard, 1964b, pp. 92–93, fig. 13.

Material: 6471 (7), 6474 (4).

Distribution: Northwestern Pacific Ocean, Japan Sea, Okhotsk Sea, 29–129 m; California from Monterey Bay to southern California, 33° N, 46–183 m.

***Pachynus barnardi* Hurley**

Pachynus barnardi Hurley, 1963, pp. 31–35, figs. 6, 7.

Pachynus species, Barnard, 1964a, p. 232.

Material: 6458 (1), 6469 (1).

Distribution: Monterey Bay to San Ramon Bay, Baja California, 12–183 m.

***Prachynella lodo* Barnard**

Prachynella lodo Barnard, 1964a, p. 233, fig. 7.

Material: 6426 (1), 6471 (1).

Distribution: Monterey Bay to San Cristobal Bay, Baja California, 10–157 m.

Family Oedicerotidae***Monoculodes emarginatus* Barnard**

Monoculodes emarginatus Barnard, 1962e, pp. 361–363, fig. 4; 1964a, p. 234.

Material: 6432 (2), 6435 (2), 6438 (1), 6466 (3), 6469 (1), 6471 (4).

Distribution: Monterey Bay to San Quintin Bay, Baja California, 55–200+ m.

***Monoculodes norvegicus* (Boeck)**

Monoculodes norvegicus.—Sars, 1895, pp. 301–302, pl. 107, fig. 1.—Barnard, 1962e, p. 367 (with references).

Material: 6425 (1).

Distribution: Subarctic-boreal in the North Atlantic and North Pacific Oceans, occurring in southern California as about 1.3 individuals per m² on the coastal shelf, in depths of 20–146 m.

***Monoculodes spinipes* Mills**

Monoculodes spinipes Mills, 1962, pp. 12–14, fig. 3.—Barnard, 1962e, pp. 368–369, fig. 10.

Material: 6454 (1).

Distribution: British Columbia to Point Conception, California, intertidal to 20 m.

***Synchelidium* species A**

A new species with vestigial rostrum, manuscript in preparation.

Material: 6427 (1), 6428 (1), 6429 (7), 6430 (2), 6431 (3), 6438 (2), 6465 (1), 6466 (1), 6474 (1).

Distribution: Monterey Bay to southern California, 32° N, 10–100+ m.

***Synchelidium* species E**

A new species, manuscript in preparation.

Material: 6435 (1), 116 meters.

Distribution: Monterey Bay to southern California, 32° N, about 40–183+ m.

Synchelidium species G

A new species, manuscript in preparation.

Material: 6435 (2), 6439 (4); varietal type: 6426 (2), 6427 (3), 6433 (2) 6440 (3), 6469 (1).

Distribution: Monterey Bay to southern California, 32° N, 10 to slightly more than 120 m.

Synchelidium shoemakeri Mills

Synchelidium shoemakeri Mills, 1962, pp. 15–17, figs. 4, 6A.

Material: 6432 (2), 98 m.

Distribution: British Columbia south to southern California, intertidal in northern end of its range, subtidal in southern California, to depths slightly exceeding 100 m but very rare below 40 m.

Westwoodilla caecula (Bate)

Westwoodilla caecula.—Mills, 1962, pp. 509, figs. 1, 6A.—Barnard, 1962e, p. 370; 1964a, p. 235.

Material: 6427 (1), 6431 (1), 6435 (3), 6438 (1), 6469 (1), 6474 (1).

Distribution: A cold-temperate species of the North Atlantic and North Pacific Oceans, in the eastern Pacific known as far south as Todos Santos Bay, Baja California; intertidal in British Columbia but occurring in southern California in 12–200 m.

Family Pardaliscidae

Nicippe tumida Bruzelius

Nicippe tumida.—Barnard, 1959c, pp. 39–40, figs. 1, 2; 1964a, p. 235.

Material: 6431 (2), 6433 (1), 6457 (1), 6465 (2), 6466 (4).

Distribution: Apparently cosmopolitan, submerging in the tropics, 34–1367 m.

Pardisynopia synopiae Barnard

Pardisynopia synopiae Barnard, 1962b, pp. 77–79, figs 3, 4; 1964a, pp. 235–236.

Material: 6431 (2), 6435 (2), 6438 (3), 6465 (1), 6469 (1), 6471 (1).

Distribution: Monterey Bay to San Quintin Bay, Baja California, 53–200+ m.

Family Phoxocephalidae

Heterophoxus oculatus (Holmes)

Heterophoxus oculatus.—Barnard, 1960b, pp. 320–324, pls. 59–61; 1964a, p. 242.

Material: 6425 (3), 6431 (2), 6432 (3), 6433 (2), 6455 (5), 6456 (1), 6457 (4), 6458 (5), 6459 (1), 6462 (1), 6464 (8), 6465 (8), 6471 (1), 6474 (8), 6477 (13), 6480 (1).

Distribution: Puget Sound, Washington to Panama, 13–1785 m; in San Quintin Bay, Baja California, 2 m.

***Metaphoxus frequens* Barnard**

Metaphoxus frequens Barnard, 1960b, pp. 304-306, pls. 51, 52; 1964a, p. 242.

Material: 6425 (12), 6426 (1), 6428 (4), 6429 (2), 6430 (4), 6431 (1), 6432 (5), 6433 (12), 6435 (6), 6438 (3), 6458 (1), 6466 (2), 6470 (2), 6471 (3), 6477 (1), 6480 (1).

Distribution: Monterey Bay to Isabel Island, Mexico, 13-458 m.

***Metaphoxus fultoni* (Scott)**

Metaphoxus fultoni.—Chevreux and Fage, 1925, pp. 106-107, figs. 96, 97.—Barnard, 1964a, pp. 242-243.

Material: 6425 (4), 6474 (4).

Distribution: Eastern Atlantic Ocean and Mediterranean Sea, from England to Tunisia; in the eastern Pacific Ocean from Monterey Bay to San Cristobal Bay, Baja California, 0-170 m.

***Paraphoxus bicuspidatus* Barnard**

Paraphoxus bicuspidatus Barnard, 1960b, pp. 218-221, pls. 15, 16; 1964a, p. 243, fig. 12.

Material: 6430 (8), 6431 (21), 6432 (22), 6433 (23), 6435 (13), 6438 (13), 6447 (2), 6448 (6), 6451 (13), 6452 (12), 6455 (4), 6456 (2), 6457 (1), 6458 (5), 6466 (7), 6469 (4), 6471 (5).

Distribution: Monterey Bay to Santa Maria Bay, Baja California, 8-210 m.

***Paraphoxus epistomus* (Shoemaker)**

Paraphoxus epistomus.—Barnard, 1960b, pp. 205-209, pls. 6-8; 1964a, p. 243.

Material: 6429 (4).

Distribution: Mendocino County in northern California to Panama, 0-182 m; northwestern Atlantic Ocean from New Hampshire to South Carolina.

Paraphoxus fatigans* Barnard*FIGURES 6, 7**

Paraphoxus fatigans Barnard, 1960b, pp. 209-210, pl. 9; Barnard, 1964a, p. 244.

Material: Kind 1: 6426 (48), 6427 (14), 6428 (1), 6429 (3), 6440 (5), 6442 (17), 6443 (18), 6444 (6), 6445 (32), 6446 (18), 6448 (1), 6449 (7), 6450 (6), 6453 (2), 6454 (40). Kind 2: 6427 (38), 6428 (33), 6429 (54), 6430 (60), 6431 (30), 6432 (14), 6433 (23), 6435 (11), 6438 (24), 6445 (2), 6446 (8), 6447 (26), 6448 (41), 6449 (4), 6451 (6), 6452 (4), 6453 (18), 6466 (25), 6469 (1), 6471 (1).

Remarks: The most common members of *Paraphoxus* in Monterey Bay are the most difficult to identify. These specimens have several characters which are intermediate between those of *P. fatigans* and *P. daboivus* (both Barnard, 1960b). Two kinds of fifth pereopods

occur which resemble the figures of *P. fatigans* published by Barnard. The first gnathopods of *P. fatigans* are slender, those of *P. daboius* strongly expanded and those of the specimens at hand are intermediate between the two species. The two species and the specimens at hand have small female eyes. The epistomal cusp is usually longer than it is in either *P. fatigans* or *P. daboius*.

The two configurations of pereopod 5 are: Article 2 has more than 3 very small teeth crowded together on the posterior margin, the oblique ventral edge being slightly convex rather than truncate as in *P. fatigans* from southern California (figs. 6d,k,l); article 2 has only 2 or 3 slightly enlarged, less crowded teeth, the oblique ventral margin being nearly truncate (fig. 6c). A third kind of rare occurrence, is shown in figures 6a,e,i,j; the posterior teeth of article 2 are very large and resemble those of *P. variatus* Barnard (1960b).

Although the gnathopods of the specimens at hand are stouter than those of *P. variatus*, the enlarged teeth of pereopod 5 on some individuals demonstrate the close relationship of the *P. fatigans* complex with *P. variatus*. Barnard (1960b) has already considered the possibility that *P. fatigans* is a phenotype of *P. variatus*, but a clarification of the problem is complicated by the additional differences displayed by the specimens from Monterey Bay.

The Monterey *fatigans* complex resembles *Paraphoxus epistomus*, of which only a few specimens have been found in the present samples. *Paraphoxus epistomus* may be distinguished by the horizontal ventral edge (either truncate or slightly convex) of article 2 on pereopod 5 and by the slightly stouter gnathopods. A few specimens assigned to *P. fatigans* show a relationship to *P. epistomus* because of the peduncular setosity of uropod 2. Most of these specimens have the elongated epistomal process.

Distribution: Monterey Bay to Todos Santos Bay, Baja California, 12–162 m.

***Paraphoxus obtusidens* (Alderman)**

Paraphoxus obtusidens.—Barnard, 1960b, pp. 249–259, pls. 33–37; 1964a, p. 244.

Material: 6429 (1), 6430 (1), 6431 (6), 6432 (3), 6433 (5), 6435 (1), 6438 (1), 6439 (1), 6444 (1), 6453 (1), 6469 (3), 6471 (5).

Distribution: Kurile Islands to Columbia, South America, 0–180 m.

***Paraphoxus robustus* Holmes**

Paraphoxus robustus.—Barnard, 1960b, pp. 235–236, pl. 25; 1964a, p. 244.

Material: 6431 (1), 6432 (2), 6433 (4), 6466 (1), 6471 (1), 6474 (4).

Distribution: Puget Sound, Washington to San Quintin Bay, Baja California, 4–183 m.

***Paraphoxus similis* Barnard**

Paraphoxus similis Barnard, 1960b, pp. 230–233, pls. 22, 23.

Material: 6431 (2), 6432 (6), 6438 (3), 6444 (11), 6456 (1), 6458 (11), 6459 (1), 6465 (10), 6466 (6), 6474 (17), 6477 (13), 6478 (4), 6480 (2).

Distribution: Puget Sound, Washington, to southern California, 32° N, 31–324 m, abundant on the shelf of southern California in depths of 55–110 m.

***Paraphoxus variatus* Barnard**

Paraphoxus variatus Barnard, 1960b, pp. 198–202, pls. 3, 4; 1964a, p. 245.

Material: 6426 (14), 6428 (2), 6446 (2), 6447 (8), 6450 (17).

Distribution: Monterey Bay to San Ramon Bay, Baja California, 5–93 m.

***Phoxocephalus homilis* Barnard**

Phoxocephalus homilis Barnard, 1960b, p. 301, pls. 49, 50; 1964a, p. 245.

Material: 6433 (1), 6456 (10), 6471 (12), 6474 (51), 6477 (9), 6480 (5).

Distribution: Monterey Bay to San Cristobal Bay, Baja California, 62–200+ m.

Family Pleustidae***Parapleustes pugettensis* (Dana)**

Parapleustes pugettensis.—Barnard and Given, 1960, pp. 43–45, fig. 4 (with synonymy).—Shoemaker, 1964, pp. 410–413, fig. 10.

Material: 6445 (1), 25 m.

Distribution: West coast of Alaska, 62° N to southern California, 32° N, where it is moderately abundant in the intertidal zone and on shallow water epifloras.

Family Podoceridae***Podocerus cristatus* (Thomson)**

Podocerus cristatus.—Barnard, 1962a, pp. 67–69, figs. 31, 32; 1964a, p. 246.

Material: 6425 (11).

Distribution: Probably cosmopolitan in the Indo-Pacific tropical and warm-temperate regions, southwest Africa, New Zealand, Hawaii, Australia, in the eastern Pacific Ocean from Monterey Bay to Turtle Bay, Baja California, 0–171 m.

Family Stenothoidae***Metopella aporpis* Barnard**

Metopella aporpis Barnard, 1962c, pp. 142–145, figs. 12, 13; 1964a, p. 246.

Material: 6425 (1), 24 m.

Distribution: Monterey Bay to San Cristobal Bay, Baja California, 24–140 m, south of Point Conception not shallower than 84 m.

Stenothoe freccanda Barnard

Stenothoe freccanda Barnard, 1962c, p. 151, fig. 18.

Material: 6471 (1)

Distribution: Monterey Bay to southern California shelf, 64–92 m.

Family Synopiidae (=Tironidae)

Tiron biocellata Barnard

Tiron biocellata Barnard, 1962b, p. 75, fig. 2; 1964a, p. 247.

Material: 6440 (1).

Distribution: Monterey Bay to San Cristobal Bay, Baja California, 11–180 m.

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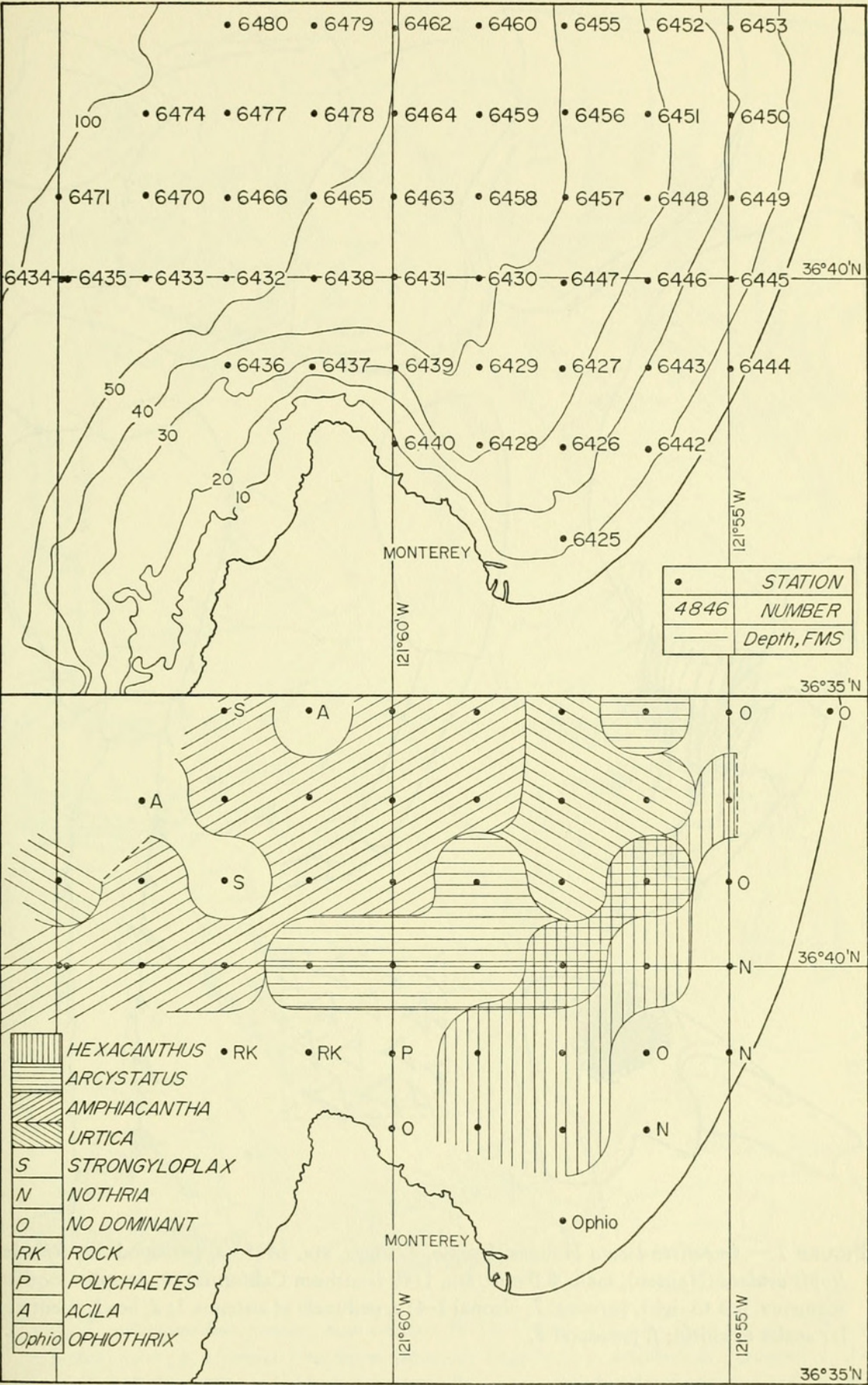


FIGURE 1.—Upper, station locations in Monterey Bay; lower, distribution of community dominants.

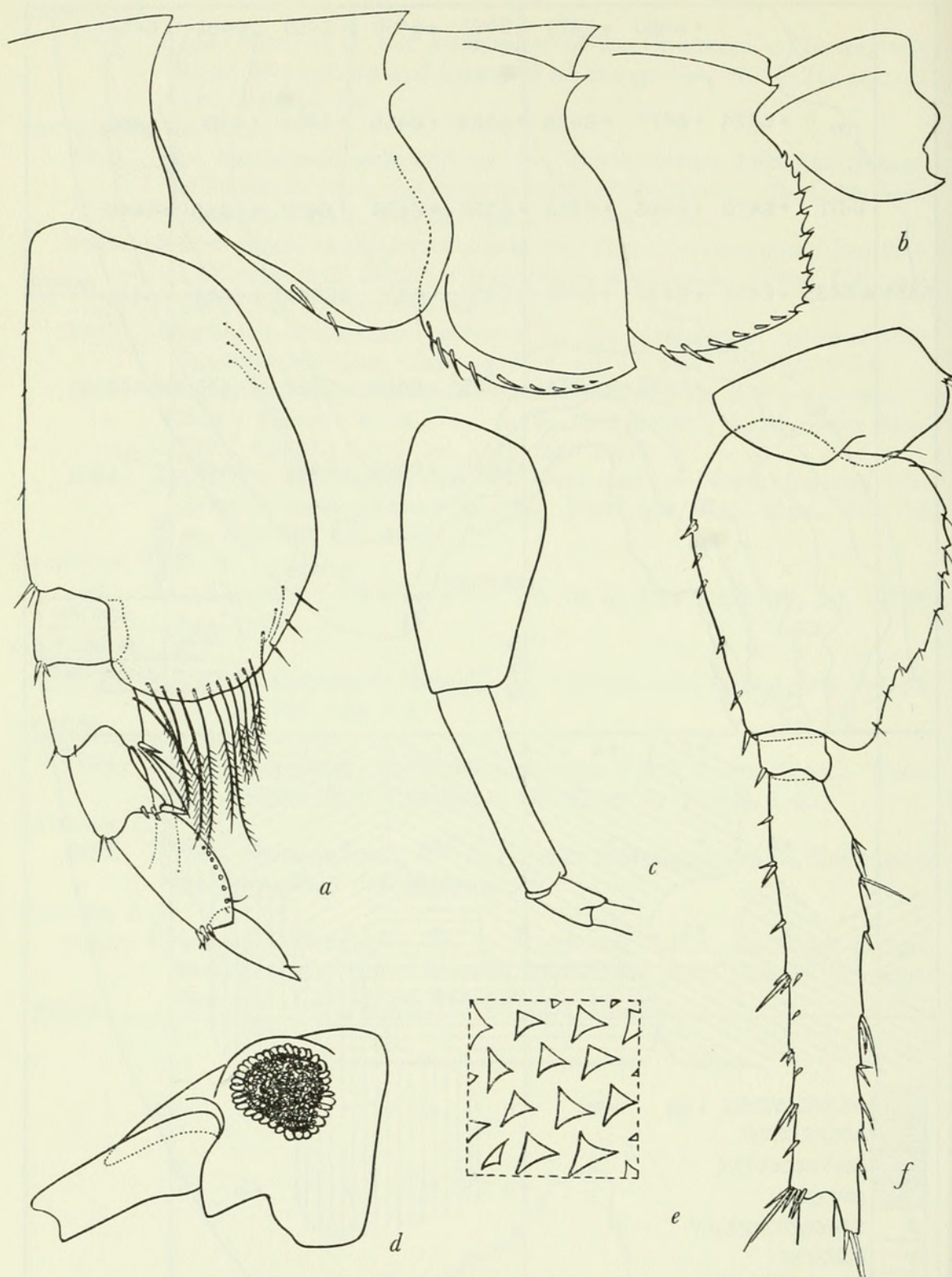


FIGURE 2.—*Ampelisca lobata* Holmes, female, 4.0 mm, sta. 6425: *a*, pereopod 5. *Rhachotropis oculata* (Hansen), male, 8.0 mm, sta. 1149 (southern California): *b*, dorsally toothed segments, left to right, pereonal 7, pleonal 1–4; *c*, peduncle of antenna 1; *d*, head; *e*, cuticular scales of chitin; *f*, pereopod 5.

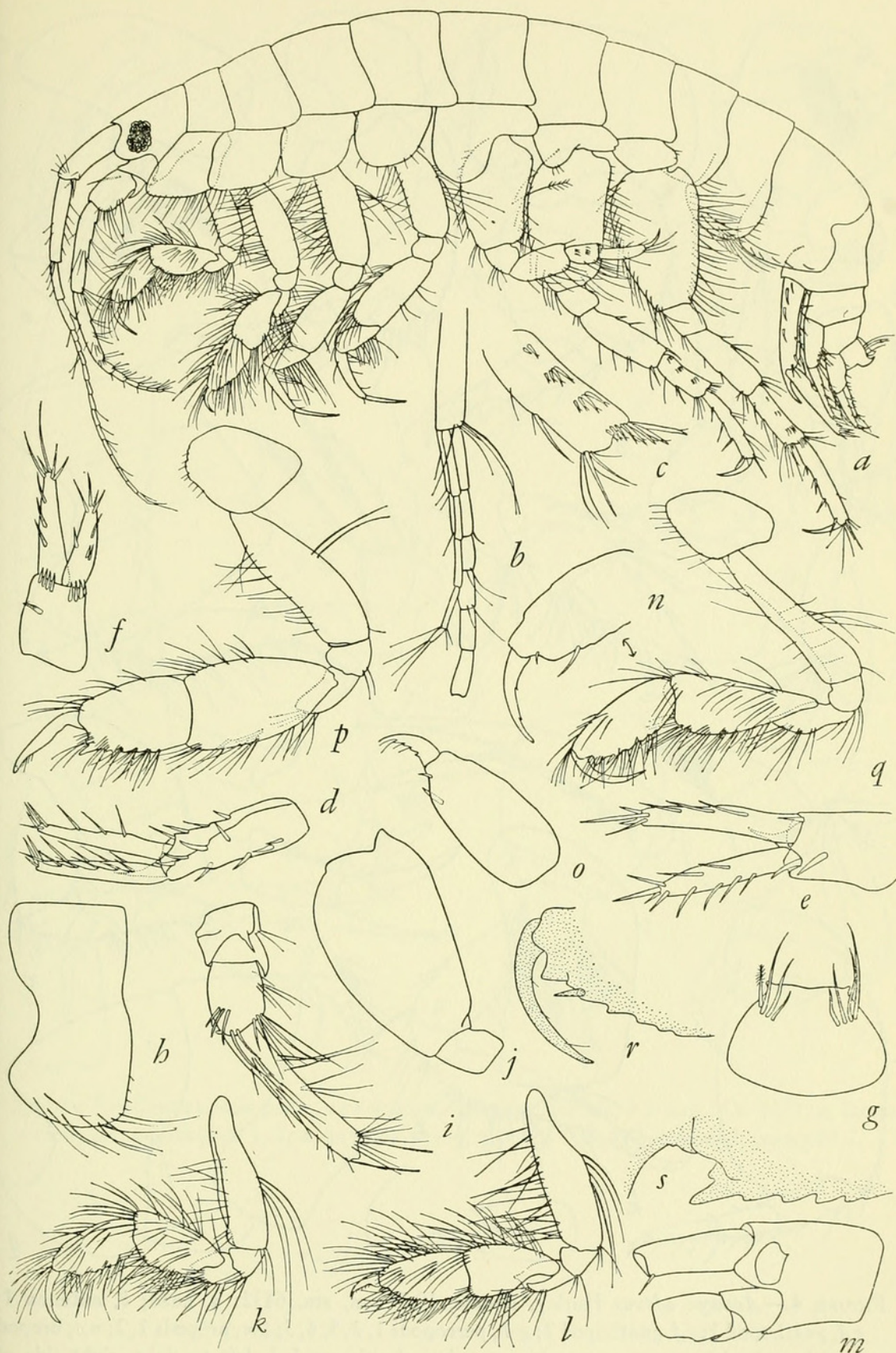


FIGURE 3.—*Protomedeia penates*, new species, White Gulch, Tomales Bay, female, 7.0 mm: *a*, lateral view; *b*, antenna 1 to show accessory flagellum; *c*, article 5 of pereopod 4; *d-f*, uropods 1, 2, 3; *g*, telson; *h*, pleonal segment 2; *i*, base of peduncle of antenna 2; *j*, articles 2-3 of pereopod 5; *k, l*, gnathopods 1, 2; *m*, head; *n, o*, articles 6-7 of gnathopods 1, 2. Male, 6.0 mm: *p, q*, gnathopods 2, 1; *r, s*, palms of gnathopods 1, 2.

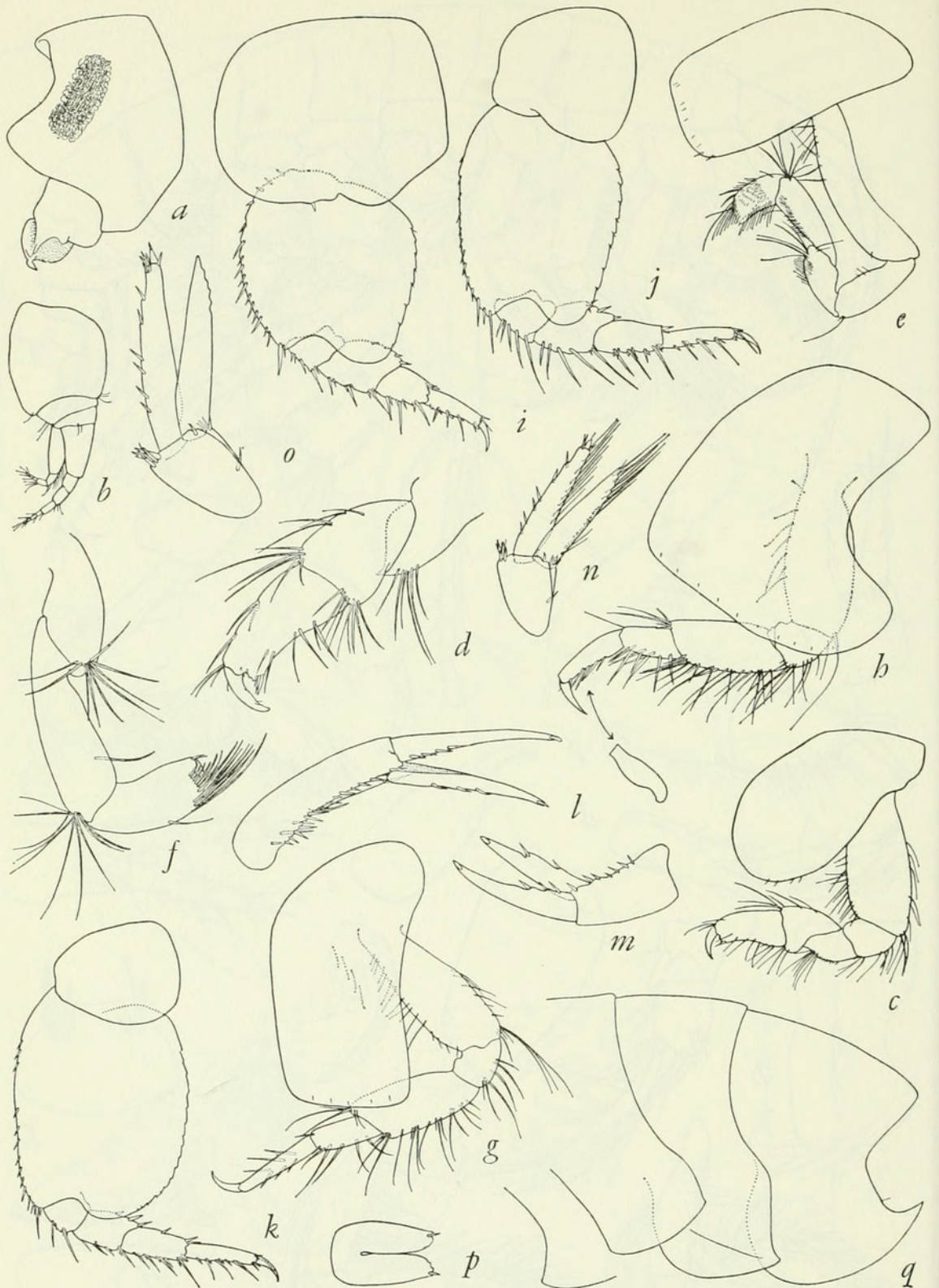


FIGURE 4.—*Anonyx adoxus* Hurley, female, 10.0 mm, sta. 6432: *a*, head; *b*, antenna 1; *c, d*, gnathopod 1; *e, f*, gnathopod 2; *g-k*, pereopods 1, 2, 3, 4, 5; *l, m*, uropods 1, 2; *n, o*, uropod 3 with and without setae; *p*, telson; *q*, pleonal epimera 1-3, left to right, right side of pleonal epimeron 1 offset.

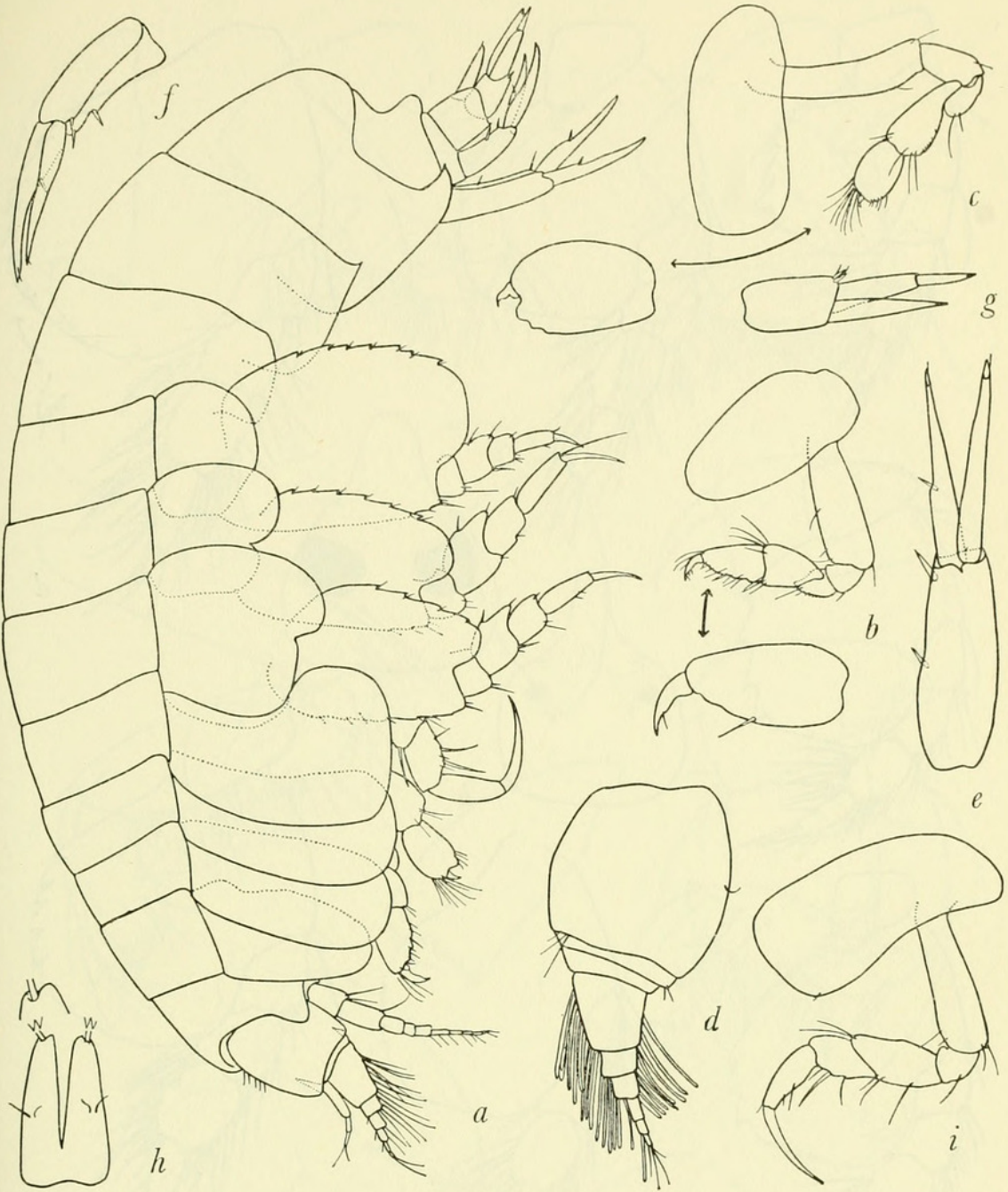


FIGURE 5.—*Centromedon pavor*, new species, holotype, female, 2.9 mm, sta. 6459: a, lateral view; b,c, gnathopods 1, 2; d, antenna 1; e-g, uropods 1, 2, 3; h, telson; i, pereopod 1.

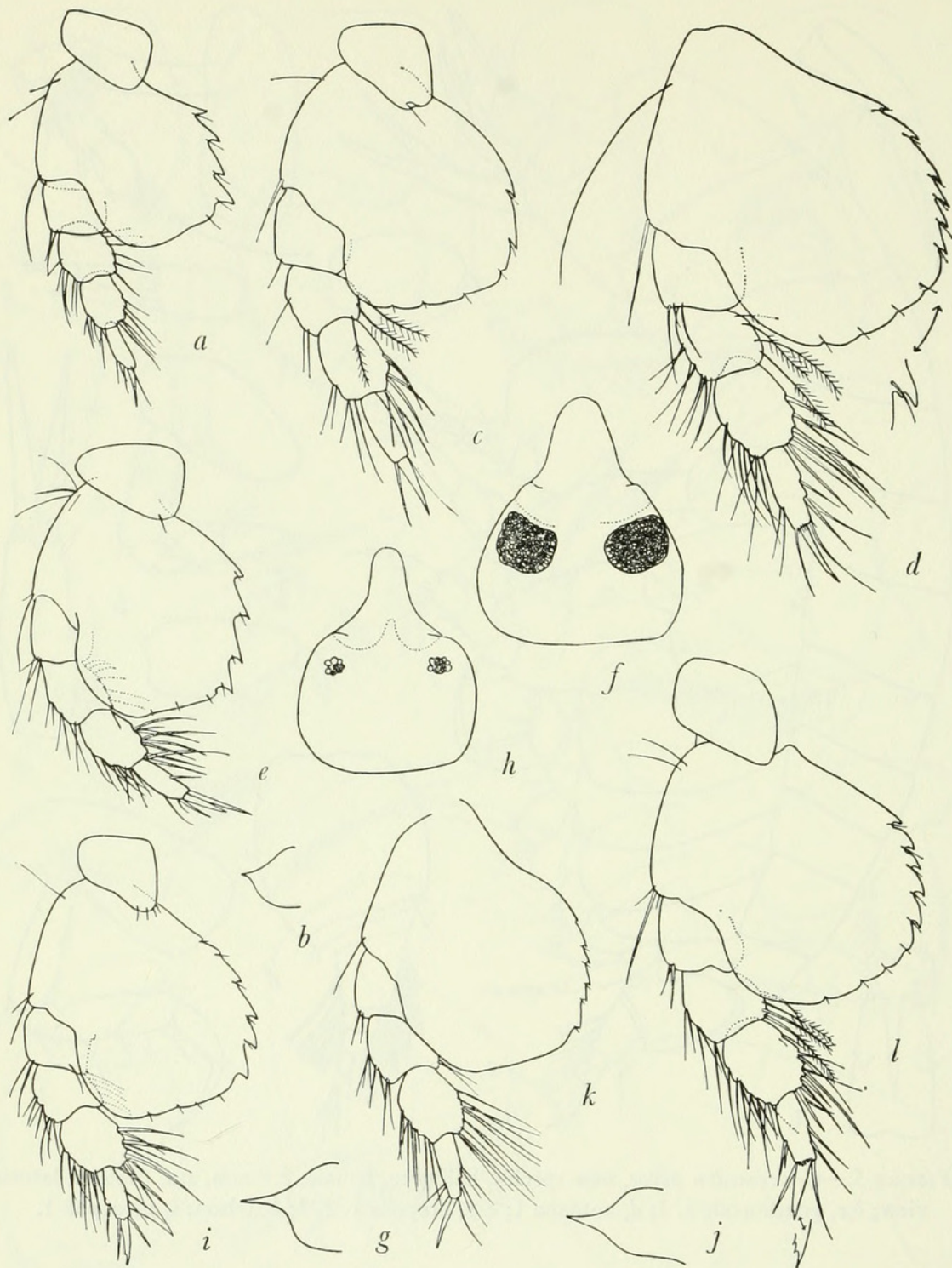


FIGURE 6.—*Paraphoxus fatigans* Barnard, male, 2.5 mm, sta. 6448, variant: *a*, pereopod 5; *b*, epistome. Female, 2.8 mm, sta. 6493, kind 2: *c*, pereopod 5. Male, 3.1 mm, sta. 6426, kind 1: *d*, pereopod 5. Male, 3.5 mm, sta. 6448, variant: *e*, pereopod 5; *f*, head; *g*, epistome. Female, 3.5 mm, sta. 6448, variant: *h*, head; *i*, pereopod 5; *j*, epistome. Female, 3.8 mm, sta. 6426, kind 1: *k*, pereopod 5. Female, 3.0 mm, sta. 6454, kind 1: *l*, pereopod 5.

EXPLANATION OF FIGURE 7

FIGURE 7.—*Paraphoxus fatigans* Barnard, female, 3.0 mm, sta. 6454, kind 1: *a, b*, gnathopod 1. Female, 3.5 mm, sta. 6448, variant: *c, d*, gnathopod 1. Male, 2.5 mm, variant: *e, f*, gnathopod 1. Male, 3.1 mm, sta. 6426, kind 1: *g, h*, gnathopod 1. Male 3.5 mm, sta. 6448, variant: *i, j*, gnathopods 1, 2. Female, 2.8 mm, sta. 6493, kind 2: *k*, gnathopod 1.

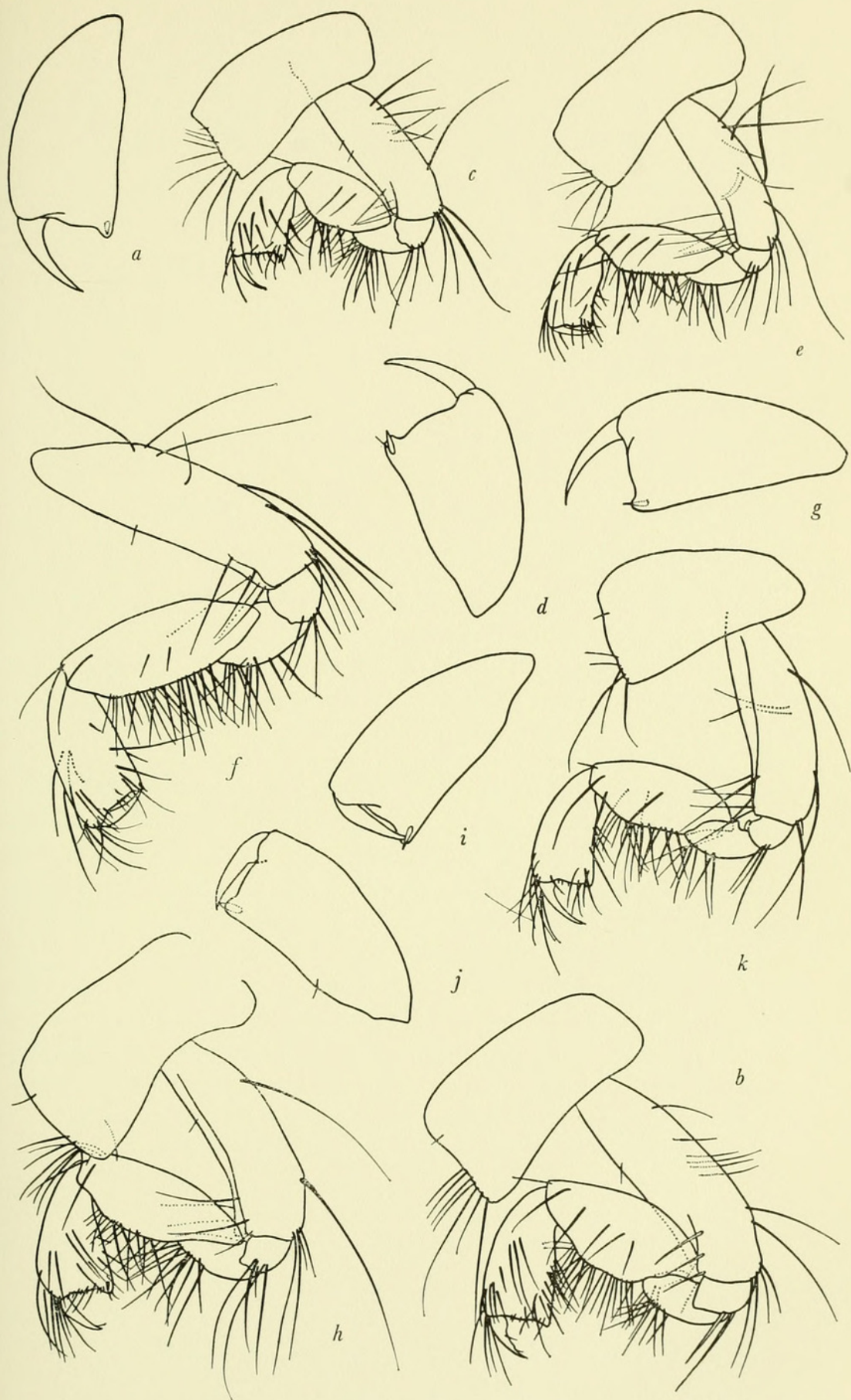


FIGURE 7.—Explanation on facing page.



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