

Calanoid Copepods from Midwater Trawl Collections Made in the Southeastern Pacific Ocean¹

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IN ADDITION TO the fishes and faster swimming invertebrates (euphausiids, squids) usually obtained in midwater trawl collections, relatively large species of copepods are also frequently captured. Aside from Sewell's (1929) report of copepods found in six midwater collections made in the Indian Ocean, it has only been in recent years that midwater trawl samples have been more or less systematically analyzed for copepods. From the Florida Current, off Miami, an area in which the copepods have been studied fairly extensively, Owre and Foyo (1964) reported that 21 calanoid species were found only in collections made by the Isaacs-Kidd midwater trawl (Isaacs and Kidd, 1953). Of these, 11 represented new records for the area. In the southwestern Indian Ocean, De Decker and Mombeck (1965) using both vertical plankton net and midwater fish trawl found 274 species of copepods. Of these the fish trawl accounted for 115 species including 43 which were not found in the plankton net collections. In the western Indian Ocean Grice and Hulsemann (1967) studied a series of 30 plankton net and 21 midwater trawl collections obtained between 18°N and 40°S. In the midwater trawl collections were found 64 species not present in the plankton net collections, including representatives of all eight species of the family Megacalanidae. It thus appears that midwater nets constitute a valuable additional means of sampling the calanoid copepod fauna in an open ocean area, and it is hoped that those interested in copepods will examine any available midwater trawl samples.

The samples examined in this study were

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obtained in the southeastern Pacific Ocean during Cruise 13 of R/V "Anton Bruun" by means of a 10-ft Isaacs-Kidd midwater trawl.³ They were collected at intervals along a transect of stations extending seaward from Valparaiso, Chile, for a distance of approximately 1,000 nautical miles between 33° and 34°S (Table 1). Of the 29 trawl collections examined, 18 sampled within the upper 1000 m and the remaining 11 sampled greater depths. A total of 904 calanoid copepods were removed from the samples aboard ship and subsequently identified in our laboratory.

In all, 78 species of calanoid copepods belonging to 11 families (Table 2) were identified. In general, these are widely distributed species and most of them occur also in the deeper waters of the Atlantic and Indian oceans. Comparing these observations, for example, with a series of midwater trawl samples collected in the Indian Ocean (Grice and Hulsemann, 1967) we find that 68% (53 species) of the species from the southeastern Pacific are also present in the Indian Ocean. Furthermore, 81% of the species occur also in the Atlantic. Of the 78 species we found, 13 have previously been reported from the waters adjacent to the coast of Chile (Fagetti, 1962); 7 have not previously been reported from the Pacific Ocean (these are marked with an asterisk in Table 2); and 6 other species, *Bradycalanus typicus* A. Scott, *Euchaeta gracili-cauda* (A. Scott), *Euchaeta weberi* (A. Scott), *Euchirella formosa* Vervoort, *Euchirella indica* Vervoort, *Lophothrix gigas* (A. Scott), have been reported only from the Malay Archipelago. Also found in the collections were 6 new species and the hitherto undescribed adult female and undescribed male of 2 other species. Descriptions of these 8 species are given below

³The help of Dr. Giles Mead and his scientific party who secured the samples is gratefully acknowledged.

TABLE 1
LIST OF STATIONS

IKMT STATION NUMBER	DATE (1966)	POSITION				MAXIMUM COLLECTING DEPTH (M)*
		START		END		
		LAT (S)	LONG (W)	LAT (S)	LONG (W)	
2	5 Jan	33°16'	72°36'	33°31'	72°41'	0- 370 (D)
3	5 Jan	33°32'	72°41'	33°48'	72°45'	0-3750 (W)
4	6 Jan	34°16'	73°24'	34°26'	73°28'	0- 250 (W)
5	6 Jan	34°26'	73°28'	34°45'	73°27'	0-5000 (W)
6	7 Jan	32°57'	74°57'	33°05'	74°59'	0-3182 (W)
7	8/9 Jan	33°02'	77°01'	33°10'	77°03'	0- 345 (W)
8	9 Jan	33°10'	77°03'	33°03'	76°59'	0-4000 (W)
10	10 Jan	33°32'	77°56'	33°46'	77°54'	0- 600 (W)
16	13/14 Jan	33°36'	79°32'	33°34'	79°48'	0-1250 (D)
17	14/15 Jan	33°50'	82°06'	33°55'	82°14'	0- 370 (D)
18	15 Jan	33°58'	82°20'	34°04'	82°30'	0-2500 (W)
19	15 Jan	33°51'	85°00'	34°01'	84°58'	0- 400 (W)
20	16 Jan	34°01'	84°58'	34°28'	85°04'	0-2900 (W)
21	17 Jan	33°50'	87°34'	33°51'	87°49'	0-2900 (W)
22	18 Jan	33°51'	87°49'	33°47'	87°57'	0- 375 (D)
23	18/19 Jan	33°49'	90°07'	33°49'	90°07'	0- 370 (D)
24	19 Jan	33°48'	90°19'	33°53'	90°30'	0-2900 (W)
27	21 Jan	30°59'	92°28'	30°47'	92°31'	0-3790 (W)
28	22 Jan	30°45'	92°34'	30°45'	92°13'	0- 320 (D)
29	23 Jan	30°57'	89°13'	31°05'	89°35'	0- 500 (D)
30	24 Jan	31°07'	89°29'	31°02'	89°06'	0- 410 (D)
31	24 Jan	31°02'	89°06'	31°02'	88°54'	0- 400 (D)
40	28 Jan	33°31'	77°29'	33°31'	77°13'	0- 820 (D)
41	28 Jan	33°31'	77°29'	33°33'	77°39'	0-1000 (W)
43	28/29 Jan	33°25'	77°38'	33°20'	77°24'	0- 380 (D)
46	30/31 Jan	33°44'	75°53'	33°53'	75°48'	0- 325 (D+W)
47	31 Jan	33°46'	75°17'	33°56'	75°16'	0- 270 (D)
54	2 Feb	33°42'	73°35'	33°51'	73°25'	0- 500 (W)
59	3 Feb	33°47'	72°18'	33°53'	72°21'	0-1280 (W)

* Depth determined by depth telemeter (D) or wire angle (W).

as well as remarks on the distribution and taxonomy of 11 other species. Type specimens have been deposited in the U.S. National Museum.

Bradycalanus typicus A. Scott, 1909

REMARKS: The specimens are considerably larger (10.33-15.16 mm) than the one originally described by Scott (1909), who reported the length as 9.00 mm. One adult female reported by Vervoort (1946) measured 11.00 mm. Sewell (1947) found a stage V copepodid believed to be *Bradycalanus typicus* in the Gulf of Aden, and Owre and Foyo (1964) described a stage IV copepodid of this species from the Florida Current.

Megacalanus princeps Wolfenden, 1904

REMARKS: Two females and two males were

found that belong to the var. *inermis* Sewell. At station 54 there was one female with a crested forehead which is believed to belong to this species since no other differences were observed. The total length of this specimen is 10.33 mm.

Batheuchaeta enormis n. sp.

Figs. 1-13

OCCURRENCE: Station 6, 1 female.

DIAGNOSIS: Female. Body elongate. Length of abdomen and furca contained 5.7 times in cephalothorax. Head and first thoracic segment incompletely separated, fourth and fifth thoracic segments fused. Anterior portion of head rounded without trace of a spine or crest. Rostrum absent. Posterior lateral margin of last thoracic segment rounded and slightly produced. Abdomen 4-segmented. Genital segment

TABLE 2
SPECIES AND THEIR OCCURRENCE

SPECIES	STATION NUMBER	SPECIES	STATION NUMBER
	(SEE TABLE 1)		(SEE TABLE 1)
CALANIDAE			
<i>Neocalanus robustior</i> (Giesbrecht)	30, 31	<i>P. tuberculata</i> Tanaka	21
		<i>P. tuberosa</i> n. sp.	3, 10, 20, 40, 41, 54, 59
MEGACALANIDAE			
<i>Bathycalanus bradyi</i> (Wolfenden)	5, 8, 16, 21, 27, 59	<i>Undeuchaeta major</i> Giesbrecht	4, 19, 21-24, 28-30, 40
<i>B. princeps</i> (Brady)	8, 18, 27, 40, 41, 43, 54	<i>Valdiviella brevicornis</i> Sars	20, 21, 24
<i>B. richardi</i> Sars	20	<i>V. insignis</i> Farran	3, 5, 6, 8, 10, 16, 21, 40, 41, 59
* <i>Bradycalanus sarsi</i> (Farran)	8, 27	<i>V. oligarthra</i> Steuer?	3, 6, 8, 10, 16, 18-21, 24, 27, 41, 59
<i>B. typicus</i> A. Scott	3, 8		
<i>Megacalanus princeps</i> Wolfenden	2, 3, 5-8, 10, 16-22, 30, 40, 41, 46, 54, 59	EUCHAETIDAE	
EUCALANIDAE			
<i>Eucalanus elongatus</i> (Dana)	4	<i>Euchaeta barbata</i> Brady	3, 5, 10, 16, 18, 20, 21, 41, 59
AETIDEIDAE			
<i>Batheuchaeta enormis</i> n. sp.	6	<i>E. bisinuata</i> Sars	21
<i>Chirundina streetsi</i> Giesbrecht	19, 21-23, 28, 46, 47	<i>E. dubia</i> Esterly	3, 5, 6, 8, 10, 16, 18, 20, 21, 40, 41, 54, 59
<i>Euchirella bitumida</i> With	30	<i>E. gracilicauda</i> (A. Scott)	21, 24
<i>E. formosa</i> Vervoort	19-21, 24, 30, 47	<i>E. hanseni</i> With	2-6, 8, 10, 16, 20, 23, 27, 40, 41, 54, 59
<i>E. indica</i> Vervoort	29	<i>E. paulovskii</i> (Brodsky)	6, 7, 10, 43, 54, 59
<i>E. maxima</i> Wolfenden	3, 4, 7, 19, 21, 22, 40, 43, 46, 47	* <i>E. pseudotonsa</i> Fontaine	23, 43
<i>E. similis</i> Wolfenden	4, 46, 47	<i>E. regalis</i> n. sp.	2, 3, 16, 20, 40, 41, 54
<i>E. speciosa</i> n. sp.	29	<i>E. sarsi</i> Farran	16, 18, 20
<i>E. truncata</i> Esterly	4, 19, 22, 23, 28-31	<i>E. scotti</i> Farran	5, 18, 59
<i>Euchirella</i> sp.**	29	<i>E. spinosa</i> Giesbrecht	19, 22, 28-31
<i>Gaetanus antarcticus</i> Wolfenden	3, 5, 6, 10, 16, 18, 27, 59	<i>E. tonsa</i> Giesbrecht	20, 23, 24
* <i>G. brachyurus</i> Sars	27	<i>E. vorax</i> n. sp.	21
<i>G. kruppii</i> Giesbrecht	3	<i>E. weberi</i> (A. Scott)	2-7, 10, 27, 41, 46, 47, 54, 59
<i>G. latifrons</i> Sars	54	PHAENNIDAE	
<i>G. miles</i> Giesbrecht	22	<i>Cornucalanus chelifera</i> (Thompson)	23, 41, 54
<i>G. pileatus</i> Farran	29, 43	<i>Onchocalanus cristatus</i> (Wolfenden)	2, 40, 41, 46
<i>Gaidius inermis</i> (Sars)	27	<i>O. magnus</i> (Wolfenden)	16, 24, 54
<i>G. robustus</i> (Sars)	8, 18, 20, 21, 24, 27	<i>Xanthocalanus pinguis</i> Farran	27
<i>Pseudeuchaeta brevicauda</i> Sars	20	SCOLECITHRICIDAE	
<i>Pseudochirella hirsuta</i> (Wolfenden)	5, 6, 16, 18, 20, 21, 24, 59	<i>Amalothrix curticauda</i> (A. Scott)	20
<i>P. incisa</i> (Esterly)	2, 21, 22, 43, 54	<i>Lophothrix frontalis</i> Giesbrecht	2, 7, 22, 23, 43, 46, 47, 54
<i>P. limata</i> n. sp.	27	<i>L. gigas</i> (A. Scott)	5, 8, 16, 21, 24
<i>P. pustulifera</i> (Sars)	5, 41	<i>L. humilifrons</i> Sars	21, 24, 41
* <i>P. squalida</i> Grice and Hulsemann	3, 16, 21, 24	<i>L. insignis</i> Sars	8
		* <i>L. similis</i> Wolfenden	16, 20

TABLE 2 (Continued)

SPECIES	STATION NUMBER
	(SEE TABLE 1)
METRIDIIDAE	
<i>Gaussia princeps</i> (T. Scott)	2-5, 7, 8, 10, 17, 19-23, 27, 28, 30, 40, 41, 43, 46, 47, 54, 59
<i>Metridia macrura</i> Sars	27
<i>M. princeps</i> Giesbrecht	3
<i>Pleuromamma abdominalis</i> <i>abdominalis</i> (Lubbock)	43
LUCICUTIIDAE	
<i>Lucicutia aurita</i> Cleve	5, 16, 41
<i>L. bicornuta</i> Wolfenden	18, 21
<i>L. maxima</i> Steuer	6, 21, 24
* <i>L. sarsi</i> Hulsemann	3
<i>L. wolfendeni</i> Sewell	3, 20
AUGAPTILIDAE	
* <i>Euaugaptilus grandicornis</i> Sars	18
<i>E. magnus</i> (Wolfenden)	6, 40
<i>Pachyptilus eurygnathus</i> Sars	2
<i>Pontoptilus muticus</i> Sars	54
ARIETELLIDAE	
<i>Arietellus giesbrechti</i> Sars	29
<i>A. setosus</i> Giesbrecht	28
<i>A. simplex</i> Sars	27

* New record for Pacific Ocean.

** Species being described elsewhere by T. S. Park (in press).

with conspicuous, slightly asymmetrical lateral swellings. First antenna consisting of 24 free segments, segments 8 and 9 fused, reaching end of cephalothorax. Segments 7, 8, 13, 17, 20, 23, 24 each armed with 1 large, smooth seta; first segment bearing 2 long, plumose setae. Endopod of second antenna smaller than exopod, exopod consisting of 7 segments. First maxilla with 10 spines on first inner lobe, 0 setae on second inner lobe, 1 seta on third inner lobe, 1 seta on second basal segment, 6 setae on endopod, 11 setae on exopod, and 9 setae on outer lobe. One seta each on third to fifth lobe of second maxilla developed as spine. Second basipodal segment of maxilliped nearly twice the length of first segment. Exopods of first to fourth swimming feet 3-segmented. Exopodal segments of first foot indistinctly separated from each other. Each of the segments bearing 1 external spine. Endopod of first swimming

foot consisting of 1 segment. Endopod of second swimming foot 2-segmented, of third foot 3-segmented; fourth foot broken short. Posterior side of second basipodal segment of fourth foot smooth. Terminal spine of exopods (intact only on left second and right third swimming foot) strong, denticulate. Fifth feet absent. Total length 9.00 mm. Holotype: USNM 120526.

The male is unknown.

REMARKS: The genus *Batheuchaeta* was established by Brodsky (1950) to accommodate one species, *B. lamellata*, which he found in the northwestern Pacific. The female of the new species proposed here, *B. enormis*, differs from the description of the genus given by Brodsky in the following points: The genital segment is slightly asymmetrical, it is symmetrical in *Batheuchaeta*; the posterior margins of the abdominal segments are smooth, they carry teeth in *Batheuchaeta*; the second maxilla carries 3 spines, 1 each on lobes 3 to 5, *Batheuchaeta* has one spine each on lobes 4 and 5 only.

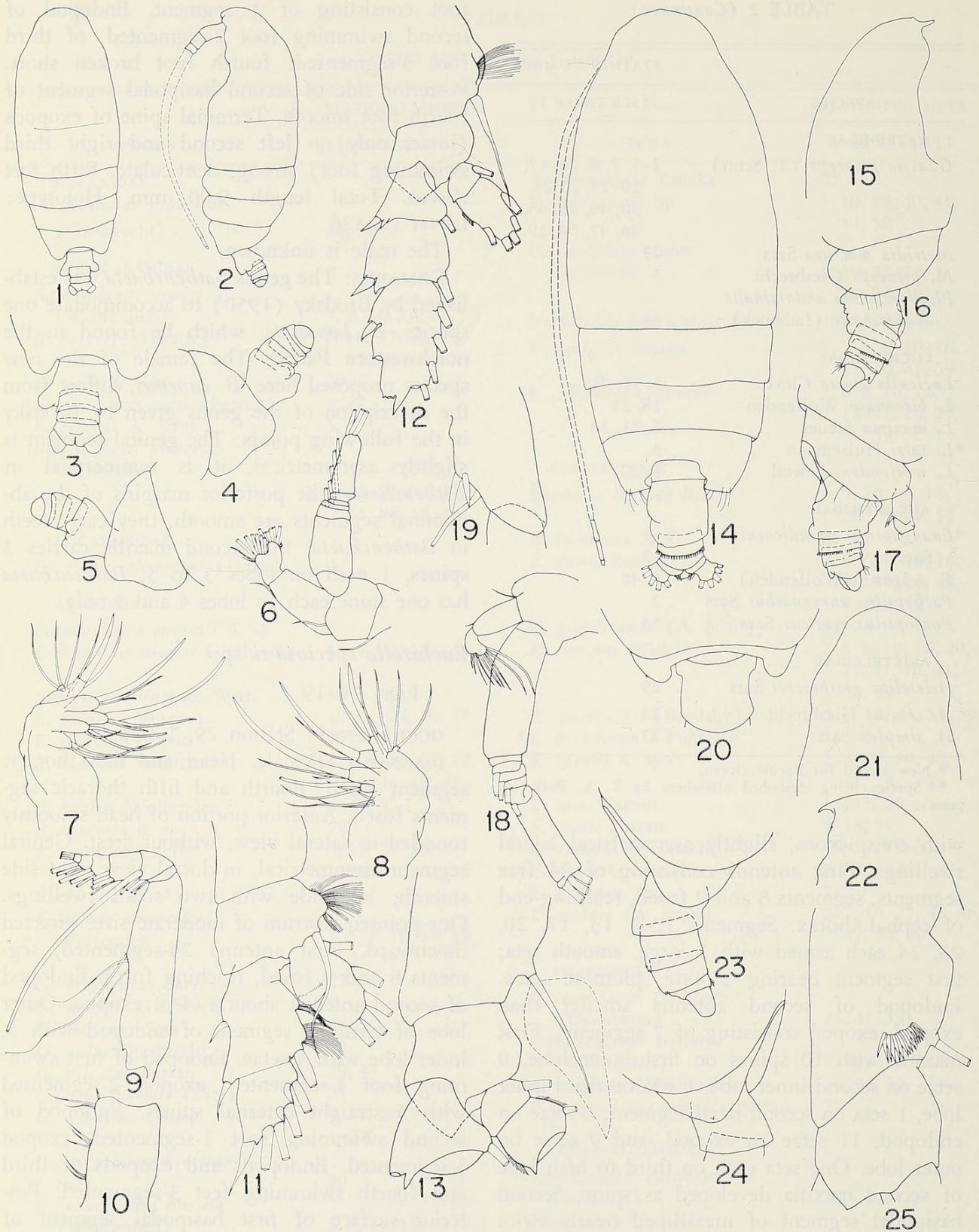
Euchirella speciosa n. sp.

Figs. 14-19

OCCURRENCE: Station 29, 1 female.

DIAGNOSIS: Female. Head and first thoracic segment fused. Fourth and fifth thoracic segments fused. Anterior portion of head smoothly rounded in lateral view, without crest. Genital segment asymmetrical, in dorsal view right side smooth, left side with two small swellings. One-pointed rostrum of moderate size, directed downward. First antenna 24-segmented, segments 8 and 9 fused, reaching furca. Endopod of second antenna about 1/4 of exopod. Outer lobe of terminal segment of endopod with 5, inner lobe with 4 setae. Endopod of first swimming foot 1-segmented, exopod 2-segmented with 3 straight external spines. Endopod of second swimming foot 1-segmented, exopod 3-segmented. Endopods and exopods of third and fourth swimming feet 3-segmented. Posterior surface of first basipodal segment of fourth swimming foot with 2 rather strong, unequal spines. Total length 4.92 mm. Holotype: USNM 120527.

REMARKS: *Euchirella speciosa* closely resembles *E. formosa* Vervoort, *E. indica* Ver-



FIGS. 1-13. *Batbeuchaeta enormis* n. sp., female. 1, Dorsal view; 2, lateral view; 3, fourth and fifth thoracic segments and abdomen, dorsal view; 4, fourth and fifth thoracic segments and abdomen, left lateral view; 5, fourth and fifth thoracic segments and abdomen, right lateral view; 6, second antenna; 7, second maxilla; 8, second maxilla, other side; 9, distal end of maxilliped; 10, proximal segment of maxilliped; 11, first foot; 12, second foot; 13, fourth foot (incomplete).

voort, and *E. venusta* Giesbrecht in the absence of a crest, the number of spines on the first basipodal segment of the fourth foot, and the number of setae on the lobes of the terminal segment of the endopod of the second antenna. *E. speciosa* is distinguished from these three species by the presence of 2 swellings on the left side and the nearly straight right side of the genital segment when seen in dorsal view.

Gaetanus brachyurus Sars, 1907

REMARKS: The first basipodal segment of the maxilliped carries a lamella on its external side as is the case in many species of *Gaidius*. Such a lamella is also present in three females of *Gaetanus brachyurus* found by us previously in the Indian Ocean (Grice and Hulsemann, 1967). This lamella is not mentioned in the description of the species by Sars (1907, 1925).

Gaidius inermis (Sars, 1905)

SYNONYMY: *Gaetanus inermis* Sars, 1905, p. 12; Sars, 1925, p. 64, pl. 19, figs. 3-5; Rose, 1929, p. 19; Wilson, 1950, p. 231.

REMARKS: According to Vervoort's (1952a, 1952b) revised definitions of *Gaidius* and *Gaetanus*, the species described by Sars as *Gaetanus inermis* is transferred to the genus *Gaidius*.

Single females of *Gaidius inermis* were reported from the northeastern Atlantic (Sars, 1925; Rose, 1929) and one female, which was identified by Sars (Wilson, 1950), from off Peru. The male is still unknown.

Pseudochirella limata n. sp.

Figs. 20-25

OCCURRENCE: Station 27, 1 female.

DIAGNOSIS: Female. Body elongate, dilated in the oral region. Anterior portion of head slightly obtuse in dorsal view. Strong 1-pointed rostrum directed downward and slightly backward. Head and first thoracic segment separated by fine line, fourth and fifth thoracic segments

separate. Posterior margin of fifth thoracic segment produced covering half the genital segment. Left side of fifth thoracic segment with minute spine. Abdomen consisting of 4 segments. Genital segment smooth, only little protruded ventrally. In dorsal view nearly symmetrical, right side slightly swollen near distal margin. Widest part proximally, behind which is abruptly narrowed portion. Patch of hair on ventral side of anal segment, also on inner margins of furca. Flat, rounded teeth dorsally on distal margin of second and third abdominal segments. First antenna consisting of 23 free segments, segments 8 and 9, and 24 and 25 fused. First antenna reaching end of furca. Endopod of second antenna two-thirds length of exopod. Exopod consisting of 7 segments. Outer lobe of terminal segment of endopod with 6 large and 1 small setae, inner lobe with 6 large and 3 small setae. Endopod of first swimming foot 1-segmented, exopod 3-segmented, segments 2 and 3 incompletely separated. Endopod of second foot 2-segmented, exopod 3-segmented. Posterior side of first basipodal segment of fourth pair of swimming feet equipped with row of 16 spines, decreasing in size toward inner side. Total length 7.33 mm. Holotype: USNM 120528.

REMARKS: *Pseudochirella limata* shows relationship to *P. lobata* (Sars), but in the latter species the fifth thoracic segment is more protruded and does not carry a spine, and the genital segment is widened distally instead of proximally.

Pseudochirella tuberosa n. sp.

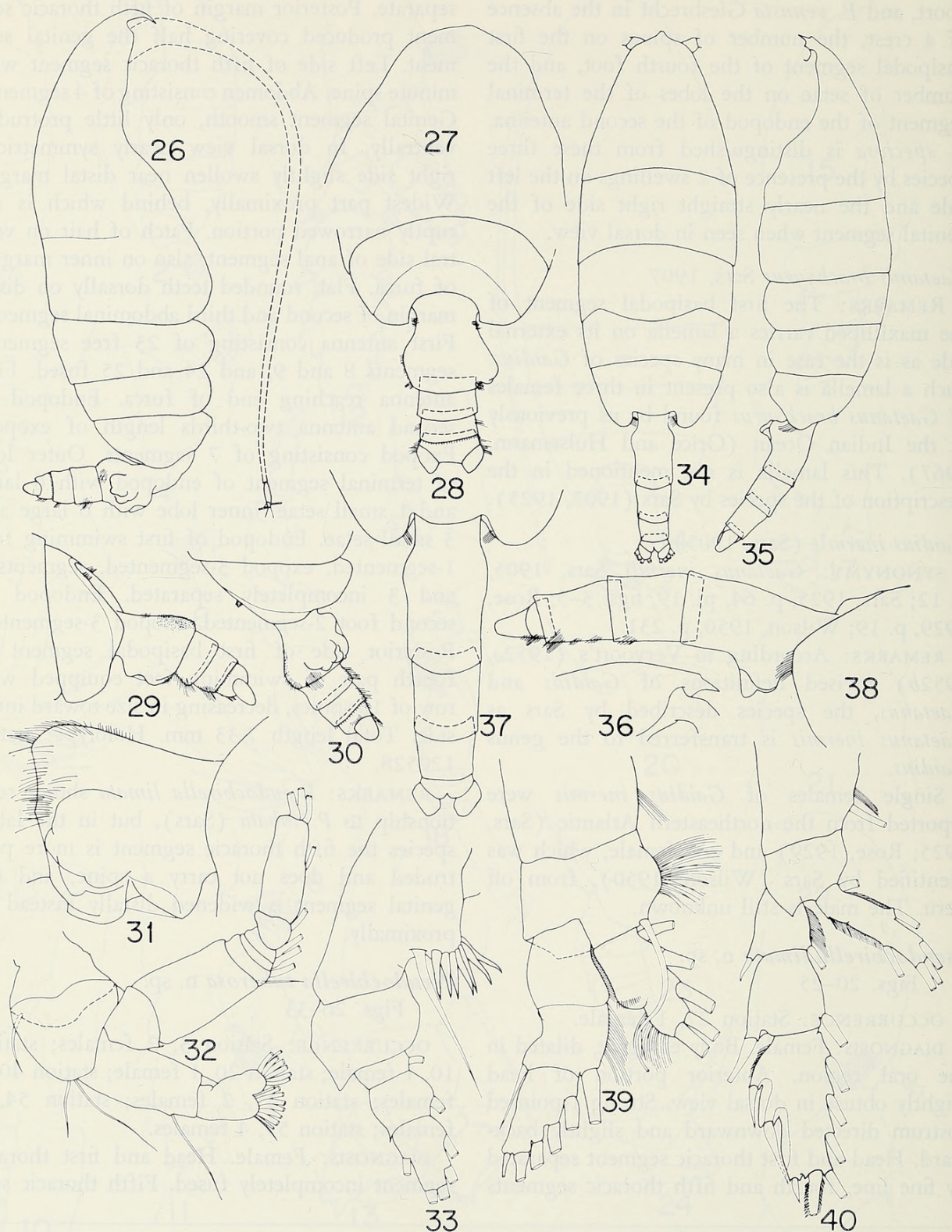
Figs. 26-33

OCCURRENCE: Station 3, 2 females; station 10, 1 female; station 20, 1 female; station 40, 3 females; station 41, 2 females; station 54, 2 females; station 59, 4 females.

DIAGNOSIS: Female. Head and first thoracic segment incompletely fused. Fifth thoracic seg-

FIGS. 14-19. *Euchirella speciosa* n. sp., female. 14, Dorsal view; 15, anterior end of head, lateral view; 16, fourth and fifth thoracic segments, left lateral view; 17, fourth and fifth thoracic segments, right lateral view; 18, second antenna; 19, first basipodal segment of fourth foot.

FIGS. 20-25. *Pseudochirella limata* n. sp., female. 20, Fifth thoracic segment and genital segment, dorsal view; 21, anterior end of head, dorsal view; 22, anterior end of head, lateral view; 23, fifth thoracic segment and abdomen, right lateral view; 24, fifth thoracic segment and genital segment, left lateral view; 25, basipodal segments of fourth foot.



FIGS. 26-33. *Pseudochirella tuberosa* n. sp., female. 26, Lateral view; 27, anterior end of head, dorsal view; 28, posterior end of thorax and abdomen, dorsal view; 29, posterior end of thorax and abdomen, left side; 30, posterior end of thorax and abdomen, right side; 31, genital segment, right side; 32, second antenna; 33, fourth foot (exopod missing).

FIGS. 34-40. *Euchaeta regalis* n. sp., female. 34, Dorsal view; 35, lateral view; 36, rostrum, lateral view; 37, abdomen, dorsal view; 38, abdomen, right lateral view; 39, first foot; 40, second foot.

ment small without spines, separated from fourth segment by fine line. Genital segment asymmetrical, right side with large swelling. Rostrum strong, 1-pointed, curved downward and backward. First antenna consisting of 24 free segments, segments 8 and 9 fused; reaching to distal end of genital segment. Endopod of second antenna slightly longer than half the length of exopod, outer lobe of terminal segment of endopod with 7 setae, inner lobe with 9 setae. Endopod of first swimming foot 1-segmented, exopod 2-segmented with 3 external spines. Endopod of second swimming foot 2-segmented, exopods of second to fourth feet and endopods of third and fourth feet 3-segmented. Posterior surface of first basipodal segment of fourth swimming foot with 6–8 rather strong spines. Total length 5.42 to 6.50 mm. Holotype: USNM 120529.

REMARKS: *Pseudochirella tuberosa* resembles *P. gibbera* Vervoort and *P. mawsoni* Vervoort, but is distinguished from these by its 2-segmented exopod in the first swimming foot and the characteristic shape of the genital segment.

Undeuchaeta major Giesbrecht, 1888

REMARKS: The first basipodal segments of the fourth pair of swimming feet of 28 females were examined. Most of them have 2 or 3 small spines on these segments. In only two specimens are the spines absent. The size of the females varies from 4.66 to 5.25 mm.

The genus *Undeuchaeta* is defined as having no spines on the first basipodal segment of the fourth swimming foot. In other respects (e.g., the structure of the genital segment), however, these females agree with the description of *U. major*. The present specimens are also similar to but smaller than *Pseudochirella incisa* (Esterly). The synonymy of this species has been discussed by Grice (1964). Pending re-examination of Giesbrecht's type specimen we will propose neither an emendation of the generic description nor a transfer of *U. major* to another genus.

Euchaeta barbata Brady, 1883

REMARKS: The total length of one female *Euchaeta barbata* from station 5 is 10.16 mm which is the size of the closely related *E. farrani* With. Our female, however, is identified with

E. barbata because the second external spine on the third exopodal segment of the second swimming foot overreaches the end of the segment, as is pointed out by With (1915).

Euchaeta dubia Esterly, 1906

REMARKS: One male *Euchaeta dubia* was found at station 10. It measures 8.00 mm in length. Tanaka (1958) reported the length of the male of this species (as *Pareuchaeta comosa*) as 7.25 mm, Vervoort (1963) as 6.80 and 7.10 mm, and Grice and Hulsemann (1967) as 6.35 mm. The tooth mentioned by Vervoort as being present in the incision of the bifid lamella on the exopod of the left fifth foot is absent in our specimen. It is also absent in Esterly's (1906) and Tanaka's (1958) figures of this species as well as in a male found by Grice and Hulsemann (1967) in the Indian Ocean.

Euchaeta pavlovskii (Brodsky, 1955)

REMARKS: *Euchaeta pavlovskii* was described from specimens obtained in the Bering Sea and Kuril-Kamchatka Trench. Our findings of this species extend its geographical range to the eastern South Pacific and its size range to 9.33–10.83 mm in length. Brodsky's (1955) specimens measured 10.4–10.8 mm. It may be added here that the first antenna of *E. pavlovskii* consists of 24 free segments (segments 8 and 9 are fused) and reaches the posterior margin of the second thoracic segment.

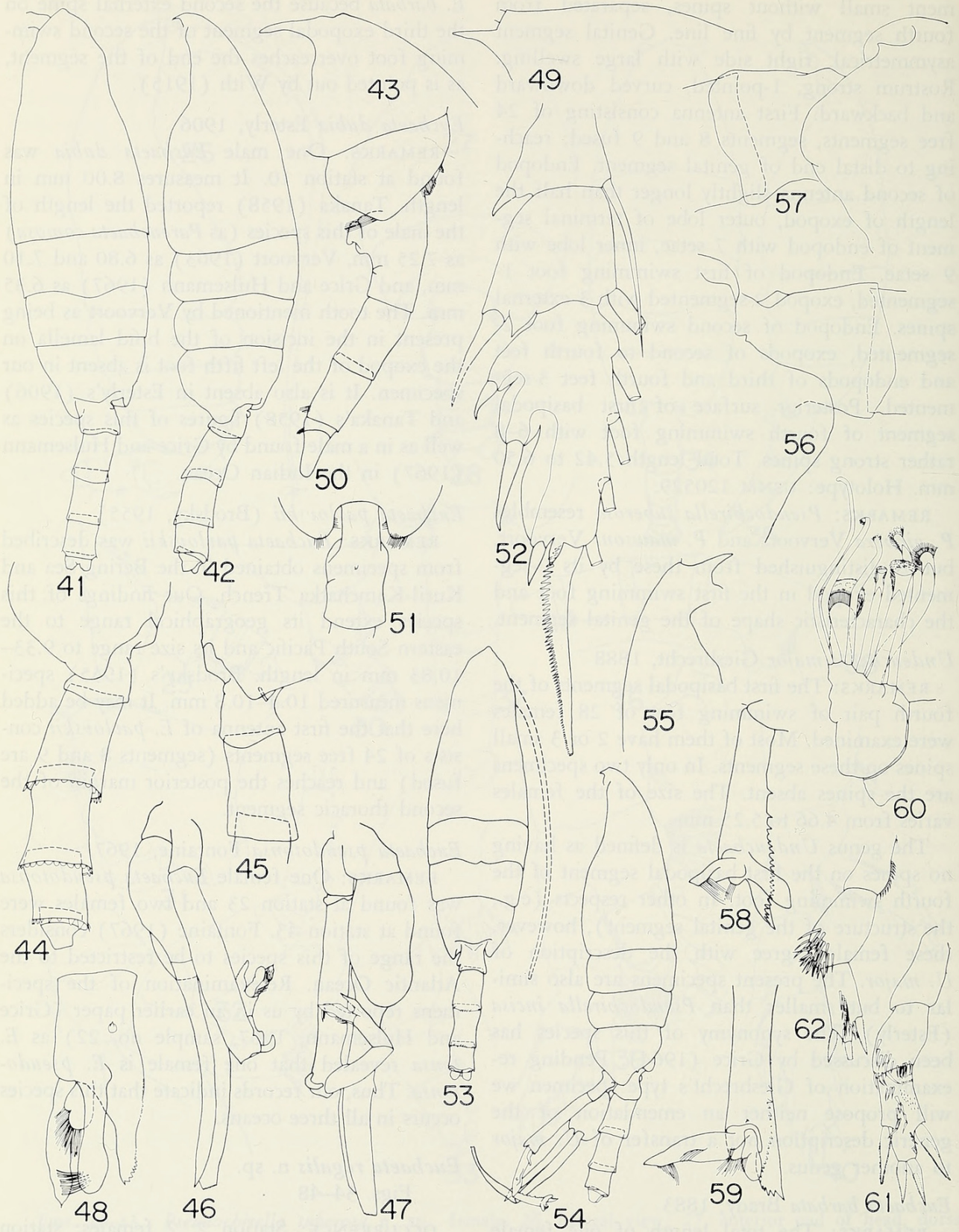
Euchaeta pseudotonsa Fontaine, 1967

REMARKS: One female *Euchaeta pseudotonsa* was found at station 23 and two females were found at station 43. Fontaine (1967) considers the range of this species to be restricted to the Atlantic Ocean. Re-examination of the specimens reported by us in an earlier paper (Grice and Hulsemann, 1967, sample no. 22) as *E. tonsa* revealed that one female is *E. pseudotonsa*. Thus, our records indicate that this species occurs in all three oceans.

Euchaeta regalis n. sp.

Figs. 34–48

OCCURRENCE: Station 2, 2 females; station 3, 1 female; station 16, 1 female; station 20, 1 female; station 40, 9 females, 1 male; station 41, 3 females; station 54, 3 females.



FIGS. 41-48. *Euchaeta regalis* n. sp., male. 41, Dorsal view; 42, lateral view; 43, rostrum, lateral view; 44, abdomen, left lateral view; 45, abdomen, right lateral view; 46, fifth feet (distal end of right exopod missing); 47, fifth feet, another view; 48, distal end of exopod of left fifth foot.

FIGS. 49-52. *Euchaeta vorax* n. sp., female. 49, Rostrum, lateral view; 50, fourth and fifth thoracic segments and abdomen, left lateral view; 51, genital segment, dorsal view; 52, exopod of second foot.

DIAGNOSIS: Female. Body slender. Length of abdomen and furca contained 2.5 times in cephalothorax. Head and first thoracic segment separate. Fourth and fifth thoracic segments fused. Rostrum of moderate size, pointed downward and forward. Posterior lateral margin with patch of hair, in lateral view rounded, in dorsal view smoothly rounded. Abdomen consisting of 4 segments. Genital segment long and slender; in dorsal view almost symmetrical, moderately widening on both sides of proximal half, becoming slender again in distal half. Genital swelling produced ventrally; in lateral view the posterior part more produced than the anterior due to the shape of the genital flaps. Posterior margins of abdominal segments smooth. Anal segment very short. First antenna reaching to fourth thoracic segment, consisting of 23 free segments (8 and 9, and 24 and 25 are fused). First and second exopodal segments of first swimming foot incompletely separated. External spine of second exopodal segment of second foot almost reaching tip of first external spine of third exopodal segment. Total length 8.50–9.41 mm. Holotype: USNM 120530.

Male. Body slender. Abdomen contained 2.3 times in cephalothorax. Rostrum small, slender, directed downward and somewhat backward. Forehead in side view rounded. Head and first thoracic segment fused as are fourth and fifth thoracic segments. Posterior lateral margin of last thoracic segment asymmetrical: left side rounded, protruded; right side shorter, bluntly triangular. Abdomen consisting of 5 segments. Right side of first abdominal segment slightly longer than left. Anteriorly there is a dorsal button, somewhat set off toward the right side; there is also a V-shaped ridge. The distal margins of second to fourth abdominal segments carry flat, rounded teeth. Anal segment very small. First antenna reaching end of genital segment; consisting of 22 free segments (segments 8–10, and 24 and 25 are fused). Fifth feet longer than abdomen. Endopod of right fifth foot as long as first exopodal segment which

carries a tubercle in about its middle. Distal end of exopod broken off. Endopod of left fifth foot small, curved. First exopodal segment of left fifth foot flattened, second segment carrying a recurved tooth. Inner distal end of this segment prolonged into a slender lamella with smooth outer margin; inner margin beset with row of teeth separated into proximal and distal portion. Finely striated finger-shaped process about as long as toothed lamella. Haired tubercle bilobed. Pointed third exopodal segment only slightly longer than toothed lamella bearing the usual patch of hair. Total length 8.50 mm. Allotype: USNM 120531.

REMARKS: The female *Euchaeta regalis* is similar to *E. dubia* Esterly, *E. hanseni* With, and *E. sarsi* Farran. It is readily distinguished from these species by the more slender abdomen and the peculiarly shaped genital protuberance. The male of *E. regalis* shows close affinities to the males of *E. dubia* Esterly and *E. hanseni* With. It differs from the male of *E. dubia* in the absence of hyaline spines on the posterolateral margin of the last thoracic segment and in the structure of the toothed lamella on the left fifth foot. This lamella is spoon-shaped and smooth on the external margin. The lamella of *E. dubia* has a bifid apex and carries teeth on the external as well as on the internal margin. In the male of *E. hanseni* the lamella bears teeth also along the external margin.

Euchaeta vorax n. sp.

Figs. 49–52

OCCURRENCE: Station 21, 1 female.

DIAGNOSIS: Female. Body and abdomen slender. Length of abdomen and furca contained 2.2 times in cephalothorax. Head and first thoracic segment separated by a fine line, fourth and fifth thoracic segments fused. Rostrum slender, pointed downward and forward. In lateral view posterior lateral margin of fifth thoracic segment slightly angular, with patch of hair. Hair also present on posterior lateral margin of same segment. Abdomen con-

FIGS. 53–59. *Euchaeta weberi* (A. Scott), male. 53, Dorsal view; 54, lateral view; 55, rostrum, lateral view; 56, posterior end of thorax, left lateral view; 57, posterior end of thorax, right lateral view; 58, distal end of exopod of left fifth foot; 59, distal end of exopod of left fifth foot, another view.

FIGS. 60–62. *Xanthocalanus pinguis* Farran, female. 60, Endopod of second maxilla (8.91 mm specimen); 61, fifth foot (8.91 mm specimen); 62, fifth foot (8.00 mm specimen).

sisting of four segments. Groups of hair present on ventral side of third segment near distal margin and of anal segment. Genital segment little shorter than the two following combined. Genital protuberance protruded ventrally. Lateral flaps flanking the genital opening small. In dorsal view genital segment slightly asymmetrical. Proximal third of segment slender, distal two-thirds dilated. Segment with small knob on dorsal side and ridge on left side. First antennae broken short. First and second exopodal segments of first swimming foot incompletely separate. External spines of second foot long; external spine of second segment overreaching insertion of first spine on third segment; first spine of third segment reaching insertion of second spine, second spine overreaching end of segment. Total length 7.25 mm. Holotype: USNM 120532.

REMARKS: *Euchaeta vorax* is similar to *E. gracilicauda* (A. Scott). It differs, however, in the somewhat shorter abdomen, the asymmetrical and wider genital segment and the longer external spines on the exopod of the second swimming foot.

Euchaeta weberi (A. Scott, 1909)

Figs. 53-59

DIAGNOSIS: Male. Body slender, length of abdomen and furca contained twice in that of the cephalothorax. In dorsal view cephalon triangular anteriorly. Rostrum small, pointed downward. Head and first thoracic segment and fourth and fifth thoracic segments fused. Posterior lateral margins rounded, asymmetrical; left side slightly more produced than right side. Small spine on both sides near dorsal margin. Abdomen consisting of 5 segments. Genital segment slightly asymmetrical with small ridge on right dorsal side. Posterior margins of second to fourth abdominal segments with small spines. First antenna reaching beyond genital segment. Fifth pair of feet longer than abdomen. Right endopod styliform, just exceeding first segment of exopod in length. Left endopod 2-segmented. One tubercle in about middle of left first exopodal segment. Second exopodal segment prolonged into spoon-shaped lamella equipped with teeth along the distal and outer margins, the larger teeth being located distally. Finger-shaped process about as long as lamella.

Tubercle at base of third exopodal segment haired. Third exopodal segment exceeding lamella and finger-like process in length, pointed at the apex, and with the usual tuft of hair. Small tooth present near base of finger-like process. Total length 6.41 mm.

REMARKS: The species A. Scott (1909) described from the male as *Paraeuchaeta tuberculata* was considered by Vervoort (1957:76) to be the male of *Euchaeta weberi* (A. Scott). Tanaka (1958) synonymized *P. tuberculata* with *E. tonsa* Giesbrecht. Fontaine (1967) transferred the males which were described as *P. tuberculata* by A. Scott and referred to *E. tonsa* by Tanaka to a new species, *E. scaphula* Fontaine. There was no male of this species in our samples.

The male characterized above and presented as the hitherto undescribed male of *Euchaeta weberi* differs from *E. scaphula* mainly in the shape of the toothed lamella on the exopod of the left fifth foot, the distribution of the teeth on this lamella, and the presence of only 1 tubercle on the first exopodal segment of the left fifth foot. *E. scaphula* has 2 tubercles and 1 small spine on the first exopodal segment of the left fifth foot.

Xanthocalanus pinguis Farran, 1905

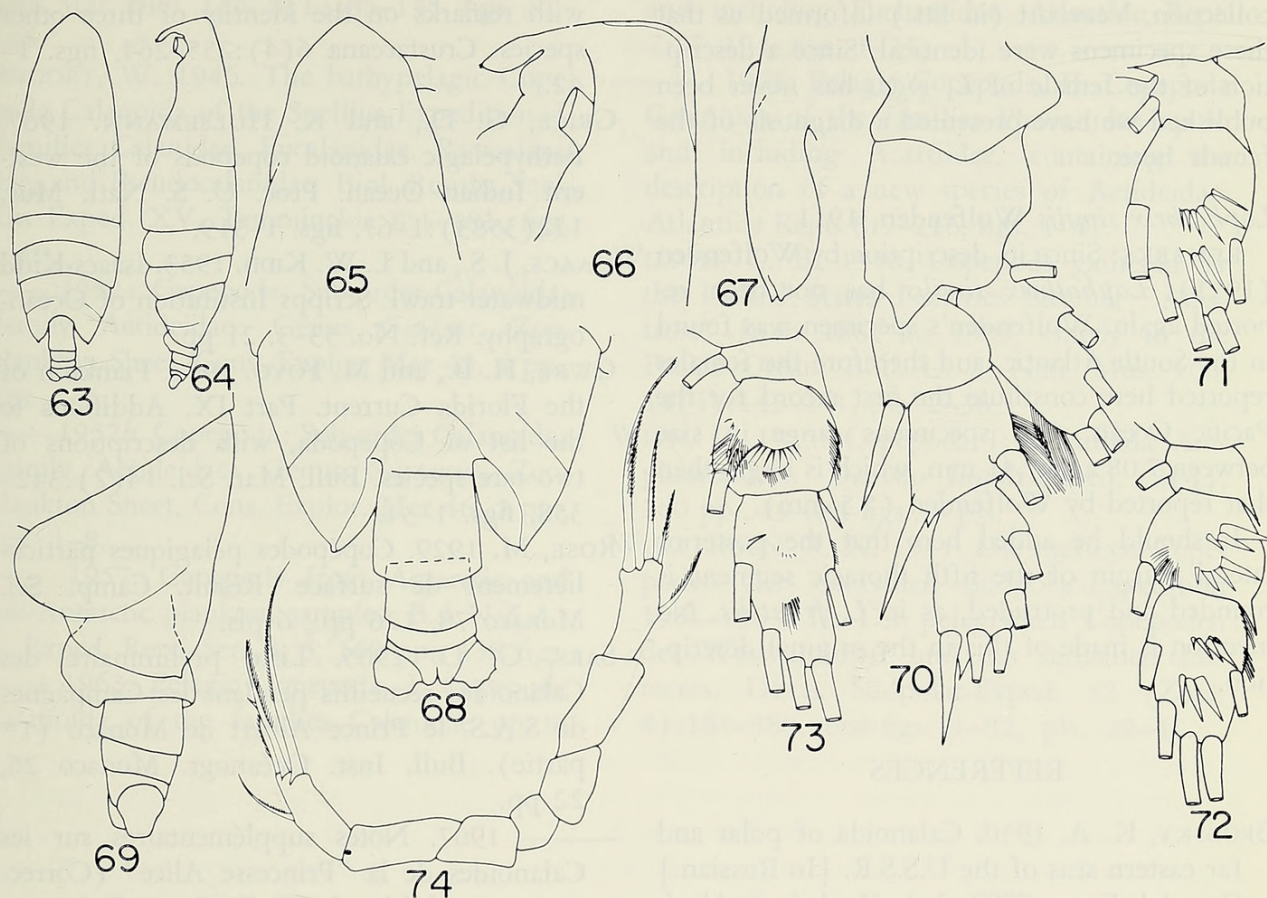
Figs. 60-62

REMARKS: Two female specimens belonging to the genus *Xanthocalanus* were found at station 27. Their total lengths are 8.00 mm and 8.91 mm. We are referring them to *X. pinguis* Farran, although the terminal segment of the fifth foot in the larger specimen is longer than the second segment, and the terminal segment of the fifth foot in the smaller specimen bears only 3 spines. There are 4 spines on the fifth foot of the larger specimen. The first antennae of both females consist of 24 free segments, with segments 8 and 9 fused, as reported by Tanaka (1960). The terminal part of the second maxilla is provided with sensory appendages of various sizes.

Lophothrix gigas (A. Scott, 1909)

Figs. 63-74

DIAGNOSIS: Female. Body elongate, slender. Abdomen contained 5 times in cephalothorax. Cephalon and first thoracic segment separated



FIGS. 63-74. *Lophothrix gigas* (A. Scott), female. 63, Dorsal view; 64, lateral view; 65, anterior end of head, dorsal view; 66, anterior end of head, lateral view; 67, rostrum; 68, posterior end of thorax and abdomen, dorsal view; 69, posterior end of thorax and abdomen, lateral view; 70, first foot; 71, endopod of second foot; 72, endopod of third foot; 73, endopod of fourth foot; 74, fifth feet.

by fine line, fourth and fifth thoracic segments incompletely fused. Head in dorsal view triangularly rounded, in lateral view with low crest. Posterior lateral corner of last thoracic segment broadly triangular ending in a point. Fifth thoracic segment and ventral portion of fourth with pitted surface. Rostrum large, directed downward and backward; swollen in its distal half, tapering into two separate points. Genital segment about as long as the rest of the abdomen produced ventrally, slightly overhanging second abdominal segment. Furcal rami short, divergent. First antenna 24-segmented, segments 8 and 9 incompletely fused, reaching third abdominal segment. Exopod of second antenna slightly longer than endopod. Second maxilla distally with sensory appendages. Exopods of first to fourth swimming feet 3-segmented; endopod of first foot 1-segmented, of second foot 2-segmented, of third and fourth feet 3-segmented. Second and third endopodal

segments of second to fourth foot armed with spines on their posterior sides. Fifth foot 3-segmented. Terminal segment bearing 4 setae; 1 originating in the middle of the outer margin, 1 on the inner margin near the distal end, and 2 on the distal end. Inner seta nearly 3 times the length of outer seta. Total length 7.91-8.66 mm.

REMARKS: The large size, the pointed fifth thoracic segment, and the shape of the fifth pair of feet distinguish *Lophothrix gigas* from all other species in the genus.

Vervoort (1965) recognized that the immature male described by A. Scott (1909) as *Brachycalanus gigas* belongs to the genus *Lophothrix*. Vervoort mentions also that he found an immature male and an adult female of *Lophothrix gigas* in the "Snellius" collection. We obtained seven females of this large species. After kindly comparing drawings of one of our females with the female from the "Snellius"

collection, Vervoort (in litt.) informed us that these specimens were identical. Since a description of the female of *L. gigas* has never been published we have presented a diagnosis of the female here.

Lophothrix similis Wolfenden, 1911

REMARKS: Since its description by Wolfenden (1911), *Lophothrix similis* has not been reported again. Wolfenden's specimen was found in the South Atlantic, and therefore the females reported here constitute the first record for the Pacific Ocean. Our specimens range in size between 7.08 and 7.41 mm, which is larger than that reported by Wolfenden (5.5 mm).

It should be added here that the posterior lateral margin of the fifth thoracic segment is rounded and protruded, as in *L. frontalis*. No mention is made of this in the original description.

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