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Distribution of Hyperiid Amphipods off the Oregon Coast

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A total of 19 species of hyperiid amphipods was collected from 1963 to 1967 off Oregon. *Parathemisto pacifica, Paraphronima gracilis, Streetsia challengeri, Tryphana malmi, Hyperia medusarum, Hyperoche medusarum*, and *Primno macropa* were common. New distributional records are reported for *Scina crassicornis bermudensis* and *Lanceola loveni*. Abundance and occurrence of common species are lower inshore than offshore suggesting centers of abundance are in offshore-oceanic waters. Yearly changes in occurrence and abundance of hyperiid amphipods inshore may be related to coastal upwelling. There was no evidence for vertical migrations or diel differences at depth intervals of 0–150 m and 150–450 m.

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Un total de 19 espèces d'amphipodes hypériens furent recueillis de 1963 à 1967 au large de l'Orégon. *Parathemosto pacifica, Paraphronima gracilis, Streetsia challengeri, Tryphana malmi, Hyper medusarum, Hyperoche medusarum* et *Primno macropa* étaient communs. Nous signalons des extensions d'aire pour *Scina crassicornis bermudensis* et *Lanceola loveni*. Les espèces communes sont moins abondantes et se rencontrent moins fréquemment près du rivage qu'au large, ce qui suggère que les centres d'abondance se trouvent dans les eaux du large et océaniques. Les changements annuels d'occurrence et d'abondance des hypériens du littoral peuvent être liés aux remontées d'eaux profondes près de la côte. Il n'y a pas d'indications de migrations verticales ou de différences nycthémérales dans les intervalles de profondeur de 0–150 m et 150–450 m.

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AMPHIPODS of the suborder Hyperiidea are often important components of pelagic communities and sometimes rank third in abundance of the marine crustacean zooplankters. Moreover, hyperiid amphipods are an important food source for oceanic fishes (Iversen 1962; LeBrasseur 1966).

Distributions of hyperiid amphipod in the northeast Pacific have been reported by Thorsteinson (1941), Bowman (1953, 1960, 1973), Brusca (1967), and Sanger (1972, 1973). The purpose of this study was to describe the abundance, distribution, and seasonal occurrence of hyperiid amphipods off Newport, Oregon from June 1963 to June 1967.

Materials and methods — Collections were taken with 1-m diameter plankton nets (0.571-mm mesh) from June 1963 to June 1967 at stations 15 and 25 nautical miles offshore (inshore stations) and 50–65 nautical miles offshore (offshore stations) along the 44°39′N parallel. Prior to January 1964, 18 oblique tows were made with a net 8–9 m long, towed 4–6 knots, descending at 50 m/min and ascending at 30 m/min. After January 1964 all tows were vertical, using a net 4 m long, descending at 50 m/min and ascending at 30 m/min. All oblique and vertical collections were taken at night to a depth of about 200 m (depth permitting). A total of 144 collections was made. In addition, 68 collections were made 50 nautical miles offshore to study vertical and diel variations. Opening–closing 1-m nets were actuated by pressure-activated wire cutters (Yentsch et al. 1962). The nets were towed obliquely, in tandem, and sampled the approximate depth intervals of 0–150 m and 150–450 m. A TSK flow-meter in the mouth of nets provided estimates of the volumes of water filtered.

Samples were preserved in 10% formalin aboard ship. In the laboratory, hyperiid amphipods were sorted from the whole sample if they numbered less than 200. If they were more numerous, the whole sample was divided by a plankton splitter until about 200 hyperiids remained.

Species composition — A total of 19 species of hyperiid amphipods was collected off Oregon (Table 1). To our knowledge *Lanceola loveni* has not been reported from the eastern North Pacific and *Scina crassicornis bermudensis* has not been reported from the North Pacific. According to T. E. Bowman (personal communication), who

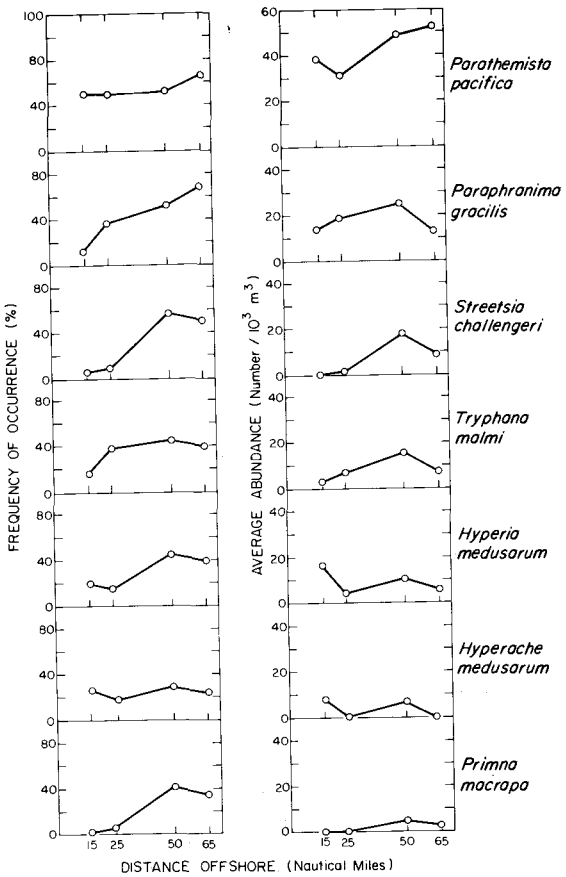

FIG. 1. Frequency of occurrence and average abundance of common species at four stations off Newport, Oreg., June 1963–June 1967.

TABLE 1. Total numbers and frequency of occurrence of hyperiid amphipods collected off Newport, June 1963–67.

	Total number	Frequency of occurrence
Parathemisto pacifica Stebbing 1888	6279	0.56
Paraphronima gracilis Claus 1879	2930	0.42
Streetsia challengeri Stebbing 1888	1227	0.36
Tryphana malmi Boeck 1870	1122	0.35
Hyperia medusarum (Müller 1776)	1367	0.31
Hyperoche medusarum (Krøyer 1838)	1353	0.24
Primno macropa Guérin 1836	626	0.22
Phronima sedentaria (Forskal 1775)	174	0.18
Vibilia armata Bovallius 1887	669	0.10
Lycaea pulex Marion 1874	65	0.06
Oxycephalus clausi Bovallius 1887	102	0.06
Primno sp.	44	0.04
Paraphronima crassipes Claus 1879	34	0.03
Dairella californica (Bovallius 1885)	60	0.03
Vibilia wolterecki Behning 1939	36	0.03
Vibilia propinqua Stebbing 1888	9	0.02
Cystisoma fabricii Stebbing 1888	5	0.02
Lanceola loveni Bovallius 1885	3	0.01
Scina crassicornis bermudensis Shoemaker 1945	1	0.01

identified our specimen of *S. crassicornis bermudensis* Shoemaker, this species is distinct from *Scina curlensis* Vinogradov, which has been previously reported from the North Pacific. Van Arsdale (1967) reported new distributional records from *Streetsia challengeri*, *Cystisoma fabricii*, *Lycaea pulex*, and *Tryphana malmi*. Sanger (1973) extended the northern ranges of *T. malmi* and *S. challengeri* to 54°N and *L. pulex* to 50°N.

The following six common species will be discussed further: *Parathemisto pacifica*, *Paraphronima gracilis*, *Streetsia challengeri*, *Tryphana malmi*, *Hyperia medusarum*, *Hyperoche medusarum*, and *Primno macropa*.

Parathemisto pacifica — This is the most common species in the eastern North Pacific (Bowman 1960; Sanger 1973). Off Oregon it was highest in total number and frequency of occurrence (Table 1). Average abundance and frequency of occurrence were highest offshore (Fig. 1). *Parathemisto pacifica* occurred during all seasons of most years with highest catches in the summer, except inshore in 1963 and 1966 (Table 2). This species was more abundant and frequent in 0–150 m than 150–450 m collections at 50 nautical miles (Table 3). Though average abundance was higher in the upper 150 m during night than day, this difference was not significant (*t*-test, $P > 0.05$).

Paraphronima gracilis — This species was second in total abundance and frequency of occurrence (Table 1). Frequency of occurrence increased with distance from shore but average abundance increased to 50 nautical miles and then decreased (Fig. 1). Bowman (1953) found *P. gracilis* to be abundant and widespread nearshore. Seasonally, abundance was lowest inshore in summer; offshore abundance did not fluctuate greatly (Table 2). The average abundance and frequency of occurrence of *P. gracilis* was higher in 0–150 m than 150–450 m (Table 3). No significant diel differences were found in either depth interval. Thus, there was no evidence for vertical migration of this species off Oregon. Brusca (1967), however, reported that this species migrates vertically off California.

Streetsia challengeri — Frequency of occurrence and average abundance of *S. challengeri* increased to 50 nautical miles and then decreased (Fig. 1). It was not common inshore. Abundance offshore was greatest during the winter for all years except 1965 (Table 2). This species was more abundant and frequent from 0–150 m than from 150–450 m (Table 3). Day–night differences within these strata were not significant, hence, there was no evidence of vertical migration. Brusca (1967), however, felt there was evidence of diurnal migration toward the surface at night.

TABLE 2. The average abundance per 1000 m^3 of common species from inshore and offshore stations off Newport, Oreg. during four seasons from June 1963 to June 1967. Blank spaces indicate no samples were taken.

	1963		1964		1965		1966		1967	
	Inshore	Offshore	Inshore	Offshore	Inshore	Offshore	Inshore	Offshore	Inshore	Offshore
Parathemisto pacifica										
Spring			26	47	20	4	124	45	37	27
Summer	0	168	42	66	81	49	10	59		
Fall	95	15	37	35	4	12	27	8		
Winter	16	70	22	63	55	0	91	39	90	97
Paraphronima gracilis										
Spring			75	8	4	12	0	15	0	8
Summer	0	98	0	8	3	10	9	12		
Fall	0	54	26	7	68	15	39	6		
Winter	26	45	14	15	15	7	23	15	2	12
Streetsia challengeri										
Spring			0	0	0	5	0	9	2	18
Summer	5	36	0	2	5	10	0	3		
Fall	4	18	0	0	0	8	8	12		
Winter	<1	203	0	15	2	0	11	14	3	21
Tryphana malmi										
Spring			17	4	2	0	0	0	8	7
Summer	0	3	0	0	14	6	6	5		
Fall	8	21	10	19	5	7	8	7		
Winter	11	48	0	25	4	14	14	11	5	21
Hyperia medusarum										
Spring			0	7	<1	6	0	2	9	3
Summer	0	6	0	0	2	5	18	15		
Fall	35	14	0	7	0	2	3	10		
Winter	3	33	0	5	0	14	184	16	30	16
Hyperoche medusarum										
Spring			0	13	1	0	0	0	4	5
Summer	0	0	0	0	2	5	3	3		
Fall	492	0	0	6	3	4	12	8		
Winter	20	198	7	0	0	2	12	9		
Primno macropa										
Spring			0	7	0	3	0	4	0	5
Summer	0	0	0	14	14	11	10	0		
Fall	0	0	0	0	0	8	2	3		
Winter	0	2	0	6	0	0	0	3	1	1

Tryphana malmi — Frequency of occurrence and average abundance of this fourth most common species increased with distance from shore to 50 nautical miles (Fig. 1). Highest abundance occurred offshore in fall and winter with the exception of 1965 (Table 2). Highest abundance and frequency of occurrence were in the 0–150 m interval (Table 3). No evidence was found for diel differences or vertical migration.

Hyperia medusarum — This species, a synonym of *Hyperia hystrix,* is the most common species of *Hyperia* along the Pacific coast of North America (Bowman 1973). It was fifth in total number and frequency of occurrence off Oregon (Table 1). The frequency of occurrence was greater offshore while average abundance was highest at 15 nautical miles (Fig. 1). Abundance was greatest in fall or winter months (Table 2). Day–night differences were not significant within or between depths. Frequency of occurrence was highest from 150 to 450 m (Table 3).

Hyperoche medusarum — Ranking sixth in total abundance, this species was highest in frequency of occurrence and abundance at 15 and 50 nautical miles (Fig. 1). Generally, greatest seasonal abundance occurred during fall and winter months (Table 2). Day–night differences gave no evidence of vertical migration (Table 3).

Primno macropa — This species was rare inshore and increased offshore in both frequency of occurrence and average abundance (Fig. 1). Larg-

TABLE 3. Vertical and diel differences, means ($\bar{x}$), and frequency of occurrence (f.o.) of 68 collections taken 50 nautical miles off Newport.

	0–150 m		150–450 m	
	Day	Night	Day	Night
Parathemisto pacifica				
$\bar{x}$	9.64	51.12	2.80	2.50
f.o.	0.63	0.94	0.46	0.50
Paraphronima gracilis				
$\bar{x}$	11.50	28.11	2.50	3.08
f.o.	0.68	0.94	0.60	0.41
Streetsia challengeri				
$\bar{x}$	12.73	13.94	2.40	0.67
f.o.	0.54	0.70	0.33	0.16
Tryphana malmi				
$\bar{x}$	5.41	3.24	0.80	1.50
f.o.	0.54	0.64	0.26	0.41
Hyperia medusarum				
$\bar{x}$	3.86	1.88	2.73	2.92
f.o.	0.31	0.29	0.80	0.50
Hyperoche medusarum				
$\bar{x}$	1.54	1.14	0.05	0.13
f.o.	0.22	0.17	0.07	0.08
Primno macropa				
$\bar{x}$	3.40	0.88	9.20	7.33
f.o.	0.31	0.17	0.80	0.75

est catches were generally made during the summer months (Table 2). There was no evidence of vertical migration; abundance and frequency of occurrence were highest from 150 to 450 m (Table 3).

Discussion — The lower abundance and frequency of occurrence inshore than offshore (Fig. 1, Table 2) indicate that most of the species of hyperiids off Oregon have centers of abundance in offshore-oceanic waters. Numbers inshore may be affected by seasonal changes in advection. During upwelling periods, when winds are from the north and surface waters are displaced offshore, the catches inshore were usually low. With the change in the wind regime during November through February from a northerly to a southerly direction, there is a net onshore movement of surface water (Burt and Wyatt 1964). During this period the occurrence and abundance of hyperiids were usually at a maximum inshore (Van Arsdale 1967; present data for 1965–67). Also, hyperiid amphipods were usually more abundant during warm years than during cool years, especially at the inshore stations (Van Arsdale 1967). Advection of surface water, therefore, may be related to both seasonal and year-to-year changes in the inshore occurrence of hyperiid amphipods.

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BOWMAN, T. E. 1953. The systematics and distribution of pelagic amphipods of the families Vibiliidae, Paraphronimidae, Hyperiidae, Dairellidae, and Phrosinidae from the Northeastern Pacific. Ph.D. Thesis. Univ. California, Los Angeles, Calif. 430 p.

1960. The pelagic amphipod genus *Parathemisto* (Hyperiidea: Hyperiidae) in the North Pacific and adjacent Arctic Ocean. Proc. U.S. Nat. Mus. 112(3439): 343–392.

1973. Pelagic amphipods of the genus *Hyperia* and closely related genera (Hyperiidea: Hyperiidae). Smithson. Contrib. Zool. 136: 1–76.

BRUSCA, G. J. 1967. The ecology of pelagic amphipods I: Species accounts, vertical zonation and migration of amphipods from the waters off southern California. Pac. Sci. 21: 382–393.

BURT, W. V. and B. WYATT. 1964. Drift bottle observations of the Davidson Current off Oregon, p. 156–165. *In* K. Yoshida [ed.] Studies on oceanography. Univ. of Washington Press, Seattle, Wash.

IVERSEN, R. T. B. 1962. Food of Albacore tuna, *Thunnus germo* (Lacpede) in the central and northeastern Pacific. U.S. Fish Wildl. Serv. Fish. Bull. 214: 495–479.

LEBRASSEUR. R. J. 1966. Stomach contents of salmon and steelhead trout in the northeastern Pacific Ocean. J. Fish. Res. Board Can. 23: 85–100.

SANGER, G. A. 1972. Pelagic amphipod crustaceans from the southeastern Bering Sea. NWFC MARMAP Survey I. Rep. No. I. 24 p. (Nat. Mar. Fish. Ser., N.W. Fish. Center, Seattle, Wash.).

1973. Epipelagic amphipods (Crustacea) off Washington and British Columbia, October–November 1971. NWFC MARMAP Survey I. Rep. No. 8. 29 p. (Nat. Mar. Fish. Ser., N.W. Fish. Center, Seattle, Wash.).

THORSTEINSON, E. D. 1941. New or noteworthy amphipods from the North Pacific coast. Univ. Wash. Publ. Oceanogr. 4: 50–94.

VAN ARSDALE, H. A. 1967. The distribution of hyperiid amphipods off the Oregon coast. M.S. Thesis. Oregon State Univ. Library, Corvallis, Oreg. 34 p.

YENTSCH, C. S., G. D. GRICE, AND A. HART. 1962. Some opening–closing devices for plankton nets operated by pressure, electrical, and mechanical actions. Rapp. P.-V. Reun. Cons. Int. Explor. Mer 153: 59–65.