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National Marine Fisheries Service

Pelagic Amphipod Crustaceans from the Southeastern Bering Sea, June 1971

GERALD A. SANGER

SEATTLE, WA

July 1974

National Marine Fisheries Service, Special Scientific Report—Fisheries Series

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GERALD A. SANGER[1]

ABSTRACT

Fourteen species of pelagic amphipods were present in zooplankton samples collected from the southeastern Bering Sea in June 1971. *Parathemisto pacifica* strongly dominated relative abundance (68-96%) and was present in numbers up to an estimated 2,755/1,000 m^3 of water. *Primno macropa* was the only other species present in all hauls and ranged from 4 to 27% in relative abundance. *Cyphocaris challengeri* was present in numbers up to 48/1,000 m^3 during night hauls, but only one animal was taken in all daylight hauls. *Hyperia medusarum* was present in 14 (82%) of the hauls but accounted for less than 1% of the total numbers.

A presumed diurnal vertical migration was evidenced for *Primno macropa*, *Cyphocaris challengeri*, and possibly for *Scina rattrayi*, *Hyperoche medusarum*, and *Hyperia medusarum*.

The occurrence of *Scina stebbingi*, *S. rattrayi*, *Vibilia caeca* (?), *Paraphronima crassipes*, *Phronima sedentaria*, and *Primno macropa* extended their known ranges in the Bering Sea eastward, and the occurrence of *Cyphocaris anonyx* represents a new record for the Bering Sea.

INTRODUCTION

Cruise K71-3 of the RV *George B. Kelez* (Northwest Fisheries Center, National Marine Fisheries Service, Seattle, Wash.) was conducted in the southeastern Bering Sea from 21 May through 11 June 1971. One objective of the cruise was to survey the diurnal variation in kinds of zooplankton occurring in the upper layers of this biologically little-known area. To this end, a series of 18 hauls was made at a floating position-reference buoy (see below) over a 30-hr period on 8-9 June (Fig. 1).

This report lists the species of amphipod crustaceans collected and discusses aspects of their diurnal variation in numbers and occurrence during the 30-hr period. A few selected amphipods collected by the International North Pacific Halibut Commission east of the K71-3 cruise area in July 1971 are also noted and briefly discussed.

METHODS

A transponding telemetering buoy, attached to a parachute drogue at a 10-m depth, was released on 8 June to provide a reference point for monitoring various oceanographic parameters of the same parcel of water in real time. Zooplankton samples were collected with a "bongo" net array, which consisted of two 60-cm (mouth diameter) and two 20-cm frames, one each equipped with nets of 0.333-mm and 0.505-mm mesh. A 122-cm Braincon® V-fin depressor was used, and TSK® flowmeters were mounted outside the array and in the mouth of its 60-cm, 0.333-mm mesh net. Towing depths were monitored with a model 1170 Benthos® time-depth recorder.

Tows were oblique between the surface and a nominal maximum depth of 200 m. Towings were at speeds

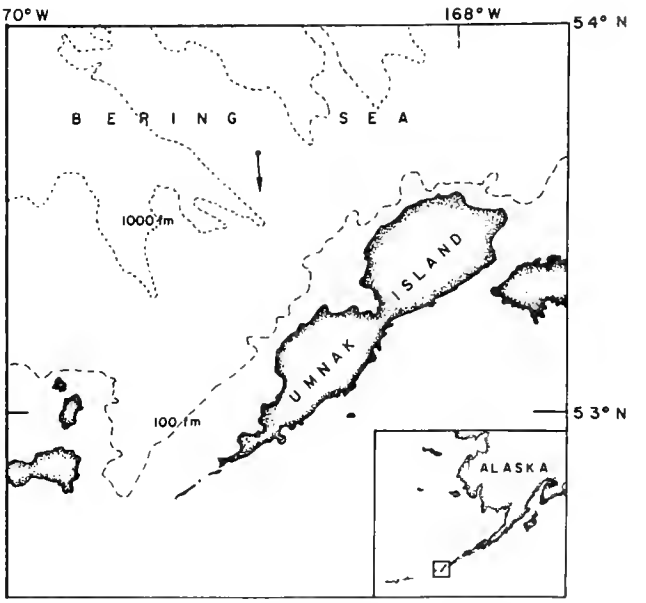

Figure 1.—Southeastern Bering Sea, showing the extent of drift of the 10-m parachute drogue between 0700 on 8 June and 1300 on 9 June 1971. Repetitive bongo net hauls were made at the drogue throughout.

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of 1.5, 3.0, and 4.5 knots, as estimated by a taffrail log, and were repeated in succession throughout the 30-hr period. Haul positions, local time, and other data for this series are listed in Table 1. Samples were preserved at sea with sodium acetate-buffered formaldehyde of about 3.7%. This report is largely restricted to the amphipods from the 60 cm, 0.333-mm mesh net.

RESULTS

Problems such as malfunctions of the flowmeter, net damage, and uncertainty of towing speeds (as measured by the taffrail log) place limitations on the data from six of the hauls (numbers 2, 8, 12, 13, 14, 18) as noted in Table 1. Also, the varying actual depths of the hauls limit the validity of direct comparisons among them. However, general trends in numbers and diurnal occurrence of some species are evident.

Table 2 lists the species identified. The higher taxa follow the classification of Bowman and Gruner (1974). Fourteen species were present in the samples, in 10 genera and 8 families. Two of these were Gammarideans and the rest of the suborder Hyperiidea.

Table 3 summarizes by haul, the numbers collected of each species, their relative abundance, estimated number per 1,000 m^3 of water, and their overall relative abundance and rate of occurrence. Numbers were clearly dominated by *Parathemisto pacifica*, which formed 87.2% of all amphipods collected. *Primno macropa* comprised 10.1% of the total and was the only species besides *Parathemisto pacifica* present in all hauls. *Cyphocaris challengeri* formed 1.6% of all amphipods taken but, except for one specimen, was present only in the night hauls. *Hyperia medusarum* was present in 14 (82%) of the hauls but accounted for less than 1% of the total numbers.

The diurnal variation in estimated numbers per 1,000 m^3 of water strained is shown in Figure 2. Except for *Parathemisto pacifica*, maximum combined numbers of the other species occurred at night, just before 0100 on 9 June. Peak numbers of *P. pacifica* occurred at 1000 on 9 June, but numbers otherwise varied from haul to haul, with no diurnal trend evident. Numbers of *C. challengeri*, and to a lesser extent *Primno macropa* and *H. medusarum*, increased at night. This was presumably due to vertical migration, but daytime avoidance of the net is also a possibility.

Figure 3 depicts the diurnal variations in relative abundance and total number of species per haul. The relative abundance was strongly dominated by *Parathemisto pacifica* throughout the study period, although it fell to 68% during the two hauls between midnight and 0100. At that time maximum relative abundance of *Primno macropa* (27.4%) and *C. challengeri* (13.5%) were observed. The maximum number of species per haul (8) occurred at 0200.

The drogue travelled about 6 miles during the sampling (Fig. 1), and surface conditions suggest that it

Table 1.—Location and dates of plankton hauls[1] and associated sampling data for station no. 6 of RV *George B. Kelez*, Cruise K71-3, June 1971.

Date	Haul no.	Position		Local time	Max. depth (m)	Water volume filtered (m^3)
		Lat. N.	Long. W.			
8 June:	1	53°40′	168°53′	0705-0736	163	544.6
	2	53°40′	168°53′	0842-0917	200	[2](792.2)
	3	53°40′	168°53′	1013-1049	178	948.2
	4	53°40′	168°53′	1131-1202	162	632.5
	5	53°36′	168°52′	1319-1359	180	435.3
	6	53°36′	168°52′	1444-1522	168	1,463.5
	7	53°36′	168°52′	1628-1658	165	485.7
	8	53°36′	168°52′	1844-1928	200	[3](918.0)
	9	53°36′	168°52′	2003-2039	225	631.5
	10	53°35′	168°52′	2108-2140	215	493.8
	11	53°35′	168°52′	2216-2255	205	868.4
	12	53°35′	168°52′	2325-0002	201	[4](853.1)
9 June:	13	53°35′	168°52′	0038-0109	185	[3](333.5)
	14	53°35′	168°52′	0141-0221	212	[4](933.8)
	15	---------- No sample; net badly torn ----------				
	16	53°34′	168°52′	0948-1020	200	408.3
	17	53°34′	168°52′	1050-1130	176	580.9
	18	53°34′	168°52′	1236-1312	181	[4](990.2)

[1]Zooplankton collected with 60 cm bongo net of 0.333-mm mesh.
[2]Value estimated; towing time uncertain.
[3]Value estimated; based on ship's speed.
[4]Net damaged during tow.

tracked approximately the same parcel of water. The surface salinity ranged from 33.11 to 33.15‰ and the surface temperature ranged from 4.1 to 4.5°C, as measured by a constantly recording salinothermograph.

ANNOTATED SPECIES LIST

Below are notes on each species, including total numbers collected, lengths when available, relative abundance, and taxonomic notes. Where pertinent, remarks on diurnal variation in numbers or occurrence are made, as well as comments on the species' occurrences in relation to previously known depth and geographic distributions.

Abbreviations used are: P = pereopod; S = segment; A = antennae.

Cyphocaris anonyx Boeck

One specimen in one haul. Length: 3.4 mm.

Guryanova (1962) stated that *Cyphocaris anonyx* ". . . inhabits a depth of no less than 500 m," and Birstein and Vinogradov (1958) consider it a species of the "upper deep-water subzone," although they did take it in one haul of 0-600 m. The occurrence of the present specimen in a 0-212 m haul is thus somewhat unusual.

The present specimen is a first record for the Bering Sea and represents a northward range extension from lat. 43°N in the North Pacific (Guryanova, 1962).

Cyphocaris challengeri Stebbing

One hundred and six (106) specimens in seven hauls. Length: up to 16.7 mm.

This species is the most common epipelagic gammaridean amphipod in the subarctic Pacific (Bowman and McCain, 1967). Its occurrence was limited to hauls between about 2015 on 8 June and 0200 on 9 June, suggesting a diurnal vertical migration. Bowman and McCain reported that it was caught mainly at night off Oregon and California, and attributed this to a diurnal vertical migration. Maximum numbers of our specimens occurred at night, when they comprised 13% of the total catch during haul 12 and when an estimated concentration of 48/1,000 m^3 was encountered during haul 13.

Birstein and Vinogradov (1955) reported the species from the western Bering Sea near the Commander Islands at about lat. 58°N, and Thorsteinson (1941) reported it from about lat. 57°30'N in the Gulf of Alaska.

Lanceola sayana Bovallius

One specimen in one haul. Length: 9.7 mm; female.

Vinogradov (1957) noted that this species is usually taken at depths over 1,000 m, although it frequently occurs in surface catches at night. Bulycheva (1955) reported the species from the western Bering Sea, but stated that it was absent from the western North Pacific Ocean off the Kurile Islands. Thorsteinson (1941) did not report it in catches from the eastern North Pacific Ocean.

The telson of this specimen is relatively short, but it fits Vinogradov's (1957) description of *L. sayana* in other respects.

Table 2.—Amphipod species collected in the southeastern Bering Sea on 8-9 June 1971 (RV *George B. Kelez*, Cruise K71-3) and in July 1971 (MV *Don Edwards*, Cruise DE-4).

Suborder Gammaridea
Lysianassidae
Cyphocaris anonyx Boeck, 1871
Cyphocaris challengeri Stebbing, 1888
Suborder Hyperiidea
Tribe Physosomata
Lanceolidae
Lanceola sayana Bovallis, 1885
Scinidae
Scina borealis (G. Sars, 1882)
Scina stebbingi Chevreux, 1919
Scina rattrayi Wagler, 1926
Tribe Physocephalata
Vibilliidae
Vibilia caeca Bulycheva, 1955 (?)
Paraphronimidae
Paraphronima crassipes Claus, 1879
Hyperiidae
Parathemisto pacifica Stebbing, 1888
Parathemisto libellula (Lichenstein, in Mandt, 1822)
Hyperoche medusarum (Krøyer, 1838)
Hyperia medusarum (Müller, 1776)
Anchylomeridae
Primno macropa Guerin, 1863
Phronimidae
Phronima sedentaria (Forskål, 1775)

Scina borealis (Sars)

Four specimens in three hauls. Length: 1.6-7.5 mm.

The species is reported as common in the Arctic (Vinogradov, 1957) and off California (Hurley, 1956). Thorsteinson (1941) reported it from the Gulf of Alaska and coastal British Columbia, Canada.

Scina stebbingi Chevreux

Three specimens in one haul. Lengths: 1.6, 4.5, and 4.8 mm; latter two males.

Vinogradov (1957) reported only one specimen, but stated "It is known only from the southwestern Bering Sea to latitude 58°08'N."

Scina rattrayi Wagler

Two specimens in two hauls. Length: 4.4 and 5.9 mm; males. Another male from a 0.505-mm net sample.

Table 3.—Numbers, relative abundance, and estimated numbers per 1,000 m^3 of amphipods collected at station No. 6 during RV *George B. Kelez*, Cruise K71-3, June 1971.

Species	Parameter	Haul number[a]																Total collected	Relative abundance[b] (%)	Occurrence rate[c]	
		1	(2)	3	4	5	6	7	(8)	9	10	11	(12)	(13)	(14)	16	17	(18)			No.	%
Cyphocaris anonyx	Number														1							
	Relative abundance (%)														0.2				1	0.1	1	5.8
	No./1,000 m^3														1.1							
Cyphocaris challengeri	Numbers									3	5	10	38	16	33		1					
	Relative abundance (%)									1.0	1.2	2.8	12.9	3.0	5.1		0.2		106	1.6	7	41.2
	No./1,000 m^3									4.8	10.1	11.5	44.5	48.0	35.3		1.7					
Lanceola sayana	Number									1												
	Relative abundance (%)									0.3									1	0.1	1	5.8
	No./1,000 m^3									1.6												
Scina borealis	Numbers							1							2	1						
	Relative abundance (%)							0.3							0.4	0.1			4	0.1	3	17.6
	No./1,000 m^3							2.1							2.1	2.4						
Scina stebbingi	Numbers								3													
	Relative abundance (%)								1.4										3	0.1	1	5.8
	No./1,000 m^3								3.3													
Scina rattrayi	Numbers												1		1							
	Relative abundance (%)												0.3		0.2				2	0.1	2	11.8
	No./1,000 m^3												1.2		1.1							
Vibilia caeca	Numbers											3			1		1	1				
	Relative abundance (%)											0.8			0.2		0.2	0.4	6	0.1	4	23.5
	No./1,000 m^3											3.4			1.1		1.7	1.0				
Paraphronima crassipes	Numbers			1					1													
	Relative abundance (%)			0.4					0.4										2	0.1	2	11.8
	No./1,000 m^3			1.0					1.1													

Table 3.—Numbers, relative abundance, and estimated numbers per 1,000 m³ of amphipods collected at station No. 6 during RV *George B. Kelez*, Cruise K71-3, June 1971.—Continued.

Species	Parameter	Haul number[a] 1	(2)	3	4	5	6	7	(8)	9	10	11	(12)	(13)	(14)	16	17	(18)	Total collected	Relative abundance[b] (%)	Occurrence rate[c] No.	%
Parathemisto pacifica	Numbers[d]	319	328	200	119	167	344	309	195	244	362	238	202	459	483	1,125	399	196				
	Relative abundance (%)	94.9	90.1	88.1	90.8	85.2	90.8	93.6	87.8	81.3	90.3	67.8	68.5	85.8	75.1	95.7	94.1	89.9	5,689	87.2	17	100
	No./1,000 m³	585.7	414.0	209.9	188.2	383.7	235.0	636.2	212.4	386.4	733.0	274.1	236.8	1,376.2	517.3	2,755.1	686.9	197.9				
Hyperoche medusarum	Numbers							1				1		1								
	Relative abundance (%)							0.3				0.3		0.2					3	0.1	3	17.6
	No./1,000 m³							2.1				1.2		3.0								
Hyperia medusarum	Numbers	1	5	5		2	1		2	7		3	1	9	7	1	1	2				
	Relative abundance (%)	0.3	1.4	2.2		1.0	0.3		0.9	2.0		0.8	0.3	1.7	1.1	<0.1	0.2	0.6	47	0.7	14	82.4
	No./1,000 m³	1.8	6.3	5.3		4.6	0.7		2.2	7.9		3.4	1.2	27.0	7.5	2.4	1.7	2.0				
Primno macropa	Numbers	16	31	21	12	27	34	19	21	45	34	96	53	50	115	48	22	17				
	Relative abundance (%)	4.8	8.5	9.2	9.2	13.8	9.0	5.8	9.4	15.0	8.5	27.4	18.0	9.3	17.9	4.1	5.2	7.8	661	10.1	17	100
	No./1,000 m³	29.4	39.1	22.1	19.0	62.0	23.2	39.1	22.9	71.2	68.8	110.6	62.1	149.9	123.2	117.5	37.9	17.2				
Phronima sedentaria	Number																	1				
	Relative abundance (%)																	0.4	1	0.1	1	5.8
	No./1,000 m³																	1.0				
Total	Numbers	336	364	227	131	196	379	330	222	300	401	351	295	535	643	1,175	424	217				
	Relative abundance (%)[e]	5.1	5.6	3.5	2.0	3.0	5.8	5.0	3.4	4.6	6.1	5.4	4.5	8.2	9.8	18.0	6.5	3.3				
	No./1,000 m³	616.9	459.4	239.4	207.1	450.3	259.0	679.4	241.8	475.0	812.0	404.2	345.8	1,604.1	688.6	2,877.6	729.9	220.2	6,526			

[a] Quantitative data from hauls in parentheses are questionable; see Table 1 footnotes.
[b] Overall relative abundance (%).
[c] Occurrence rate; frequency of occurrence in the 17 hauls.
[d] Plus "preimmature" in hauls follows: 7=10; 9=208; 10=40; 11=256; 12=31; 13=91; 14=41; 16=15; 17=1; 18=26.
[e] Relative abundance of No./1,000 m³ for haul, of total for all hauls.

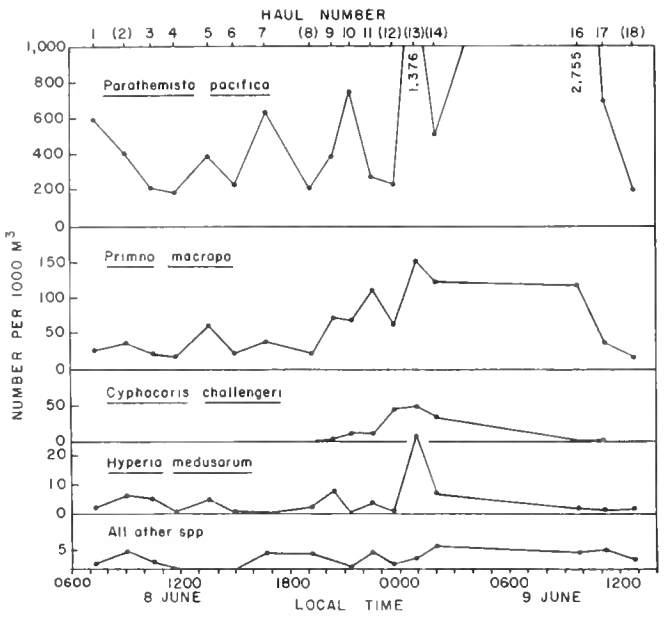

Figure 2.—Estimated numbers of amphipods per 1,000 m^3 of water strained, as a function of time of day.

Vinogradov (1957) reported this species from the southwestern Bering Sea.

Vibilia sp. (*V. caeca* Bulycheva ?)

Six specimens in four hauls. Length: 3.6-5.5 mm.

The identification of these specimens is in question, because of the confused taxonomic status of *V. caeca;* the original description (Bulycheva, 1955) is sketchy at best. The only other reference to *V. caeca* (Vinogradov, 1956) differs somewhat from the original description. Also, the distinctions between *V. caeca* and *V. australis* var. *pelagica*, which like *caeca* is eyeless, need to be clarified.

Paraphronima crassipes Claus

Two specimens in two hauls, plus one other from the 0.505-mm mesh net in a third haul (no. 13). Lengths: 6.7, 7.1, 8.1 mm.

Vinogradov (1956) reported the species from lat. 59°00'N in the western Bering Sea.

Hyperia medusarum (O. F. Müller)

Forty-seven specimens in 14 hauls, plus three others from the 0.505-mm mesh net or International Pacific Halibut Commission samples. Length: up to 23.8 mm.

Bowman (1973) described two forms of this species, *hystrix*-form and *medusarum*-form, based in part on the spine armature of P 1 and P 2; *medusarum*-form has more and relatively longer spines on S 6 than *hystrix*-form. Bowman implies that *medusarum*-form may be associated with coastal scyphomedusae and *hystrix*-form with offshore ones.

Of the 47 specimens taken in the diurnal study, 30 can be positively identified as *Hyperia medusarum, hystrix*-form. One, a 9.2-mm female, seems intermediate between the two forms. The remaining 16 specimens are too small (≤3.9 mm) to be positively ascribed to either form, but they are presumably *hystrix*-form. Two specimens, both taken by the Halibut Commission in shallow water (≤15 fm), were identifed as *medusarum*-form.

Occurrences and numbers were scattered among the hauls, although they seemed most prevalent at night (Fig. 2, Table 3).

This species is the most common *Hyperia* in the eastern North Pacific Ocean (Bowman, 1973).

Hyperoche medusarum (Krøyer)

Three specimens in three hauls. Length: 4.8-5.5 mm.

The species has been recorded from the Arctic Ocean (Shoemaker, 1920; Tencati, 1970); in the subarctic Pacific from off the Kurile Islands and in the Okhotsk Sea (Bulycheva, 1955); off southern British Columbia; and in the Gulf of Alaska (Thorsteinson, 1941; misnamed as *H. leutkeni* according to Bowman, 1953).

Parathemisto pacifica Stebbing

Five thousand six hundred and eighty-nine (5,689) specimens in 17 hauls. Length: up to 8.3 mm.

The morphologically similar *Parathemisto japonica* was recently reported from the southeastern Bering Sea (Fukuchi, 1970), although it usually ranges several hundred miles to the west and southwest of here (Bowman, 1960). All of the females examined in the

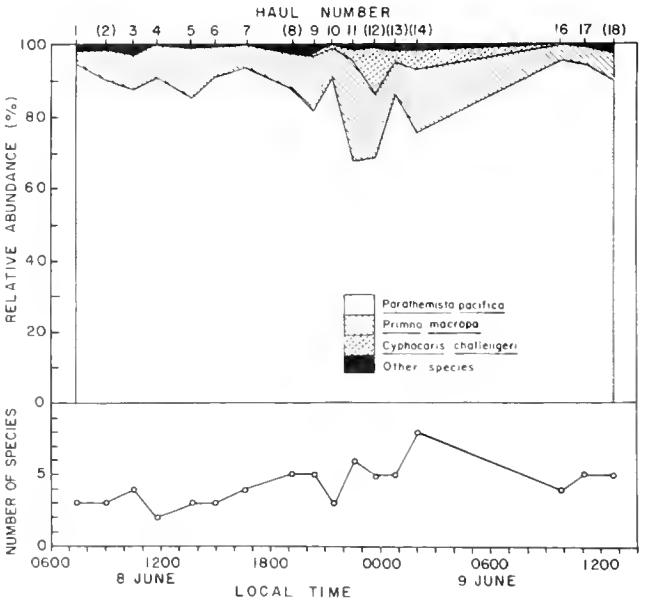

Figure 3.—Relative abundance and numbers of species of amphipods per haul, as a function of time of day.

present samples had subsimilar A 1 and A 2, while in *P. japonica* A 2 is considerably longer than A 1. Also, the relatively short lengths of the present specimens, many of which bore eggs or young, rules out their being *japonica* (Bowman, 1960).

The relative abundance of *P. pacifica* decreased markedly at night (Fig. 3), but it was always the most abundant species. The numbers per 1,000 m^3 seemed to show no diurnal variation (Fig. 2), suggesting a lack of diurnal vertical migration. Bowman (1960) found no evidence for a diurnal vertical migration off Oregon and California.

Many of the females examined had eggs or brood young. Also, many samples contained loose eggs and young that were likely separated from females while being caught in the net or during subsequent handling and examination. This factor introduces a possible error into the numbers of animals. An attempt to overcome this was made by counting separately loose eggs and what appeared to be brood young. Whenever young appeared small enough, or undeveloped enough, they were considered to be "preimmatures." An "immature" is taken to be a free-swimming, nonbrooding young, less than 3 mm in length. The numbers of animals or eggs thus designated are indicated as footnotes in Table 3, and are not included in the numbers collected, nor do they figure in estimated number per 1,000 m^3. There was no diurnal variation in size range or sex ratio. Overall, the females outnumbered the males by a ratio of 1.2:1, although this difference is insignificant at the 5% level (heterogeneity χ^2 test).

Bowman (1960) showed that *P. pacifica* is widely distributed in the subarctic Pacific and that it is the most abundant epipelagic amphipod off Oregon and California. He further stated, "It is apparent that *P. pacifica,* like *Sagitta elegans* and *Eukrohnia hamata,* is by virtue of its temperature requirements an inhabitant of the subarctic water, and like these chaetognaths can serve as a biological indicator of this cold water of low salinity. However . . . the euphausiid, *Euphausia pacifica* . . . has a distribution more nearly like that of *P. pacifica* than does *S. elegans.*"

Although no *P. japonica* were taken in the present hauls, this species has recently been taken in the same general area (Fukuchi, 1970). Since its population center lies far to the southwest, the southeastern Bering Sea should be considered to be in the fringes of its range. Its occurrence there is probably dependent on intrusion of water from the western Bering Sea, and *P. japonica* should probably be considered to be an indicator species for western subarctic water in the eastern Bering Sea.

Parathemisto libellula (Lichtenstein)

One specimen in one haul (International Pacific Halibut Commission). Length: 21.3 mm, female.

This specimen was taken in a shallow tow over shelf waters. Bowman (1960) reported the species as widespread throughout the Bering Sea.

Phronima sedentaria (Forskäl)

One specimen in one haul, plus another in a 0.505-mm mesh sample. Length: 16.5 and 17.7 mm, both males.

Thorsteinson (1941) recorded the species from the Gulf of Alaska but gave no details on actual locations. Fukuchi (1970) recorded the species from lat. 41°55'N off Hokkaido, Japan, and Vinogradov (1956) reported the species from the western Bering Sea at lat. 55°N.

Primno macropa Guerin

Six hundred and sixty-one (661) specimens in 17 hauls. Length: up to 16.0 mm for females and 10.5 mm for males.

This species is common in the North Pacific Ocean from southern California (Brusca, 1967) northward to the Gulf of Alaska (Thorsteinson, 1941), off the Kurile Islands (Bulycheva, 1955), and in the western Bering Sea (Vinogradov, 1956).

The increase during the night hauls in numbers per 1,000 m^3 and relative abundance (as high as 27% at haul 11) strongly suggest a diurnal vertical migration of this species.

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