TAXONOMY, DISTRIBUTION AND ASPECTS OF THE BIOLOGY OF SOME DEEP-LIVING COPEPODS IN B.C. INLETS AND ADJACENT WATER

by

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to the required standard

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1974

ABSTRACT

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The bathypelagic copepods *Spinocalanus brevicaudatus*, *Scaphocalanus brevicornis* and *Heterorhabdus tanneri* have established relatively large, permanent breeding populations in Bute and Jervis Inlet, British Columbia. They are found only rarely in the shallower Strait of Georgia. The preference shown by *Spinocalanus brevicaudatus* and *Scaphocalanus brevicornis* was attributed to the deep living habits of breeding adults. The reason for *H. tanneri's* preference of deep water was not apparent from the distribution study.

Two general patterns of vertical distribution were seen among the calanoid copepods in the inlets. The common interzonal species such as *Calanus glacialis* preferred a definite depth interval near mid-water. The deep-living species such as *Spinocalanus brevicaudatus* were found throughout the water column below the thermocline, in about equal numbers. Maximum numbers usually occurred in the depth interval immediately below the thermocline.

Only females of *Metridia pacifica* showed a strong diurnal migration pattern in July. This migration became less intense near the head of Bute Inlet. The vertical distribution and migration patterns of *Spinocalanus brevicaudatus*, *Scaphocalanus brevicornis* and *H. tanneri* appeared to increase the chances of sexual encounters in these relatively rare species.

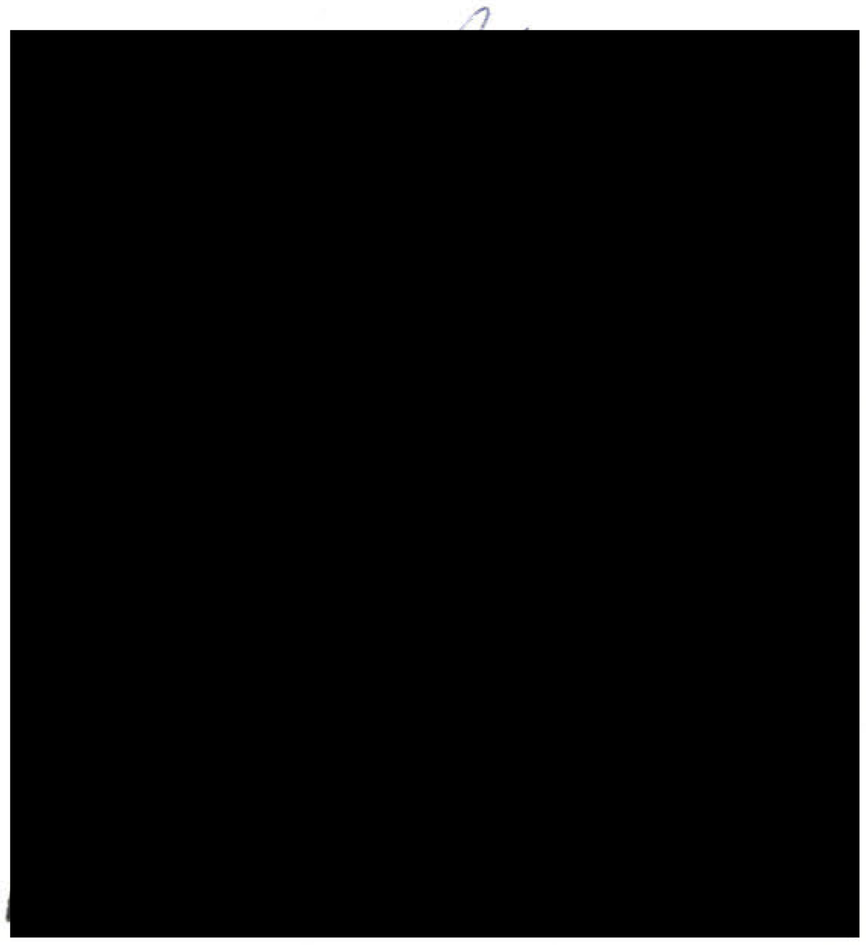
The interzonal and deep-living species showed contrasting life-histories. The interzonal species exhibited a well-defined breeding season, with adults maturing in the winter, and young appearing in the

spring. The deep-living species did not show a yearly breeding cycle. Females dominated the population at all times of year, and a relatively small percentage of males and females were always present.

A reduction in the male:female sex ratio occurred during or after the last moult in *Spinocalanus brevicaudatus* and *Scaphocalanus brevicornis*. In the animals the male has reduced mouth parts and probably dies soon after mating. *H. tanneri* males do not have reduced mouth parts. This species had a sex ratio close to unity at all times.

An increase in total copepod numbers was observed with increasing distance from the head of Bute Inlet. An increase in the percentage of juveniles in the population of most species was also observed with increasing distance from the inlet head.

Spinocalanus brevicaudatus, *Scaphocalanus brevicornis* and *H. tanneri* are redescribed. *Comantenna columbiae* is described for the first time.



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INTRODUCTION

The vertical distribution and biology of bathypelagic organism is largely unknown due to their scarcity and inaccessibility in the open ocean. Quantitative descriptions of zooplankton distribution in the deep sea have emerged only recently with the investigations of Grice and Hulseman (1965), Wheeler (1970) and Roe (1972) in the Atlantic Ocean and by the Soviets in the Pacific Ocean (reviewed by Vinogradov, 1968). Only Roe, however, gives quantitative distributions of individual species.

Most knowledge of deep-sea biology has come from the taxonomic literature and from examinations of the gut contents of preserved animals. Mednikov (1961), for example, suggested that the low male:female sex ratio in deep sea copepods is a necessary adaptation which increases fecundity in a regime with restricted food resources. Mauchline (1972) suggested that this predominance of females reflected the absence of a well-defined breeding season. Extrapolations of trends seen in the epipelagic zone as well as increases in mean body size observed with depth also suggested that low temperatures decrease growth rate, increase longevity and consequently produce larger organsims in relation to those inhabiting the surface zones (Mauchline, 1972). Vinogradov (1962) concluded that deep sea organisms are largely carnivorous. Food is carried to the deep sea zone in the form of actively migrating animals and reaches the greatest depths via a "ladder of migrations".

A few inlets found along the coast of British Columbia have depths considered by some authors to be within, or to border on the deep sea zone (Brodskii, 1950; Vinogradov, 1968). Accordingly, these inlets may

harbour species similar to those found in the deep sea community and present an opportunity to study these organisms in a highly productive and relatively accessible area. In his list of B.C. zooplankton, Fulton (1968) included some brief semiquantitative remarks which support this view. The copepod *Spinocalanus brevicaudatus* is listed as "common in Pendrell Sound". *Gaetanus intermedius* appears to be restricted to Indian Arm. These copepods belong to genera whose members are largely abyssal and are found up to several thousand meters below the surface in the open ocean (Brodskii, 1950). Three other species belonging to the bathypelagic copepod genera *Scaphocalanus*, *Candacia* and *Heterorhabdus* are listed as "rare" in the Strait of Georgia. The individuals found in Fulton's samples may have been either transient visitors from the open ocean or isolated members of a deep sea community existing within the inlets opening into the Strait of Georgia.

The present program was initiated to investigate the possibility that breeding populations of deep-sea copepods exist in some B.C. inlets. Specifically, the aims of the study were (1) identify any copepods which may be members of a deep-sea community within the inlets; (2) determine if and to what extent such animals are restricted to the inlets, and to identify the factors restricting them; (3) describe their vertical distribution within a selected inlet; and (4) obtain information about the life histories of these organisms from the preserved material. Although there were too few sampling times to treat the last point adequately it was hoped that enough information could be obtained to demonstrate the major differences between deep-living species and those inhabiting the surface zones.

The main part of the investigation was carried out in Bute Inlet, a deep fjord whose physical oceanography has been studied extensively (Tooms, 1956; Tabata and Pickard, 1957; Pickard and Rodgers, 1959). Unfortunately biological phenomena have remained largely uninvestigated in the mainland inlets. Work on zooplankton distribution in the region has concentrated in the Strait of Georgia (Campbell, 1934; Légaré, 1957; Fulton et al, 1967; 1969) and in a few inlets within easy access to research facilities (Shan, 1962; McHardy, 1964; Bary, 1967; Hoos, 1972). The only study dealing with zooplankton distribution in the deep, high runoff inlets such as Bute Inlet is limited to the upper 15 meters (Lebrasseur, 1954; 1955).

There are some distinct advantages that the inlet system may offer to the student of zooplankton distribution. In many cases the bulk of freshwater runoff enters the inlet via a single river at the head. As a result a gradient of temperature and salinity is established in which these properties change predictably with horizontal distance along the inlet and with depth. In addition, any material leached from the land by running water, or suspended particulate matter such as glacial silt will decrease in concentration with distance from the head and with depth. Recently Lewis (unpublished data) has used this tendency to establish a spatial concentration gradient in relating the distribtuion of the copepod *Euchaeta japonica* to the concentration of various chemical parameters in Bute Inlet.

METHODS AND MATERIALS

1. Study Area

The fjord-land of British Columbia is situated on the west coast of North America between Latitude 49° and 55° N. (Fig. 1). Eight inlets and their adjacent areas were investigated during the study (Table I). Sampling schedules and locations are given in Table II and Figure 1. Additional samples were provided by Dr. A.G. Lewis, Institute of Oceanography, University of British Columbia.

2. Field Methods

Nets of four different types were used during the study (Table III). *Qualitative zooplankton sampling:* Meter nets or Bongo nets equipped with flowmeters were hauled obliquely to sample as much of the water column as possible without fouling on the bottom. Stations were placed mid-inlet along the entire length of each inlet. Approximate depth reached was estimated from the amount of wire paid out and the wire angle. *Quantitative zooplankton sampling:* All quantitative sampling was done with vertically hauled nets of two types. The non-closing SCOR net was hauled from a known depth to the surface, usually in intervals of 100 meters. The BOGO net utilized for most of the quantitative sampling was similar in design and operation to the Bogorov-Rass net described by Vinogradov (1968). Like the SCOR net, the BOGO net is lowered in the open position (Fig. 2, A) and hauled vertically toward the surface. The net can be closed at any depth by timing the dropping of a messenger from the beginning of the

FIGURE 1.

General area of observations and station locations.

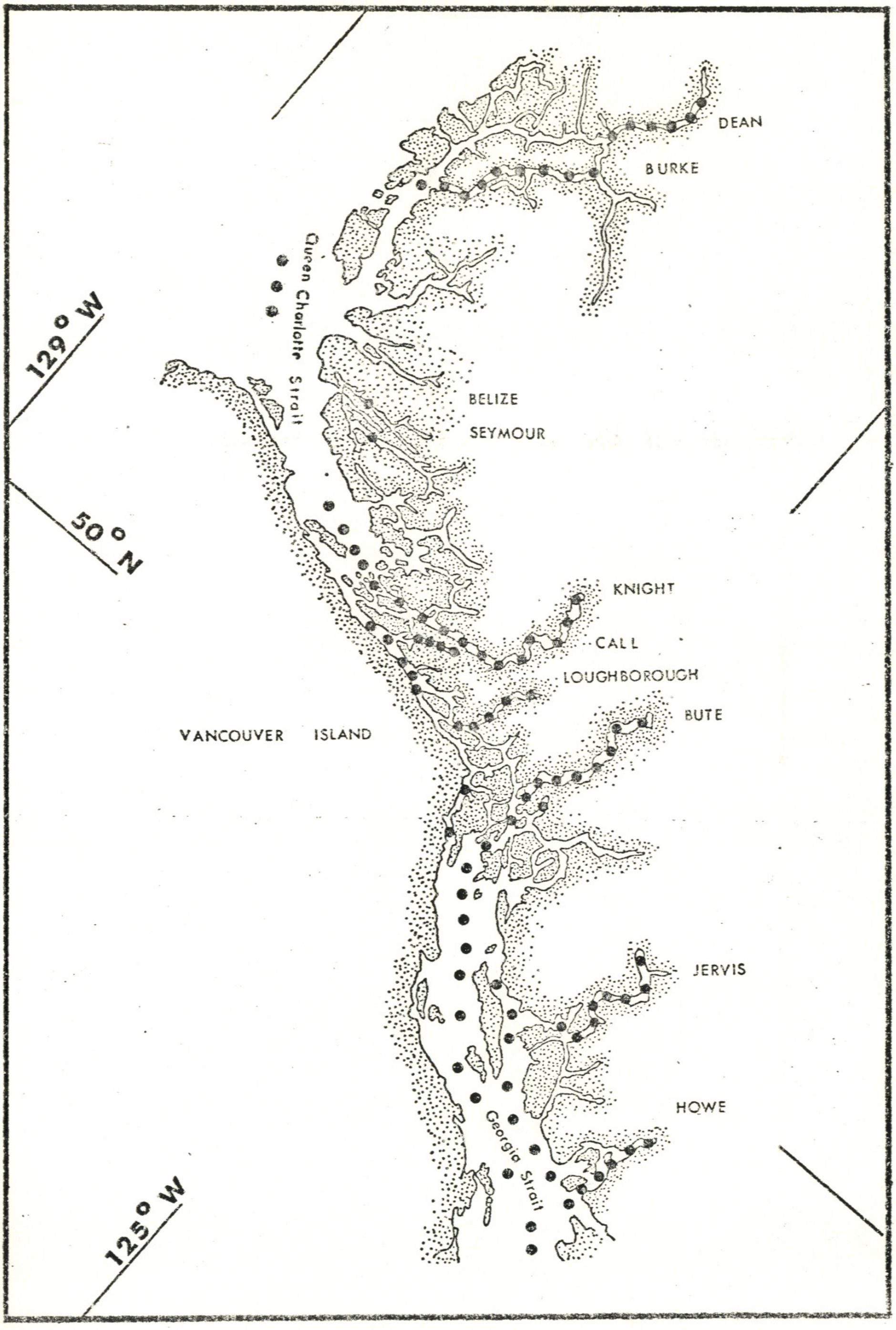

129° W
50° N
125° W
Queen Charlotte Strait
Georgia Strait
VANCOUVER ISLAND
DEAN
BURKE
BELIZE
SEYMOUR
KNIGHT
CALL
LOUGHBOROUGH
BUTE
JERVIS
HOWE

TABLE I. Physical characteristics of B.C. inlets sampled for deep-living copepods (after Pickard, 1961).

Inlet	Length (nautical miles)	Mean width (nautical miles)	Mean mid-inlet depth (meters)	Max. depth (meters)	Outer sill depth (meters)	Runoff
Dean	60	1.3	420	550	275	high
Burke	56	1.4	400	550	43	high
Knight	70	1.6	295	540	64	high
Call	15	0.8	135	209	48	low
Loughborough	19	0.9	190	260	128	medium
Bute	41	2.0	510	660	355	high
Jervis	48	1.7	495	730	385	medium
Howe	23	3.8	225	325	325	high

TABLE II. Sampling schedule.

Date	Location	Type of sampling	No. of samples	No. of stations	Hydro. data
May, 1972	Dean	oblique hauls	6	6	
	Burke	oblique hauls	8	8	
	Knight	oblique hauls	11	11	
	Call	oblique hauls	4	4	
	Loughborough	oblique hauls	4	4	no data
	Bute	oblique hauls	8	8	
	Jervis	oblique hauls	8	8	
	Howe	oblique hauls	5	5	
	adjacent areas	oblique hauls	38	38	
Jan. 1973	Jervis	SCOR	6	1	T, S, & O
	St. of Georgia	SCOR	5	1	T, S, & O
Feb. 1973	Bute	SCOR	10	3	T, S, & O
	St. of Georgia	SCOR	4	1	T, S, & O
June, 1973	Bute	SCOR	3	3	no data
	Ramsey Arm	SCOR	1	1	no data
July, 1973	Bute	BOGO	61	3	T, S, & O
	St. of Georgia	BOGO	4	1	T, S, & O
		Additional material (provided by Dr. A.G. Lewis)			
July, 1970	Belize	70 cm. vertical	1	1	no data
July, 1971	Seymoure	70 cm. vertical	1	1	no data

TABLE III. Mesh sizes and dimentions of nets used.

Net type	Type of Haul	Mesh size (microns)	Mouth opening Diam. (cm.)	Area (m^2)	mid-ring diameter (cm.)	collar length (cm.)	cone length (cm.)
Meter net	oblique	333	100	0.79	-	-	350
BONGO	oblique	333	70	0.38	-	-	390
SCOR	vertical	351	57	0.25	57	85	240
BOGO	vertical	333	75	0.44	100	190	350

FIGURE 2.

Sampling equipment used during July, 1973 cruise to Bute Inlet and the Strait of Georgia.

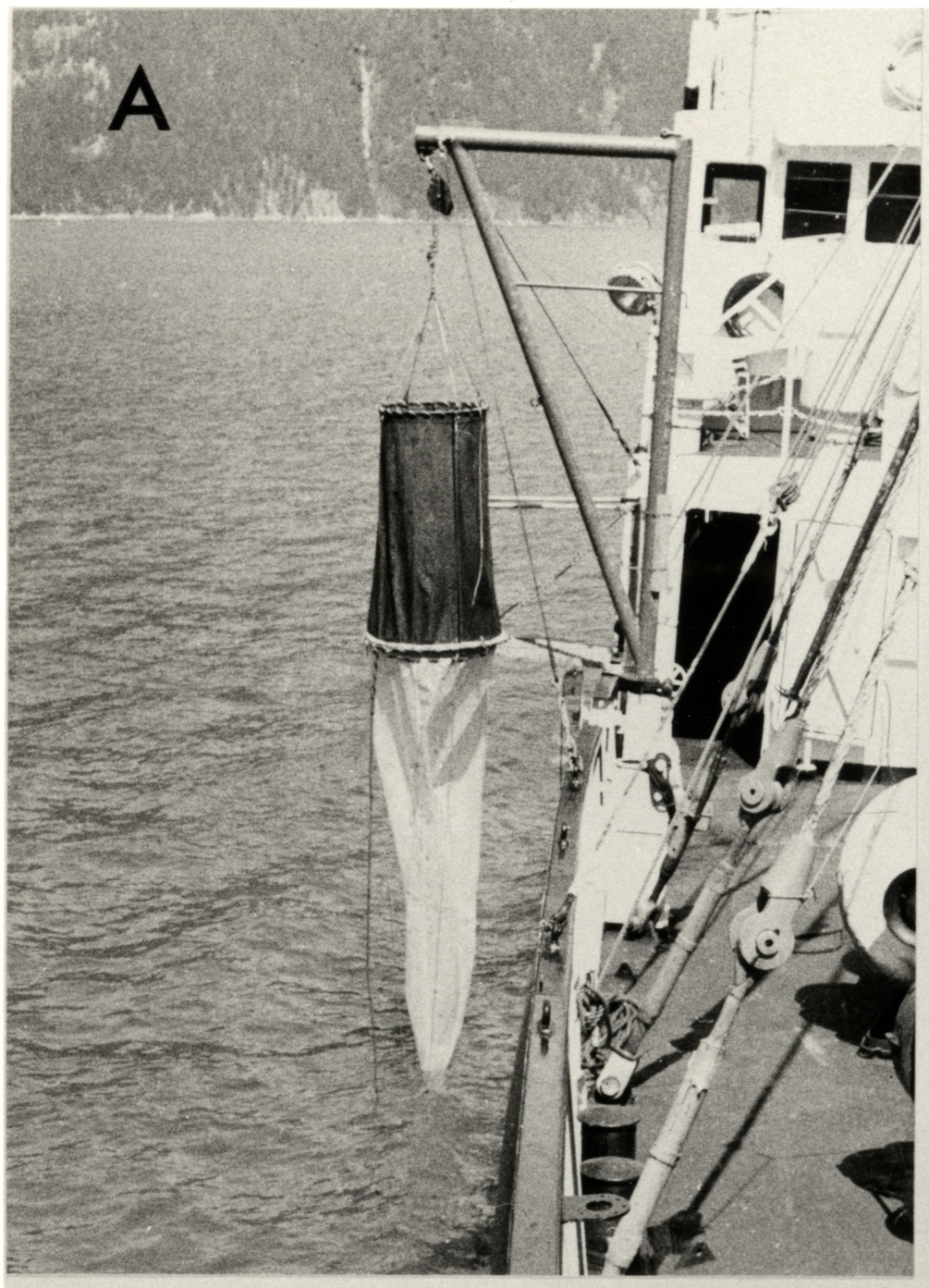
A. BOGO net in lowering and fishing position.

B. BOGO net after closure.

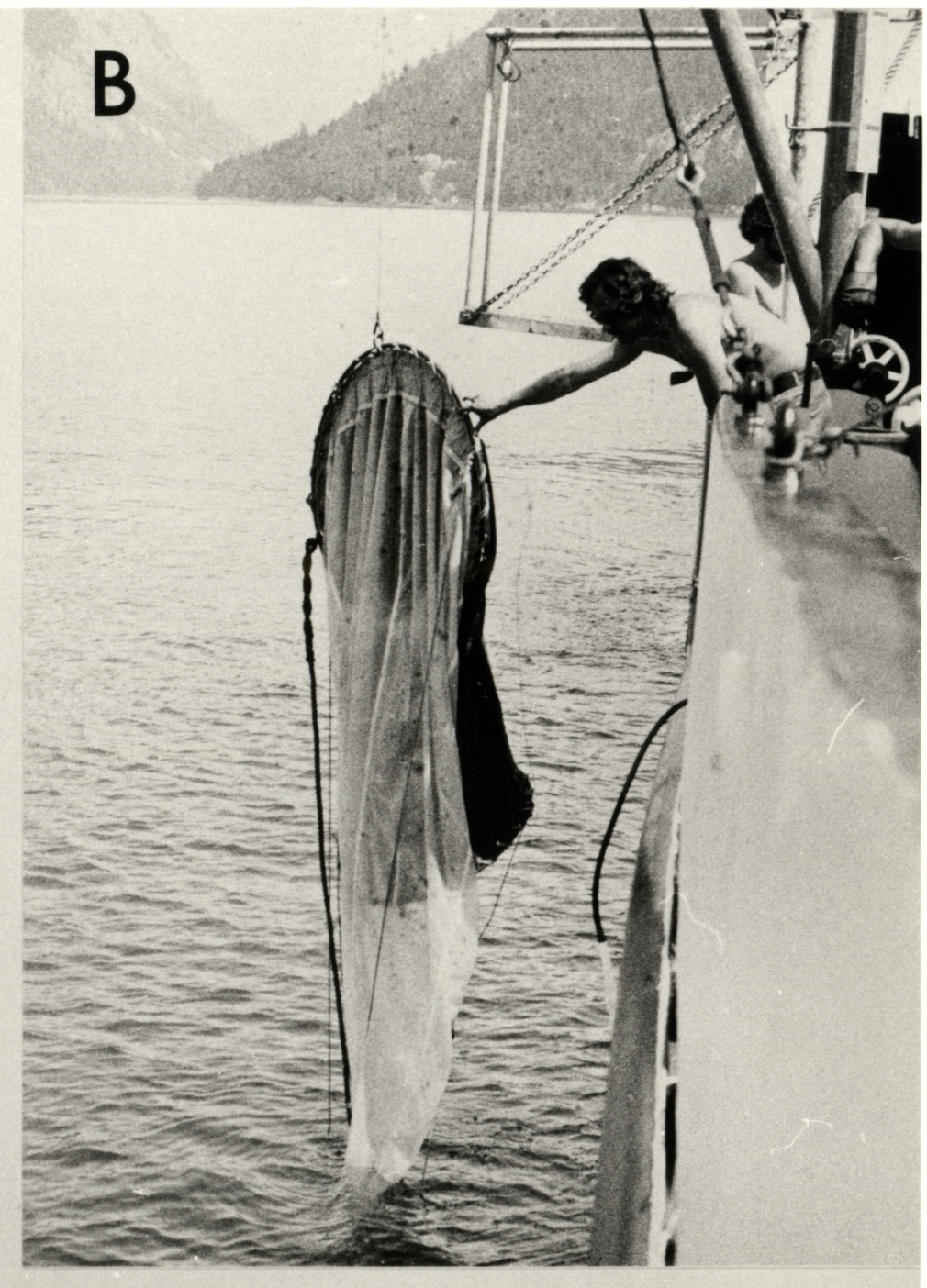
C. "Vauxhall meter"

D. Hjort-type closing device and messenger.

A



B



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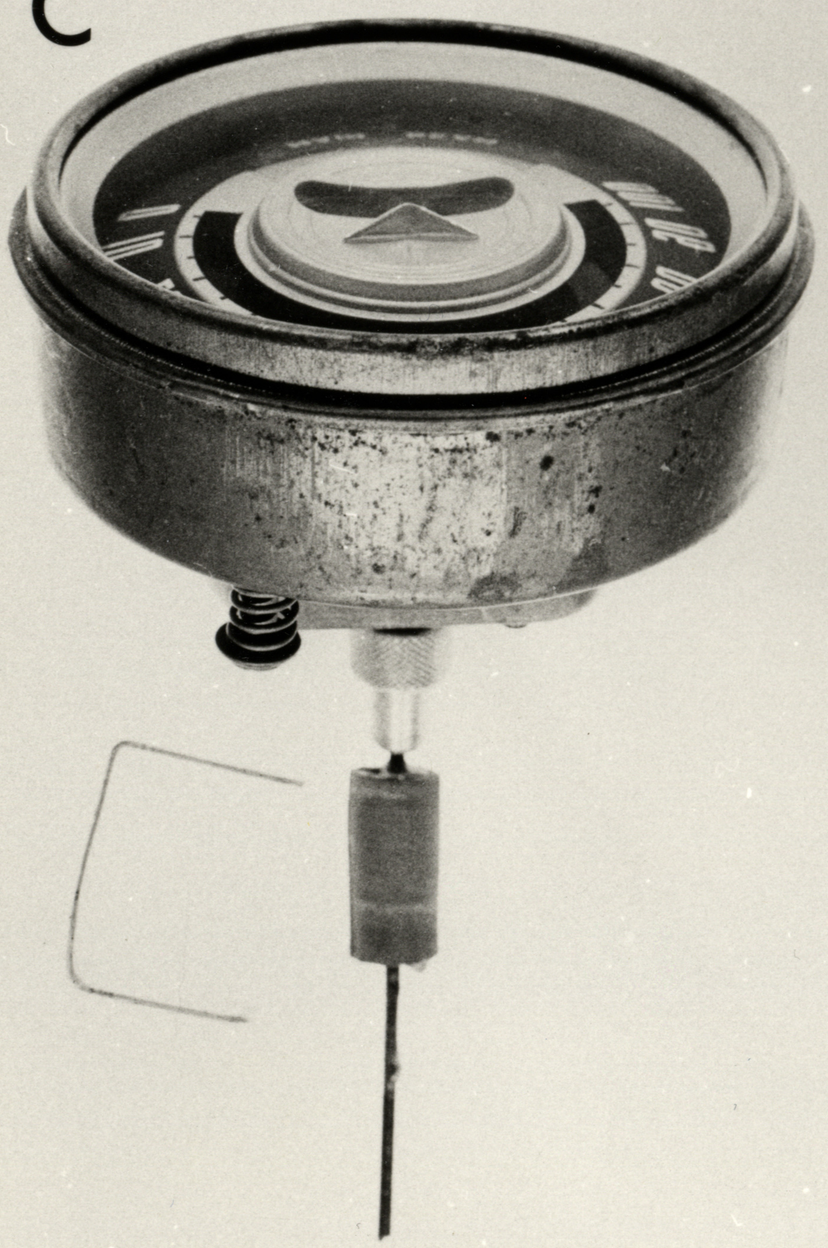
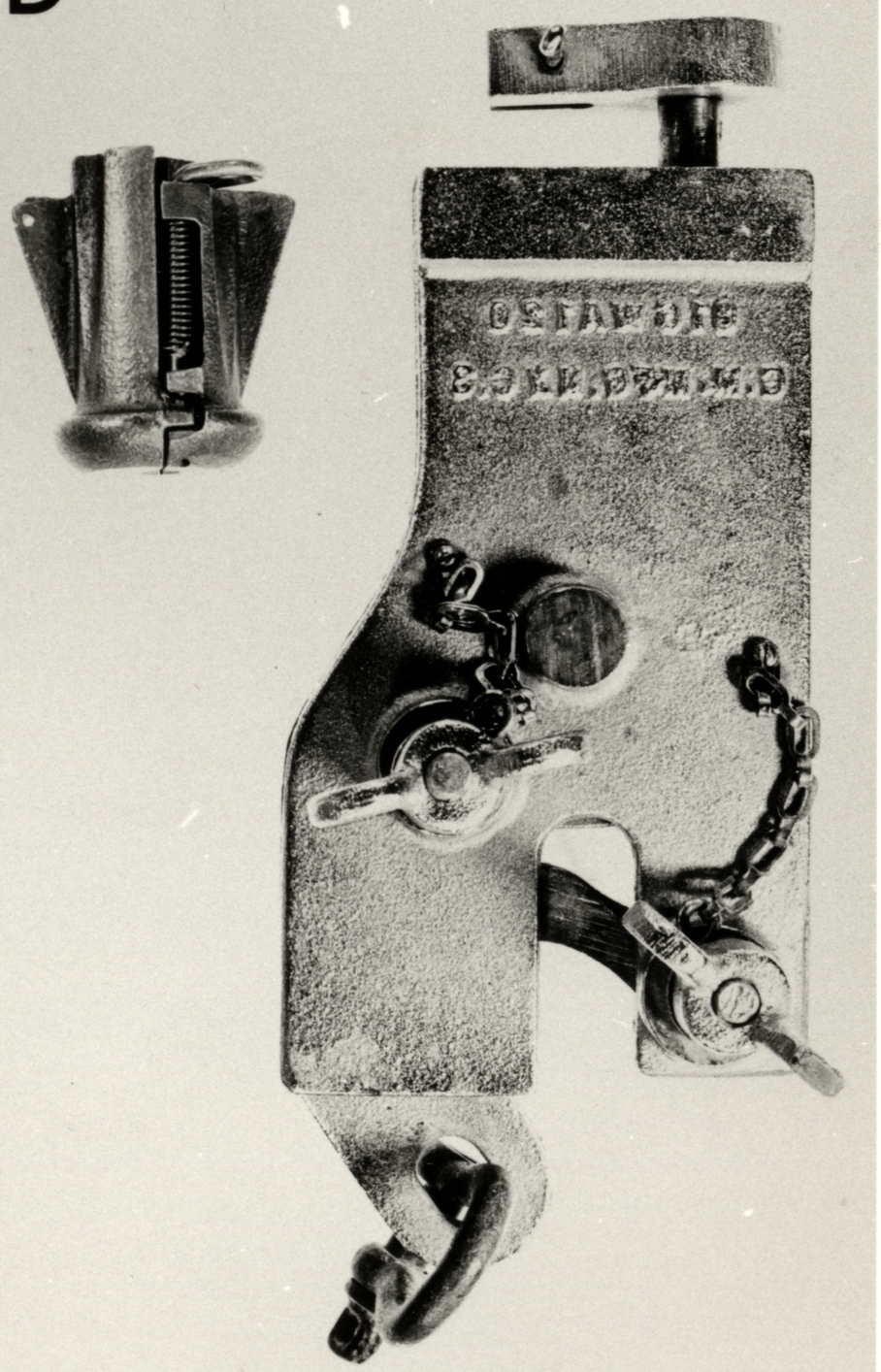


D



ascent. Net speed was kept constant with the "Vauxhall meter", a modified automobile speedometer calibrated to give a wire speed of 1 meter per second (Fig. 2, C). The net is closed with a device of the Hjort type (Fig. 2, D) and hauled by the mid-ring after closure (Fig. 2, B). Closure of the net could be recognized as a sudden slackening and tightening of the hydrographic wire. Closure exheeded or fell short of the desired depth by more than five meters only 8 times out of 72 hauls.

Nets were washed down with sea water after every haul and samples preserved in 5% formalin. All hauls in January, February and June were during daylight hours. In July profiles were done at dusk, midnight, dawn and noon to obtain information on vertical migration and an estimate of variation among tows taken at the same depth and place.

Depth intervals sampled with the BOGO net were 0-50, 50-100, 100-200, 200-300, 300-400 and 400-600 meters. Hydrographic data was obtained at standard depths using Nansen bottles equipped with reversing thermometers (U.S. Navy Hydrographic Office, 1968).

3. Laboratory Methods

Preserved zooplankton samples were transferred to 50% ethanol prior to counting. Adults and copepodites of all calanoid copepods were counted with the aid of a dissecting microscope and a partitioned (Bogorov) tray. When numbers of individuals were great an appropriate aliquot (usually 1/8 of the total sample) obtained with a Folsom plankton splitter was counted. The deep-living copepods treated in this study were usually counted in full from the unsplit sample.

Qualitative samples from oblique hauls were examined for presence and absence of all calanoid copepods. Each sample was thoroughly mixed and subsamples taken until further subsampling showed no additional species present. Abundance was indicated as; *present* if the species was found in every subsample; *rare* if not found in every subsample and; *absent* if absent in all subsamples.

For SCOR net hauls, numbers present in a given depth interval were obtained by subtracting the number present in the shallower haul from the number present in the deeper haul. Water volume filtered by the SCOR and BOGO net was calculated from the length of haul and the net diameter. Vinogradov (1968) found that on a slowly drifting vessel with a wire angle of 30^{o} or less the amount of water filtered as calculated by this method and that calculated from a flowmeter reading differed very little. Seas were calm on all sampling days of this study and wire angles did not exceed 15^{o}.

Data was processed by IBM 370/145 using an original FORTRAN program (Appendix 4). This program lists relevant information for each haul and calculates numbers/cubic meter, total numbers and percent composition for each species as well as total numbers per haul.

Microscope slide mounts of dissected appendages and whole copepods were prepared using Turtox CMC-S mounting medium. All identifications and drawings were made from these slides. Drawings were made with the aid of a camera lucida. Measurements of body lengths were obtained with a dissecting microscope equipped with an occular micrometer.

Water samples for oxygen determination were fixed in the field and returned to the laboratory for analysis by the Winkler method (Strickland

and Parsons, 1972). Salinities were determined using a Hytech salinometer Model 6220.

RESULTS

1. Distribution of temperature, salinity and dissolved oxygen in Bute Inlet, Jervis Inlet and the Strait of Georgia during zooplankton sampling.

Spatial differences in plankton concentration and variation in population structure in the ocean have often been associated with differences in the physical properties of the water inhabited by the animals. Physical data was obtained to determine if any bathypelagic copepods found only in deep inlets are associated with water properties peculiar to these inlets, or whether their preferrence can be attributed to depth alone.

Data collected at selected stations during the inlet cruises (Fig. 3) conforms very well to the general features of inlet physical oceanography described by Pickard (1961). These data support the hypothesis that water masses in the inlets and the Strait of Georgia are of two types: surface water with low salinities and variable temperatures and; colder, more saline water at subthermocline depths.

Surface water: January and February profiles (Fig. 4) indicate that the variable surface layer extends to approximately 150 meters. July profiles (Fig. 5), typical of summer conditions, continue to show the distinct and variable surface layer. Surface temperatures are higher and salinities lower than winter values at the same stations. Summer haloclines and thermoclines are nearer the surface than corresponding winter values. A dichothermal thermocline has developed in Bute Inlet which is most pronounced near the inlet head.

FIGURE 3.

Location of stations sampled in January, 1973 (GS 1 and Jervis 3) and in February, June and July, 1973 (GN 1, Bute 2, 4 and 6).

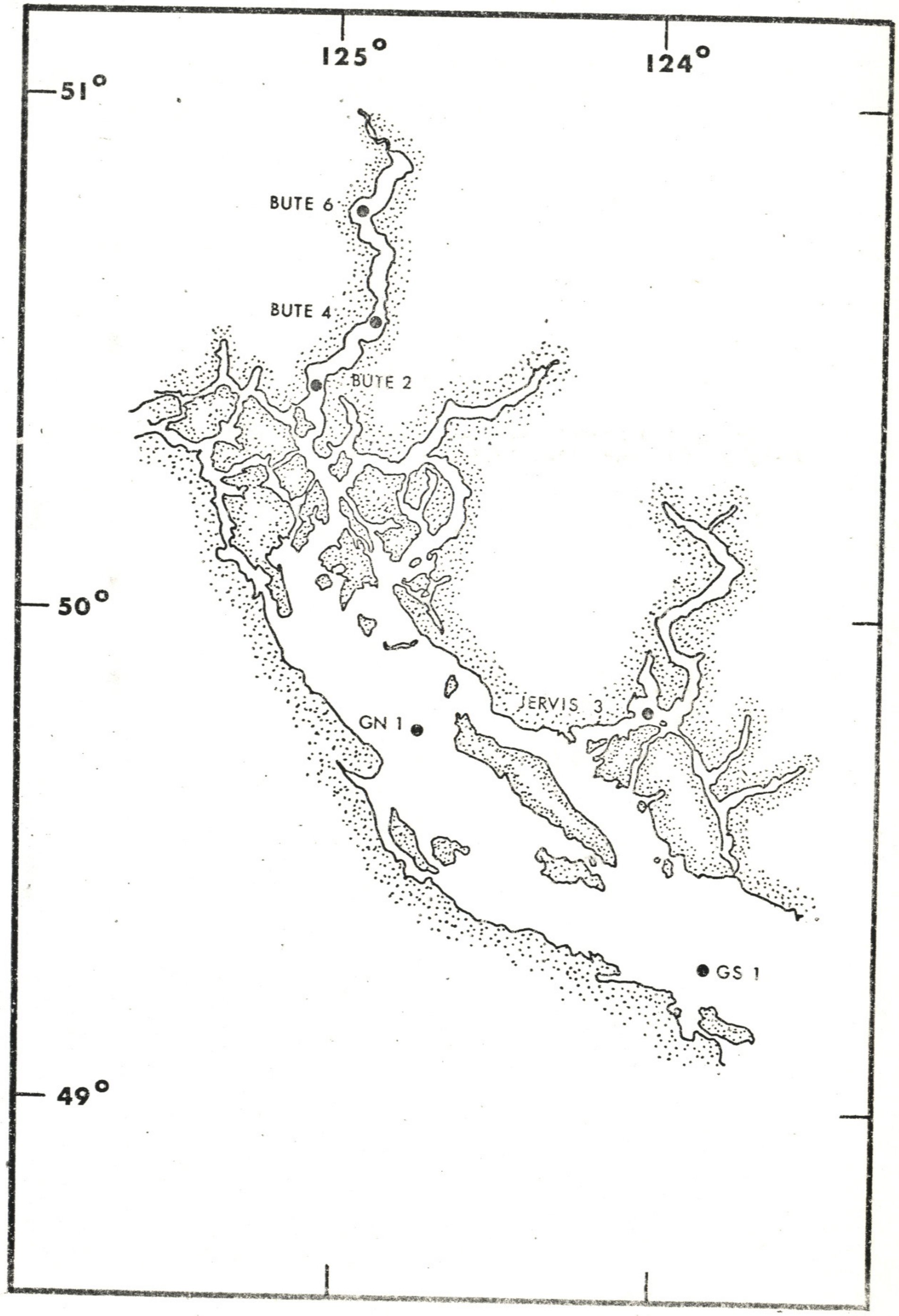

125°
124°
51°
50°
49°
BUTE 6
BUTE 4
BUTE 2
JERVIS 3
GN 1
GS 1

FIGURE 4.

Profiles for salinity, temperature and dissolved oxygen in January and February, 1973.

A. GS 1, January, 1973

B. Jervis 3, January, 1973

C. GN 1, February, 1973

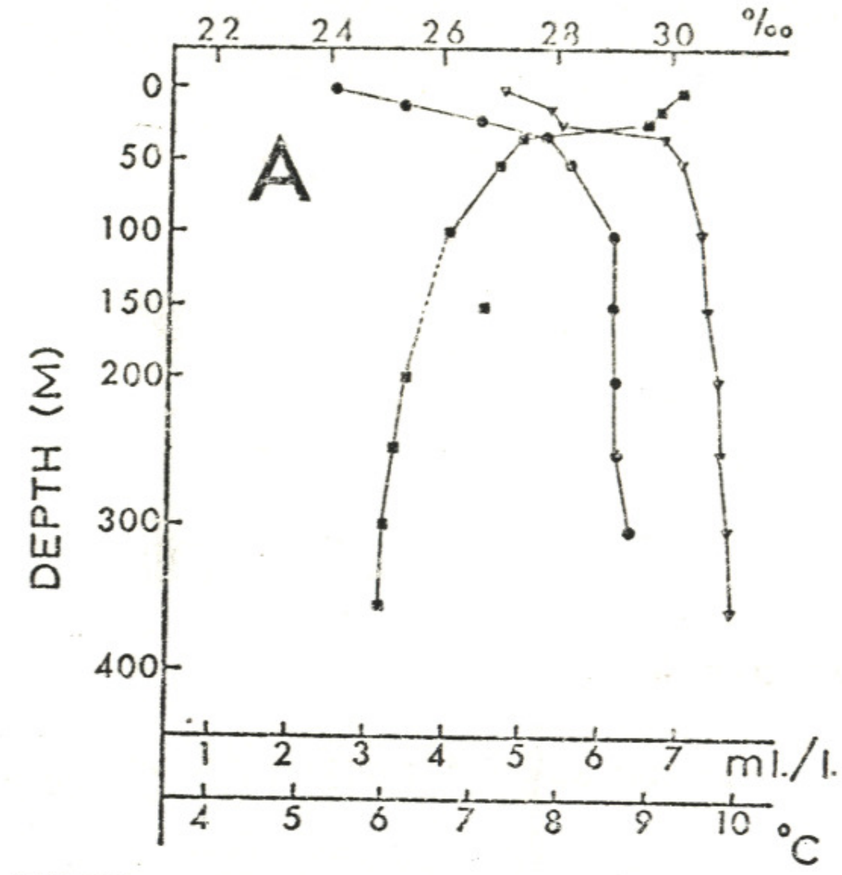
D. Bute 2, February, 1973

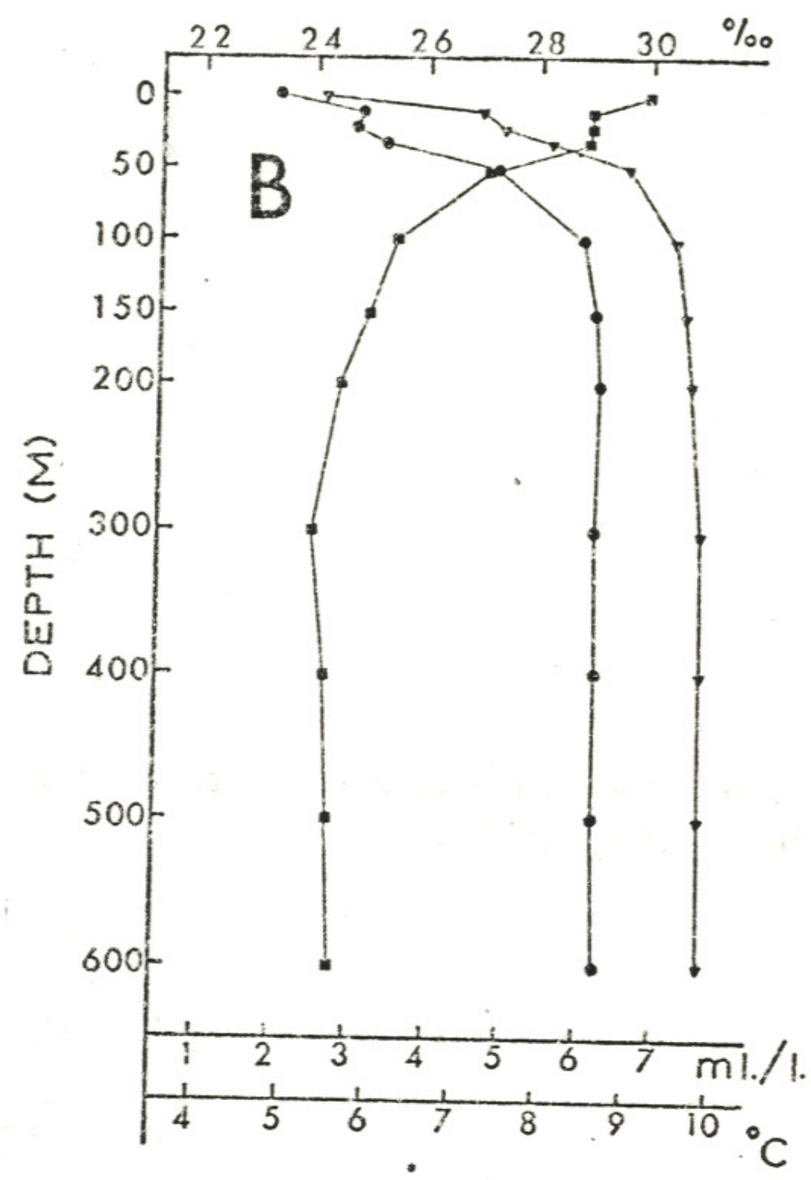
E. Bute 6, February, 1973

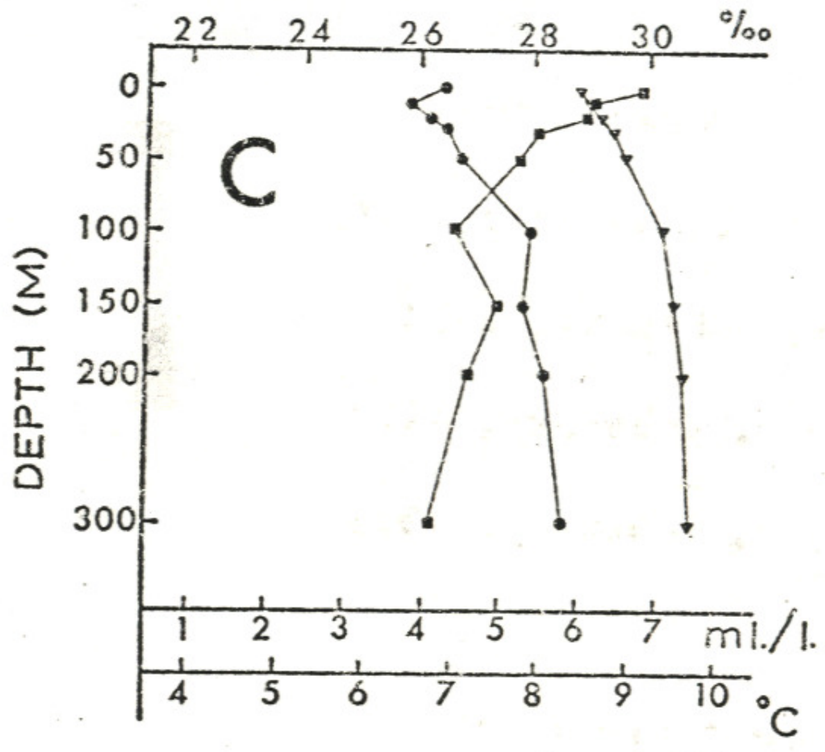
● Temperature (^{o}C)

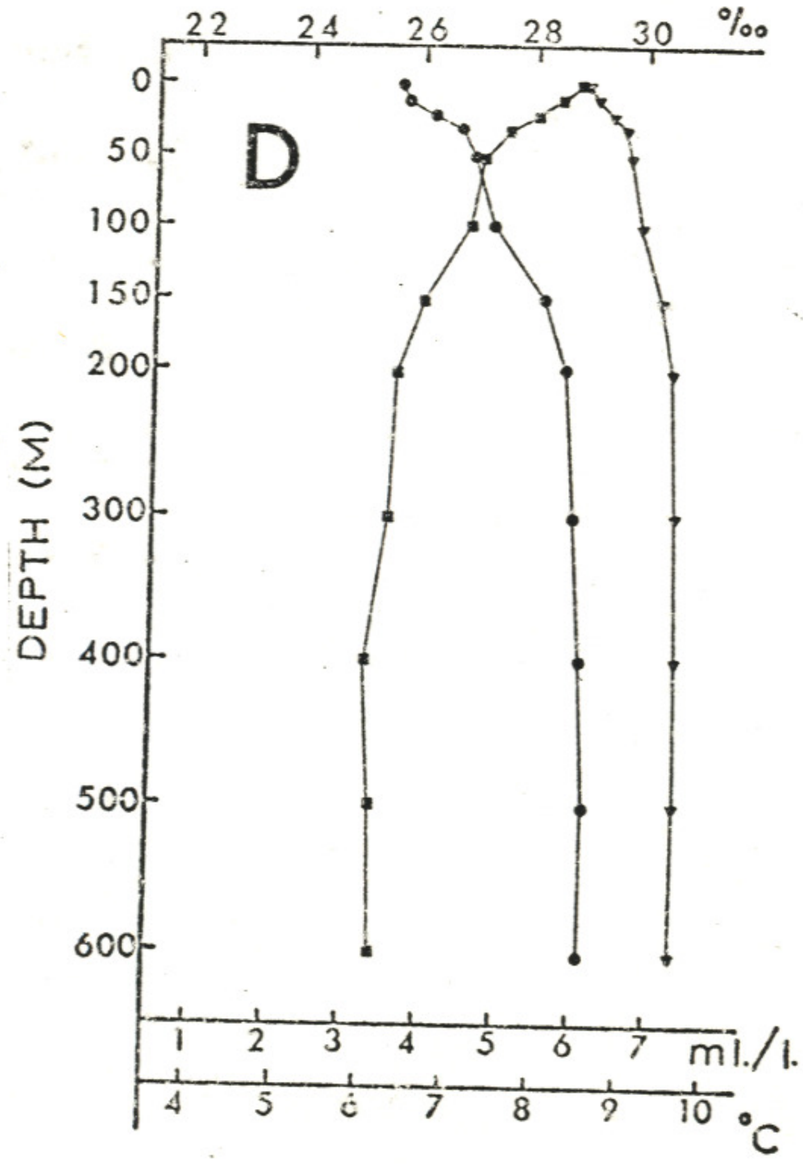
▽ Salinity (^{o}/oo)

■ Oxygen (ml/l)


A
22 24 26 28 30 ‰
0 50 100 150 200 300 400
DEPTH (M)
1 2 3 4 5 6 7 ml./l.
4 5 6 7 8 9 10 °C


B
22 24 26 28 30 ‰
0 50 100 150 200 300 400 500 600
DEPTH (M)
1 2 3 4 5 6 7 ml./l.
4 5 6 7 8 9 10 °C


C
22 24 26 28 30 ‰
0 50 100 150 200 300
DEPTH (M)
1 2 3 4 5 6 7 ml./l.
4 5 6 7 8 9 10 °C


D
22 24 26 28 30 ‰
0 50 100 150 200 300 400 500 600
DEPTH (M)
1 2 3 4 5 6 7 ml./l.
4 5 6 7 8 9 10 °C

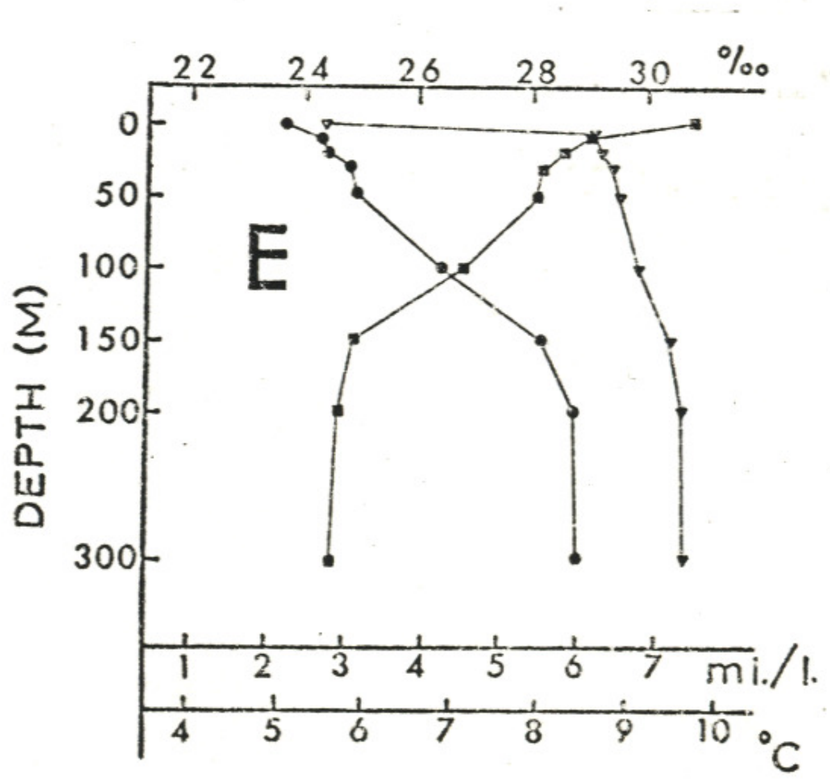

E
22 24 26 28 30 ‰
0 50 100 150 200 300
DEPTH (M)
1 2 3 4 5 6 7 ml./l.
4 5 6 7 8 9 10 °C

FIGURE 5.

Profiles for temperature, salinity and dissolved oxygen in July, 1973.

A. GN 1

B. Bute 2

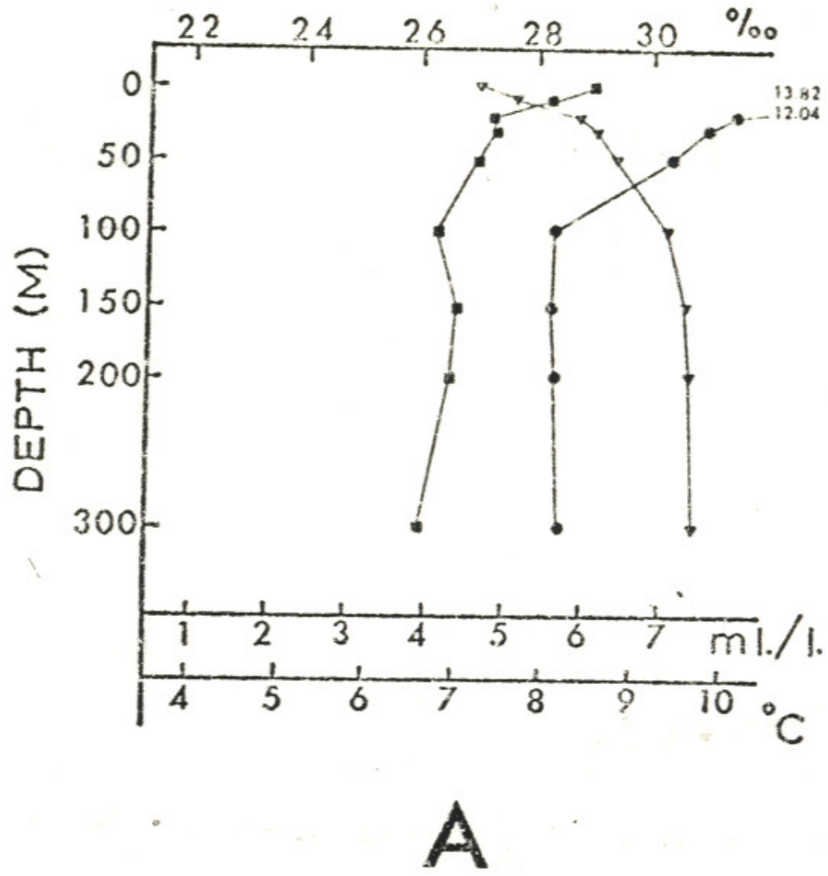
C. Bute 4

D. Bute 6

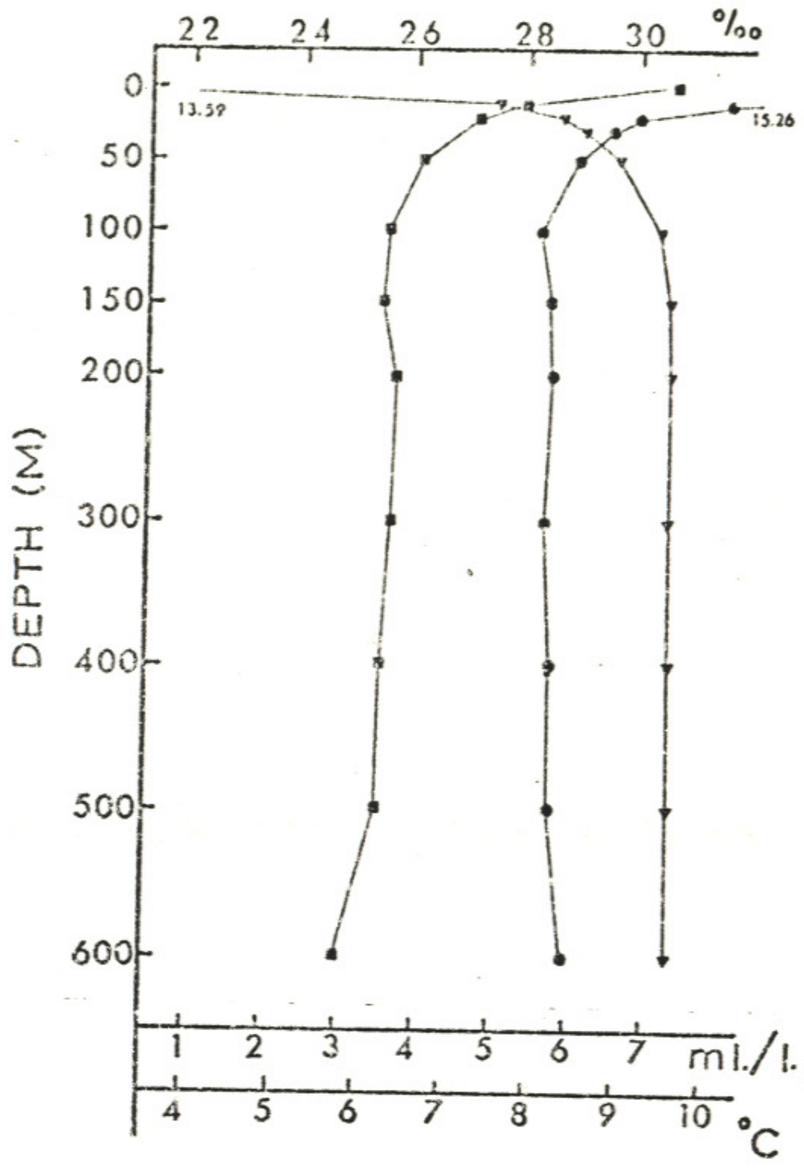
● Temperature (^{o}C)

▽ Salinity (^{o}/oo)

■ Oxygen (ml/l)

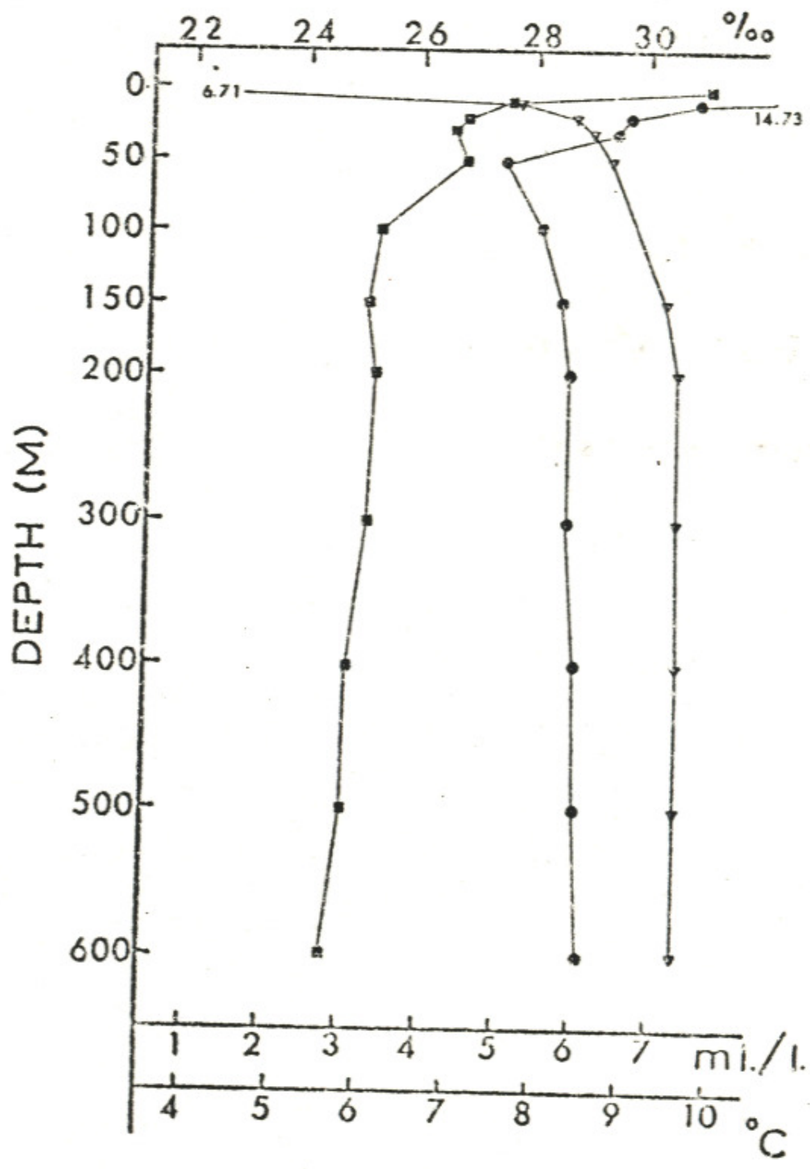

22 24 26 28 30 ‰
0
50
100
150
200
300
DEPTH (M)
13.82
12.04
1 2 3 4 5 6 7 ml./l.
4 5 6 7 8 9 10 °C

A

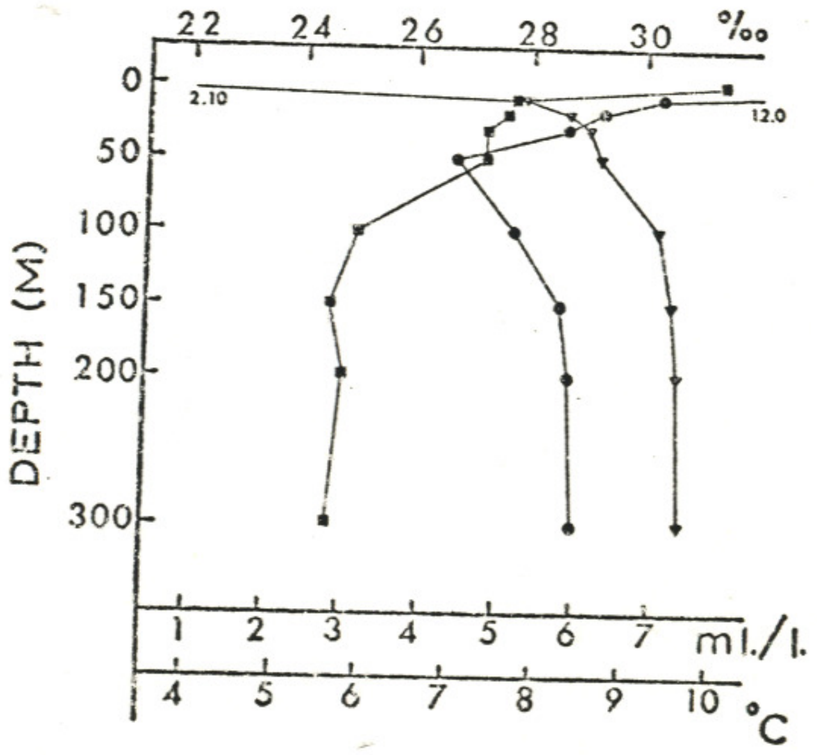

22 24 26 28 30 ‰
0
50
100
150
200
300
400
500
600
DEPTH (M)
13.59
15.26
1 2 3 4 5 6 7 ml./l.
4 5 6 7 8 9 10 °C

B

C


22 24 26 28 30 ‰
0
50
100
150
200
300
400
500
600
DEPTH (M)
6.71
14.73
1 2 3 4 5 6 7 ml./l.
4 5 6 7 8 9 10 °C

D


22 24 26 28 30 ‰
0
50
100
150
200
300
DEPTH (M)
2.10
12.0
1 2 3 4 5 6 7 ml./l.
4 5 6 7 8 9 10 °C

Oxygen content and percent saturation of the surface water for Bute Inlet stations in February and July are shown in Table IV. An increase in percent oxygen saturation with increasing distance from the head of the inlet probably reflects an increase in biological activity (phytoplankton growth), (Carter, 1933; Lebrasseur, 1955; Pickard, 1961).

TABLE IV. Oxygen content (ml./l.) and percent oxygen saturation at 0 m. in Bute Inlet at two different times of year.

Bute Inlet station	February		July	
	ml./l.	% sat.	ml./l.	% sat.
2	6.34	84	7.30	116
4			7.61	115
6	7.49	97	7.93	103

Deep water: January, February and July deep water profiles are very similar at all stations in contrast to the corresponding surface values. Temperature-salinity (TS) diagrams (Figs. 6 and 7) indicate similar TS conditions below about 150 meters in the inlets and in the Strait of Georgia. A TS envelope (Fig. 8) illustrates the uniformity and similarity of deep water at all stations throughout the year. Dissolved oxygen in the deep zone did not fall below 2.5 ml./l. throughout the sampling period.

FIGURE 6.

Temperature-salinity (TS) plots for data collected in January and February, 1973.

A. February, 1973

B. January, 1973

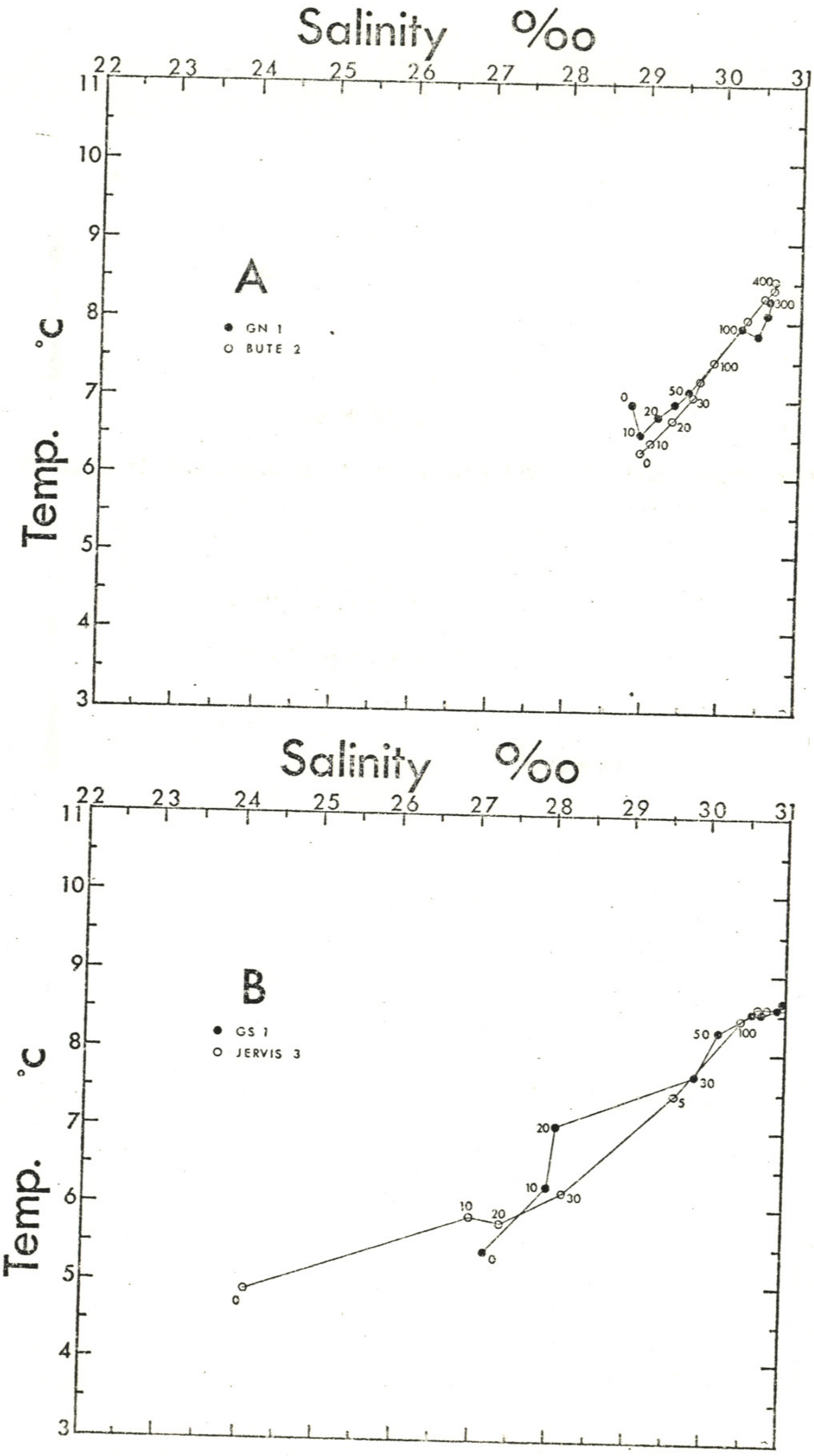

Salinity ‰
22
23
24
25
26
27
28
29
30
31
11
10
9
8
7
6
5
4
3
Temp. °c
A
GN 1
BUTE 2
400
300
100
100
50
30
20
0
20
10
10
0
Salinity ‰
22
23
24
25
26
27
28
29
30
31
11
10
9
8
7
6
5
4
3
Temp. °c
B
GS 1
JERVIS 3
50
100
30
5
20
10
30
10
20
0
0

FIGURE 7.

Temperature-salinity (TS) plot for data collected in July, 1973.

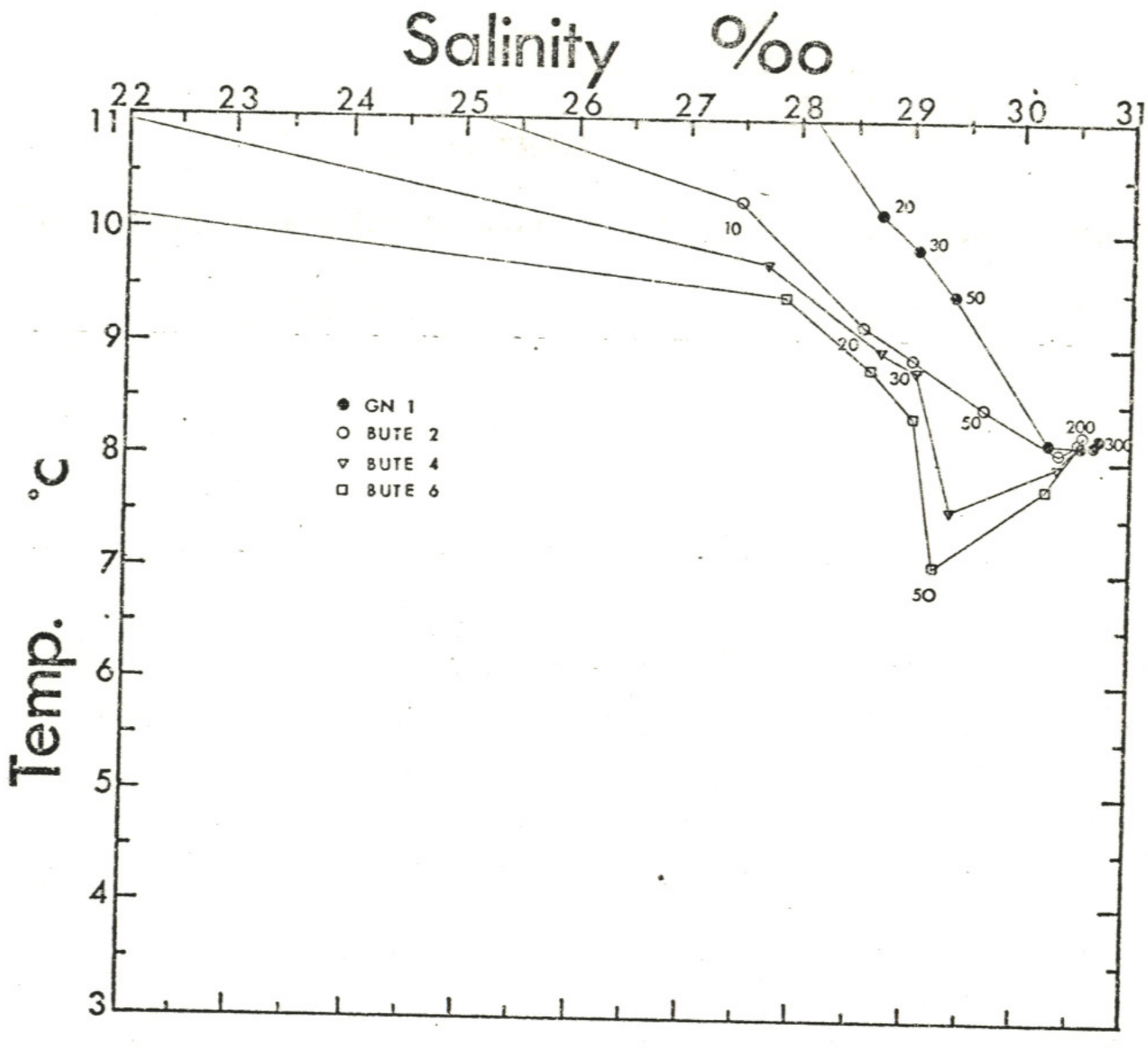
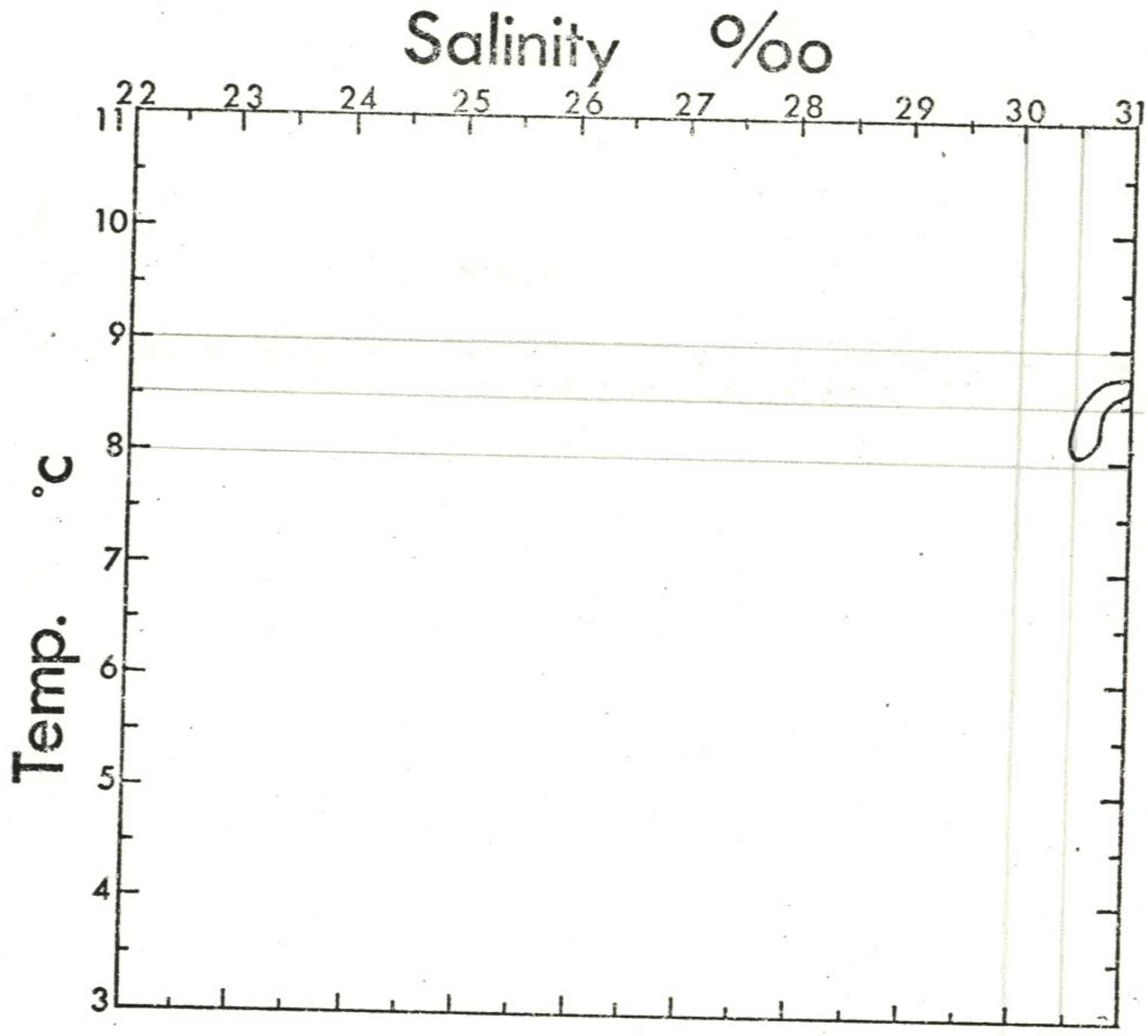

Salinity ‰
22
23
24
25
26
27
28
29
30
31
11
10
9
8
7
6
5
4
3
Temp. °C
GN 1
BUTE 2
BUTE 4
BUTE 6
10
20
30
50
10
20
30
50
50
200
300

FIGURE 8.

Temperature-salinity (TS) envelope for depths below and including 150 meters. All stations and sampling times.


Salinity ‰
22
23
24
25
26
27
28
29
30
31
11
10
9
8
7
6
5
4
3
Temp. °C

2. Geographical distribution of copepods.

Twenty-seven calanoid copepods identified during the study are listed in Table V. *Calanus glacialis* and *Pseudocalanus minutus* were present in every sample examined from all geographic areas. *Metridia pacifica* was present in 96% and *Calanus plumchrus* in 80% of the samples. Only *Spinocalanus brevicaudatus, Scaphocalanus brevicornis and Heterorhabdus tanneri* (see Appendix 1) showed a decided preference for the deep inlets and their main populations appeared to be restricted within these inlets (Figs. 9, 10 and 11). *Spinocalanus brevicaudatus* was absent from the most northern inlets sampled. All three species were absent from the stations located in the shallow outer part of Knight Inlet. This portion of the inlet is about 200 meters deep but the depth increases to more than 500 meters beyond the inner sill. The three species were also absent from Howe Sound (mean depth, 225 meters).

The amphipod *Orchomenella obtusa* was found only in Dean and Burke Channels. Fulton (1968) has noted a similar distribution. An epi-benthic calanoid, *Comantenna columbiae*, was found only within Bute Inlet throughout the study period. This species is described for the first time in Appendix 1.

TABLE V. List of calanoid copepods identified.

Calanus pacificus Brodskii, 1948

Calanus glacialis Jaschnov, 1955

Calanus plumchrus Marakawa, 1921

Calanus cristatus Kroyer, 1848

Eucalanus bungii bungii Johnson, 1938

Pseudocalanus minutus (Kroyer, 1849)

Spinocalanus brevicaudatus Brodskii, 1950

Aetideus armatus Boeck, 1872

Aetideus pacificus Brodskii, 1950

Comantenna columbiae sp. nov.

Bradyidius saanichi Park, 1966

Chiridius gracilis Farran, 1908

Gadius columbiae Park, 1967

Gadius pungens Giesbrecht, 1895

Gaetanus sp.

Euchaeta japonica Marakawa, 1921

Scaphocalanus brevicornis G.O. Sars, 1900

Scolecithricella minor (Brady, 1883)

Tharybis fultoni Park, 1967

Metridia pacifica Brodskii, 1950

Metridia okhotensis Brodskii, 1950

Centropages abdominalis Sato, 1913

Heterorhabdus tanneri (Giesbrecht, 1895)

Candacia columbiae Campbell, 1929

TABLE V (Cont'd). List of calanoid copepods identified.

Epilabidocera amphitrites McMurrich, 1916
Acartia sp.
Tortanus discaudatus (Thompson & Scott, 1897)

FIGURE 9.

Geographical distribution of *Spinocalanus brevicaudatus* in May, 1972.

● Present

◉ Rare

○ Absent

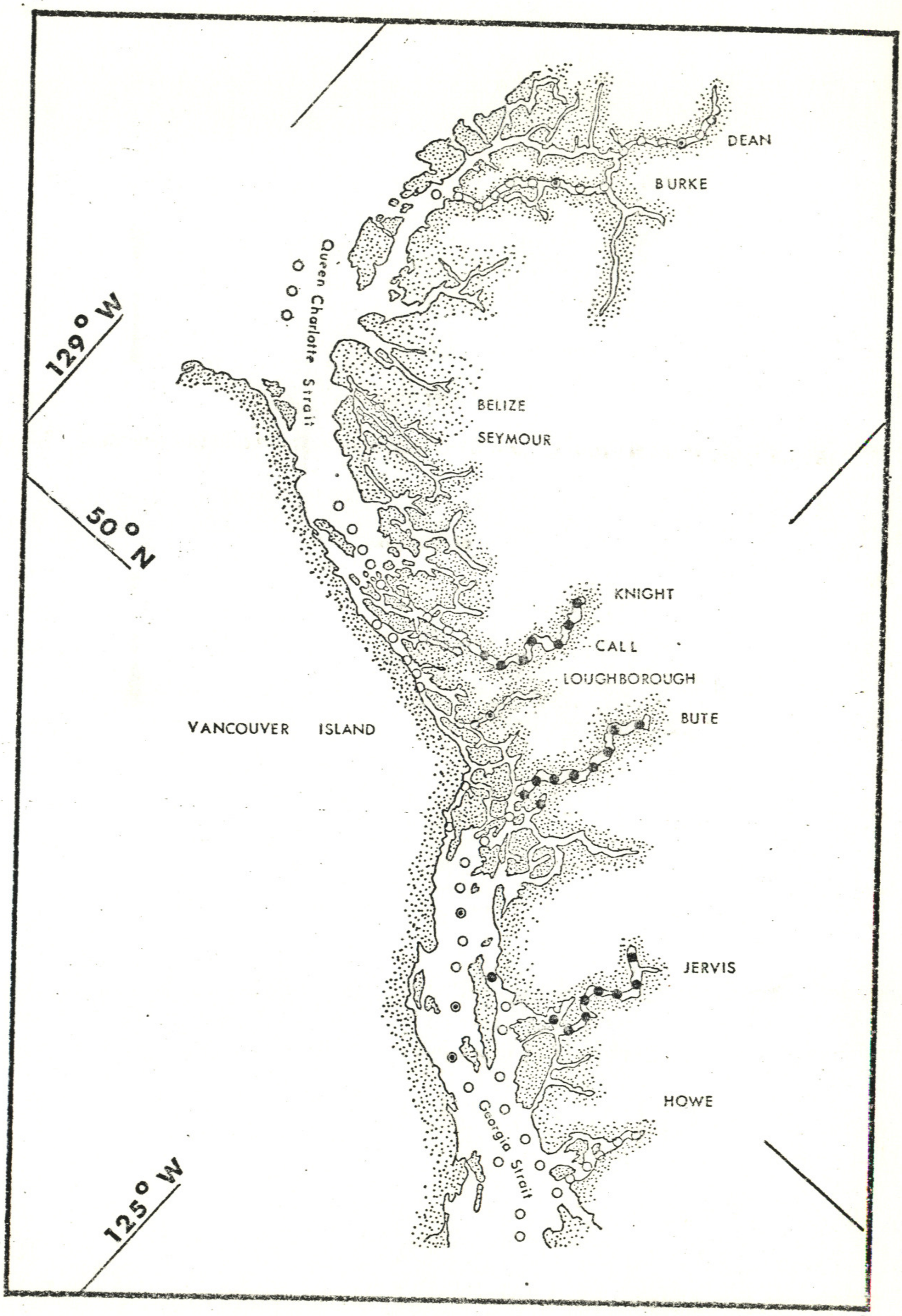

129° W
50° N
125° W
DEAN
BURKE
Queen Charlotte Strait
BELIZE
SEYMOUR
KNIGHT
CALL
LOUGHBOROUGH
BUTE
VANCOUVER ISLAND
JERVIS
HOWE
Georgia Strait

FIGURE 10.

Geographical distribution of *Scaphocalanus brevicornis* in May, 1972.

● Present

⊙ Rare

○ Absent

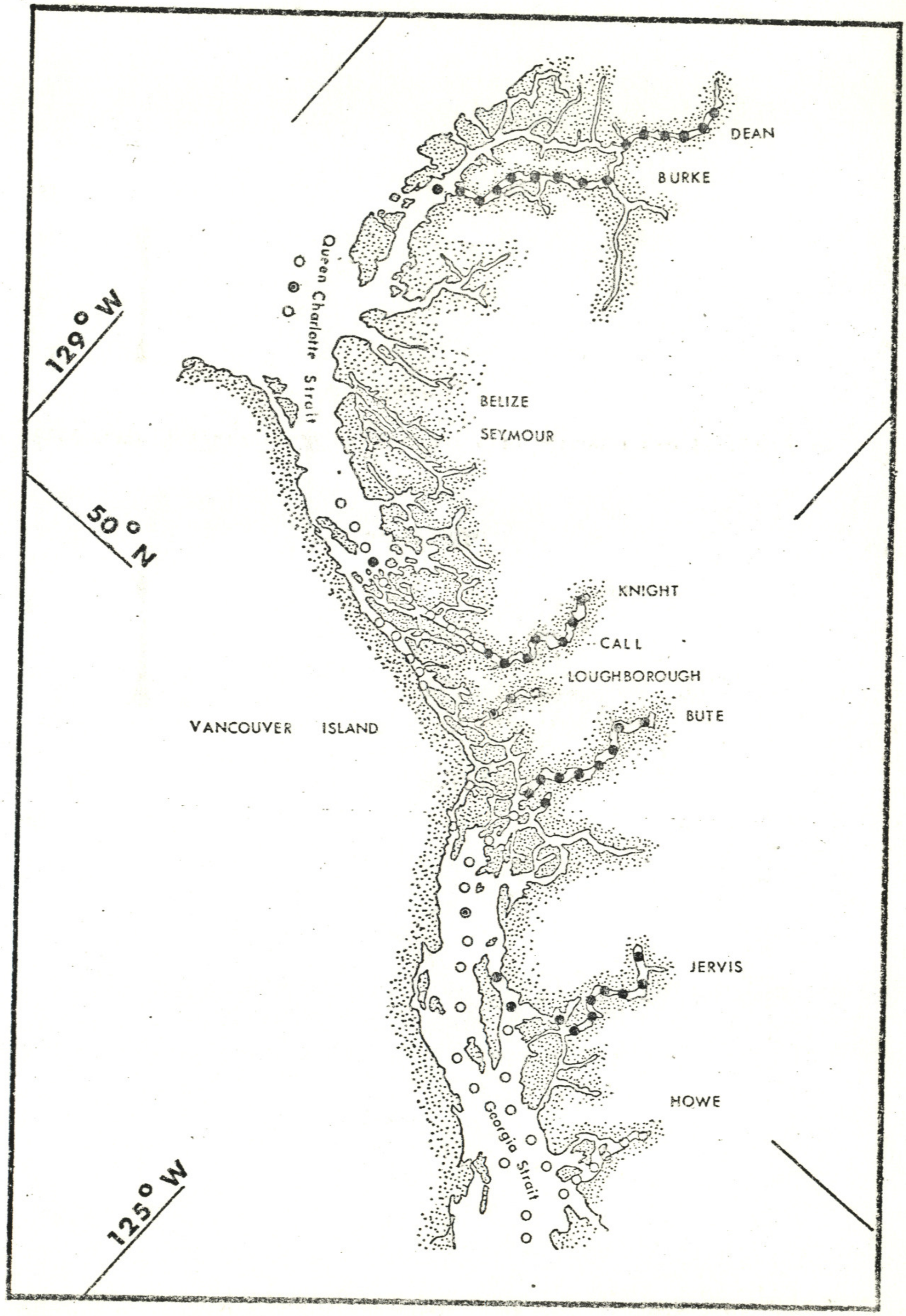

129° W
50° N
125° W
DEAN
BURKE
Queen Charlotte Strait
BELIZE
SEYMOUR
KNIGHT
CALL
LOUGHBOROUGH
BUTE
VANCOUVER ISLAND
JERVIS
HOWE
Georgia Strait

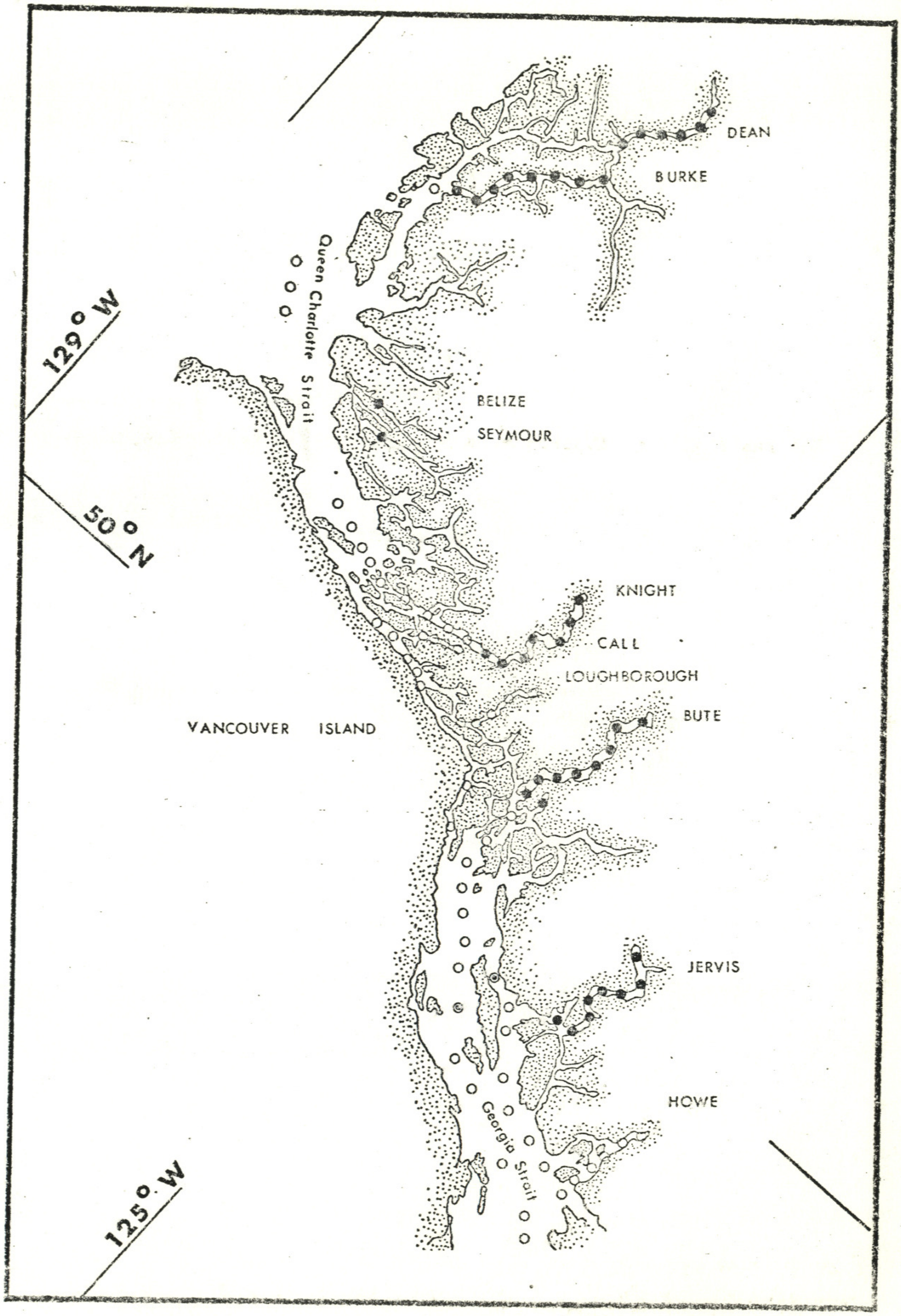
FIGURE 11.

Geographical distribution of *Heterorhabdus tanneri* in May, 1972.

● Present

◉ Rare

○ Absent


129° W
50° N
125° W
DEAN
BURKE
Queen Charlotte Strait
BELIZE
SEYMOUR
KNIGHT
CALL
LOUGHBOROUGH
BUTE
VANCOUVER ISLAND
JERVIS
HOWE
Georgia Strait

3. Vertical distribution and abundance of copepods in Jervis and Bute Inlets, and in the Strait of Georgia, in winter.

A. Jervis 3 and GS 1, January 1973.

Calanus glacialis, *C. plumchrus* and *Pseudocalanus minutus* were found at all depths below 100 meters, but depth intervals of peak concentrations are apparent (Fig. 12). The main population of *C. glacialis* and *C. plumchrus* gathered between 300 and 400 meters in Jervis Inlet. At GS 1 these two species were evenly distributed between 200 and 400 meters. *P. minutus* and *Eucalanus bungii bungii* concentrated in the 400-500 meter depth interval at Jervis 3. At GS 1 the highest concentration of these animals was found in the lowest depth interval (300-400 meters). Differences in abundance between the two stations expressed as numbers/cubic meter are not particularily striking for the above four species. These animals inhabit both surface (spring) and deep (fall and winter) zones of the ocean and can collectively be called *interzonal* species (Vinogadov, 1968).

Differences in abundance between stations are more apparent in *Gadius columbiae*, *Scolecithricella minor*, *Metridia pacifica* and *M. okhotensis* (Fig. 13). *G. columbiae* is much more abundant at GS 1 than at Jervis 3. In the Strait of Georgia it concentrated in the 200-300 meter interval. At Jervis 3 it was most abundant between 300 and 400 meters and absent below this. *S. minor* was more abundant at Jervis 3 where it was present in about equal numbers within the two intervals above 200 meters. It

FIGURE 12.

Vertical distribution of copepods in January, 1973.

Calanus glacialis

A. Jervis 3
B. GS 1

Calanus plumchrus

C. Jervis 3
D. GS 1

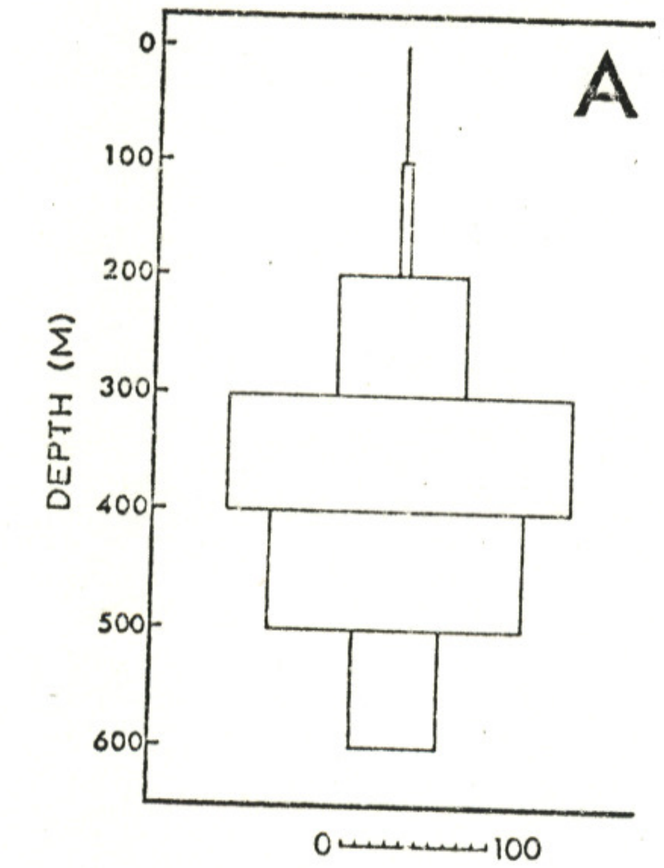
Eucalanus bungii bungii

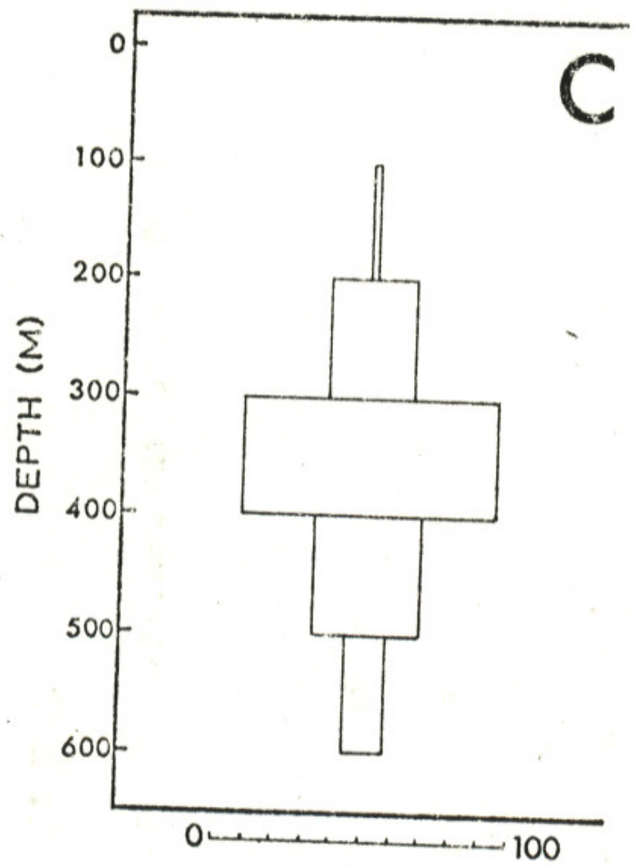
E. Jervis 3
F. GS 1

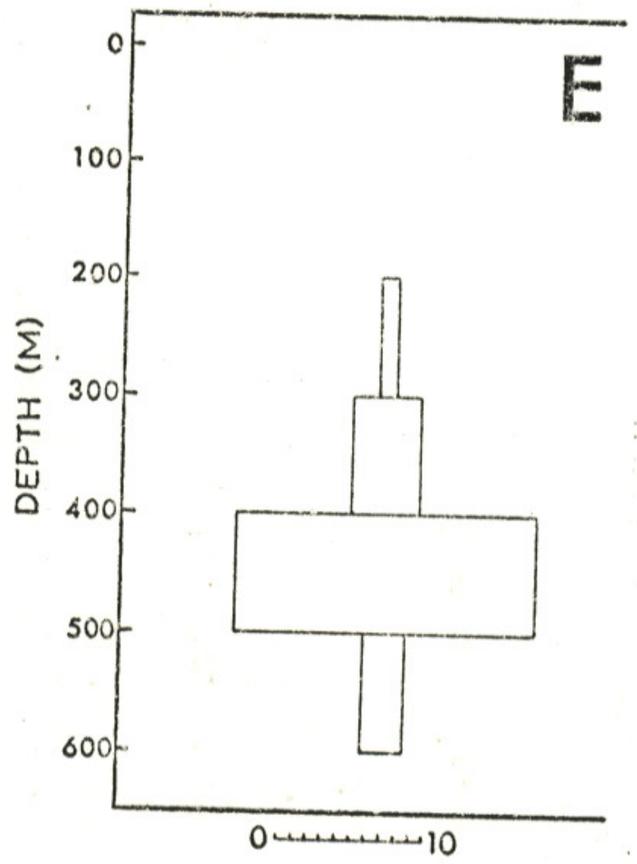
Pseudocalanus minutus

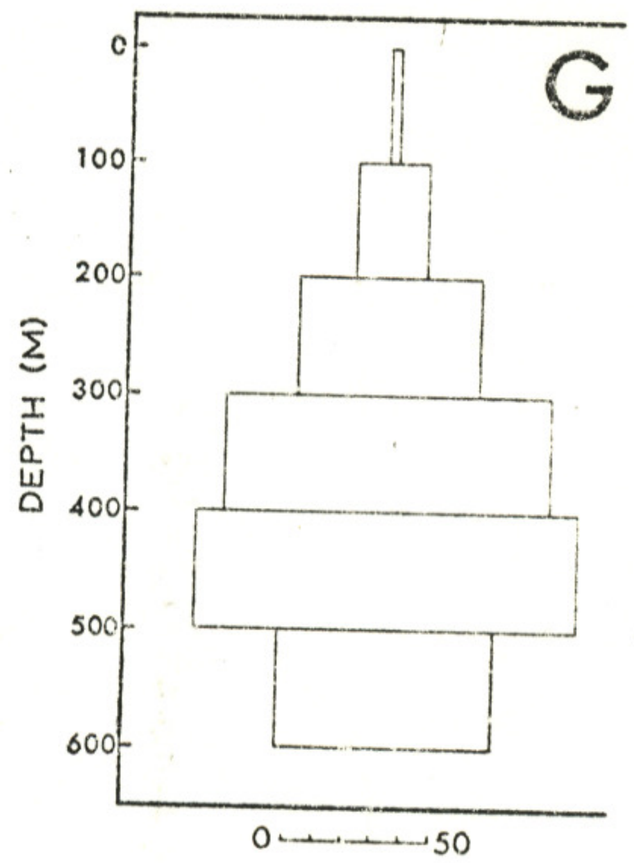
G. Jervis 3
H. GN 1

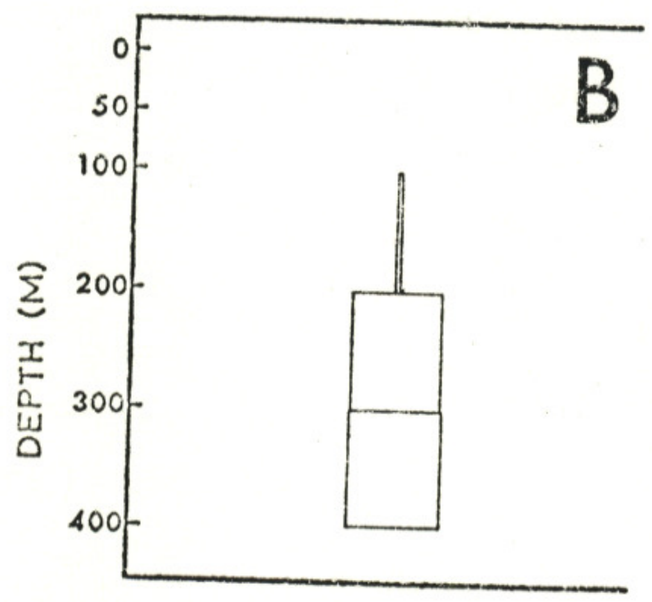
Scales in numbers/cubic meter

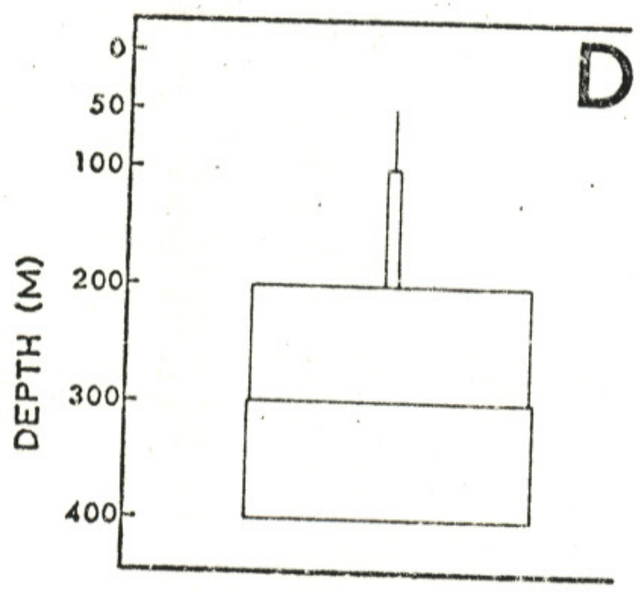

A
DEPTH (M)
0
100
200
300
400
500
600
0
100

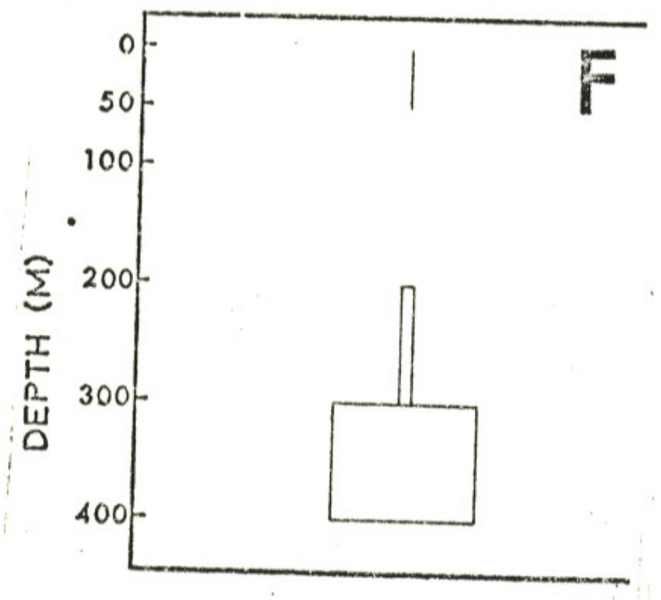

C
DEPTH (M)
0
100
200
300
400
500
600
0
100


E
DEPTH (M)
0
100
200
300
400
500
600
0
10


G
DEPTH (M)
0
100
200
300
400
500
600
0
50


B
DEPTH (M)
0
50
100
200
300
400


D
DEPTH (M)
0
50
100
200
300
400


F
DEPTH (M)
0
50
100
200
300
400

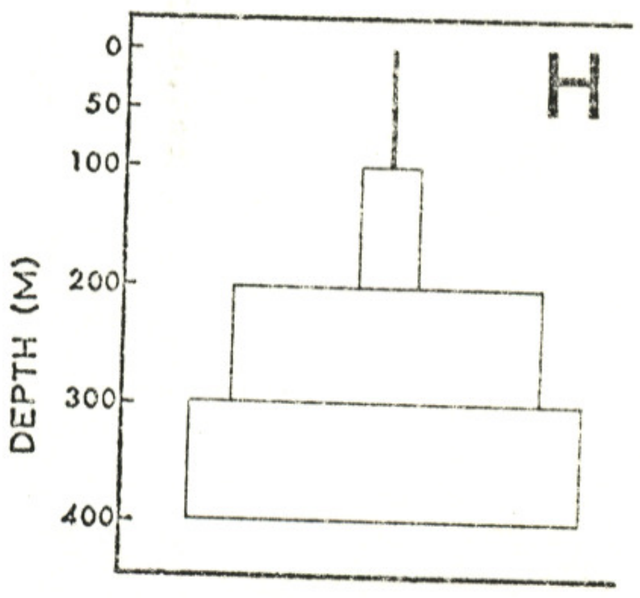

H
DEPTH (M)
0
50
100
200
300
400

FIGURE 13.

Vertical distribution of copepods in January, 1973.

Gadius columbiae

A. Jervis 3
B. GS 1

Scolecithricella minor

C. Jervis 3
D. GS 1

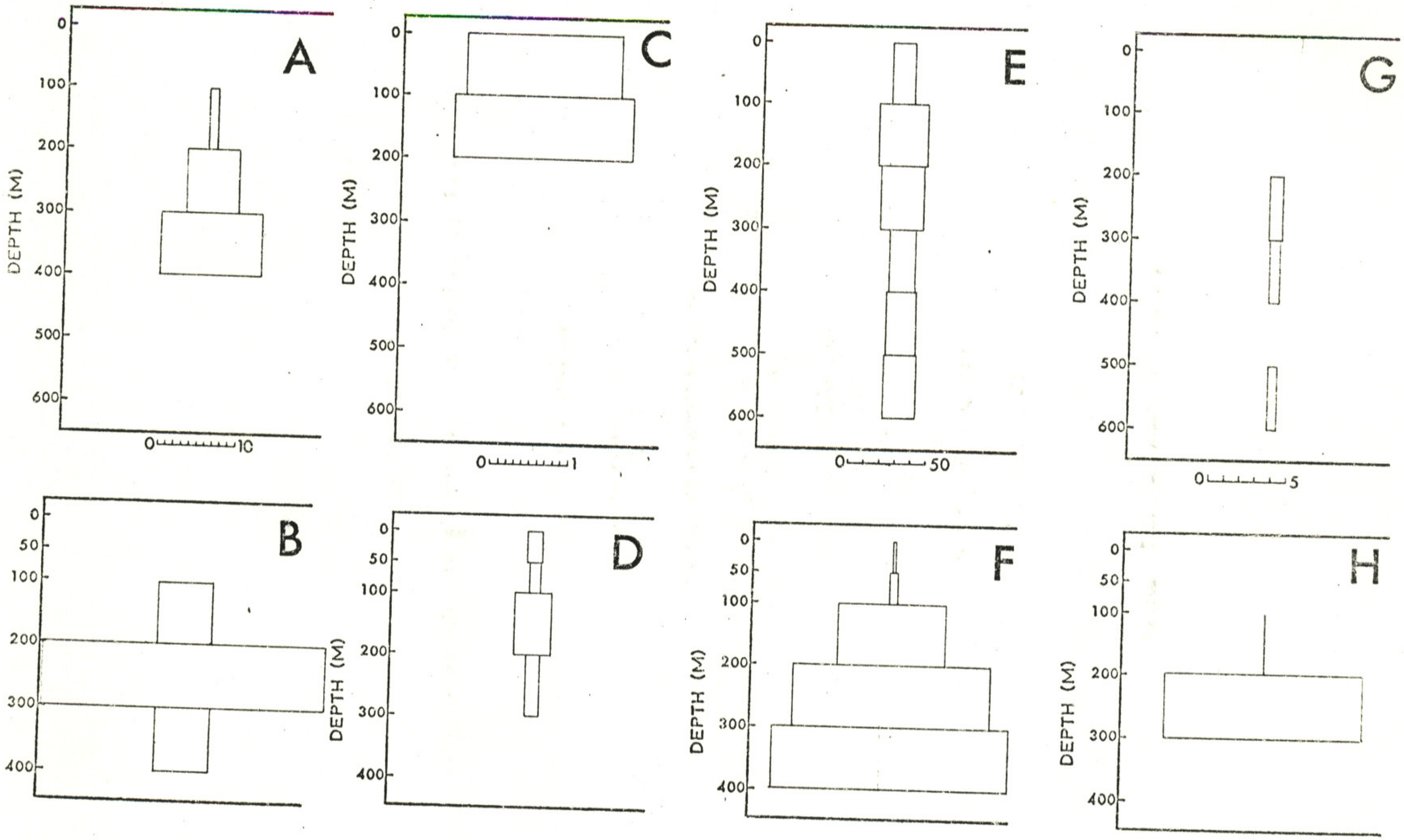
Metridia pacifica

E. Jervis 3
F. GS 1

Metridia okhotensis

G. Jervis 3
H. GS 1

Scales in numbers/cubic meter


A
B
C
D
E
F
G
H
DEPTH (M)
0
50
100
200
300
400
500
600
0 10
0 1
0 50
0 5

occurred down to 300 meters at GS 1. *M. pacifica* was present in approximately equal concentrations at all depths at Jervis 3. At GS 1 this species was much more common. Here it also occurred throughout the water column but became more concentrated in the deeper depth intervals. *M. okhotensis* was also more abundant in the Strait of Georgia at this time and was found almost exclusively between 200 and 300 meters. At Jervis 3 it occurred from 200 to 600 meters.

Spinocalanus brevicaudatus, *Scaphocalanus brevicornis* and *Heterorhabdus tanneri* occurred at all depths below 100 meters at Jervis 3, except for a break between 300 and 400 meters for *Scaphocalanus brevicornis* and *H. tanneri* where no animals occurred (Fig. 14). These absences may or may not be real. It must be emphasized at this point that because a closing net was not used in January or February the distribution of these comparitively rare species can only be approximated. However, the general distribution of these three species is in contrast to the distribution of common interzonal species such as *C. glacialis*, *C. plumchrus* and *P. minutus* which increase in numbers gradually to a maximum near mid-water, then decrease again. A lack of definite peaks of concentration is particularily evident in *Scaphocalanus brevicornis* and *H. tanneri*. The populations of these two species are distributed more or less evenly throughout the water column below 100 meters. *Spinocalanus brevicaudatus* females and juveniles appear to be somewhat more concentrated in the lowest depth interval (500-600 meters). The male of this species was found only in the 0-500 and 0-600 meter hauls. A sharp increase in numbers from the 0-100 to the 100-200 meter intervals is seen in all three species.

FIGURE 14.

Vertical distribution of copepods in January, 1973.

Spinocalanus brevicaudatus

A. Jervis 3
B. GS 1

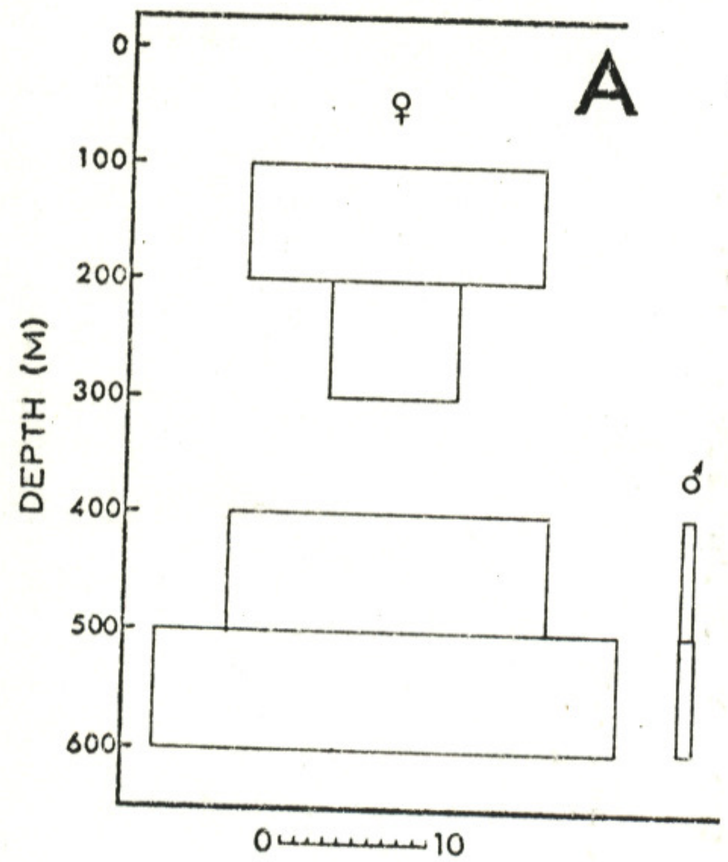
Scaphocalanus brevicornis

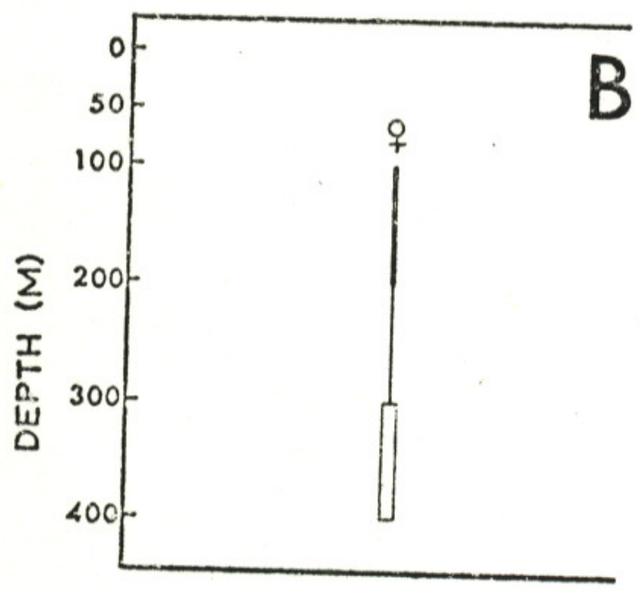
C. Jervis 3
D. GS 1

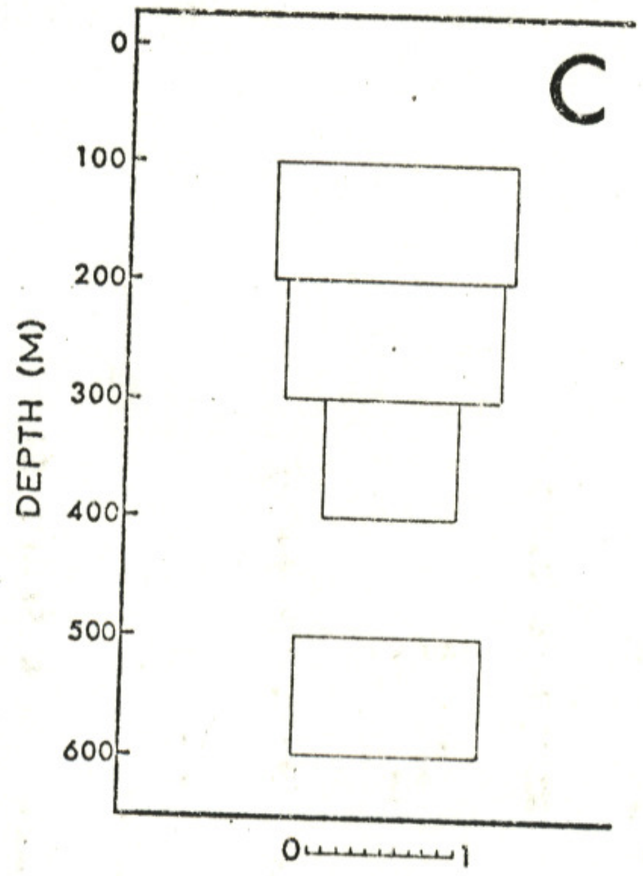
Heterorhabdus tanneri

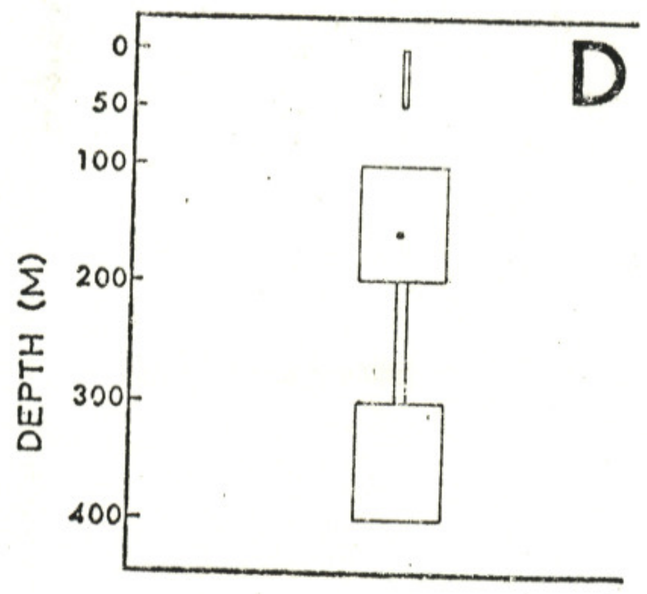
E. Jervis 3
F. GS 1

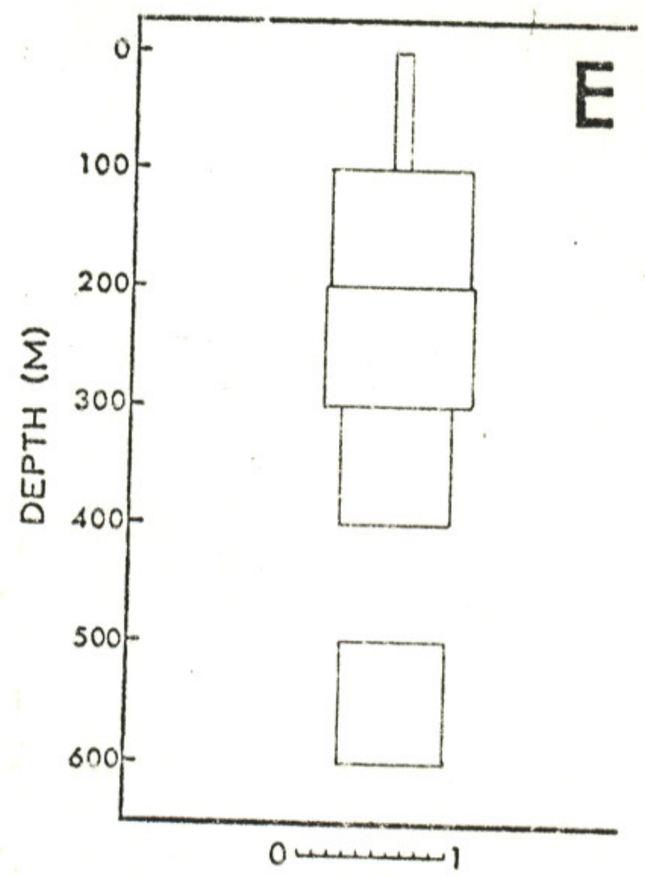
Scales in numbers/cubic meter


A
♀
♂
DEPTH (M)
0
100
200
300
400
500
600
0
10


B
♀
DEPTH (M)
0
50
100
200
300
400


C
DEPTH (M)
0
100
200
300
400
500
600
0
1


D
DEPTH (M)
0
50
100
200
300
400


E
DEPTH (M)
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400
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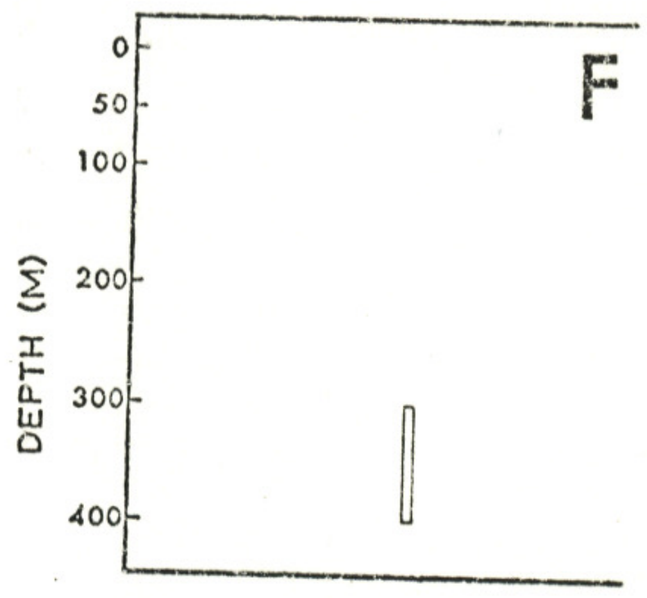
0
1


F
DEPTH (M)
0
50
100
200
300
400

Spinocalanus brevicaudatus, *Scaphocalanus brevicornis* and *H. tanneri* were also present in the Strait of Georgia, but at much lower concentrations. This is particularily true for *Spinocalanus* and *Heterorhabdus*. The difference between stations is less distinct for *Scaphocalanus brevicornis* (Table VI).

TABLE VI. Total numbers of three copepods at Jervis 3 and GS 1, bottom to surface hauls. January, 1973.

Species	Jervis 3	GS 1	% GS 1/Jervis3
Spinocalanus brevicaudatus	2120	24	1.1
Scaphocalanus brevicornis	109	32	30.1
Heterorhabdus tanneri	77	2	2.6

B. Bute 2 and GN 1, February 1973.

The vertical distribution of copepods in February is poorly documented. Only four vertical hauls were obtained from Bute 2, from 600, 500, 400 and 300 meters to the surface. At GN 1 samples were obtained from 300, 200 and 100 meters to the surface.

Peak concentrations of *C. plumchrus* are again found in the 300-400 meter interval. The main population of *E. bungii bungii* is also between 300 and 400 meters, 100 meters higher than in January at Jervis 3 (Fig. 15). Although the depth interval of highest concentration is also 300-400 meters for *C. glacialis* and *P. minutus*, the concentration in the 0-300 meter interval is only slightly less for both species. If

FIGURE 15.

Vertical distribution of copepods in February, 1973.

Calanus glacialis

A. Bute 2
B. GN 1

Calanus plumchrus

C. Bute 2
D. GN 1

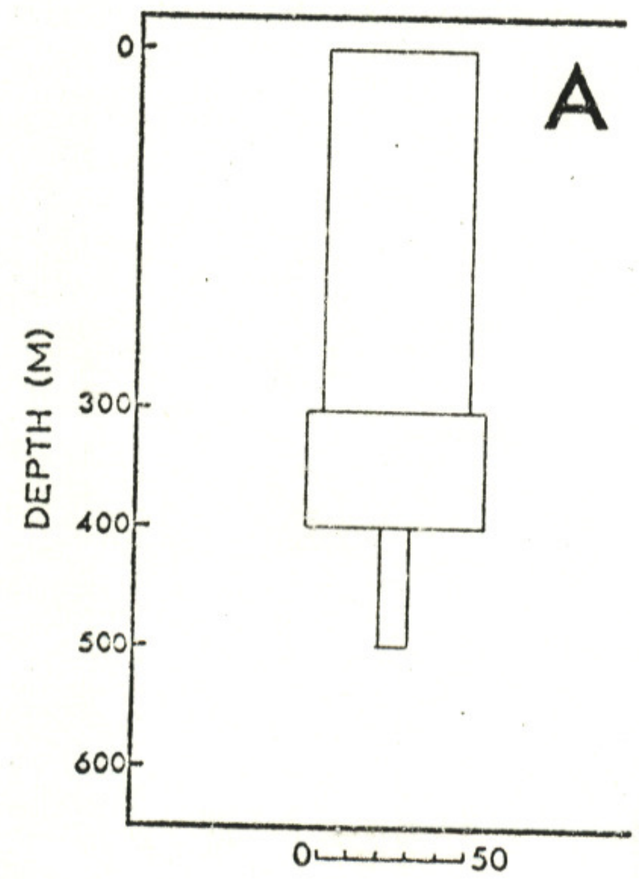
Eucalanus bungii bungii

E. Bute 2
F. GN 1

Pseudocalanus minutus

G. Bute 2
H. GN 1

Scales in numbers/cubic meter


A
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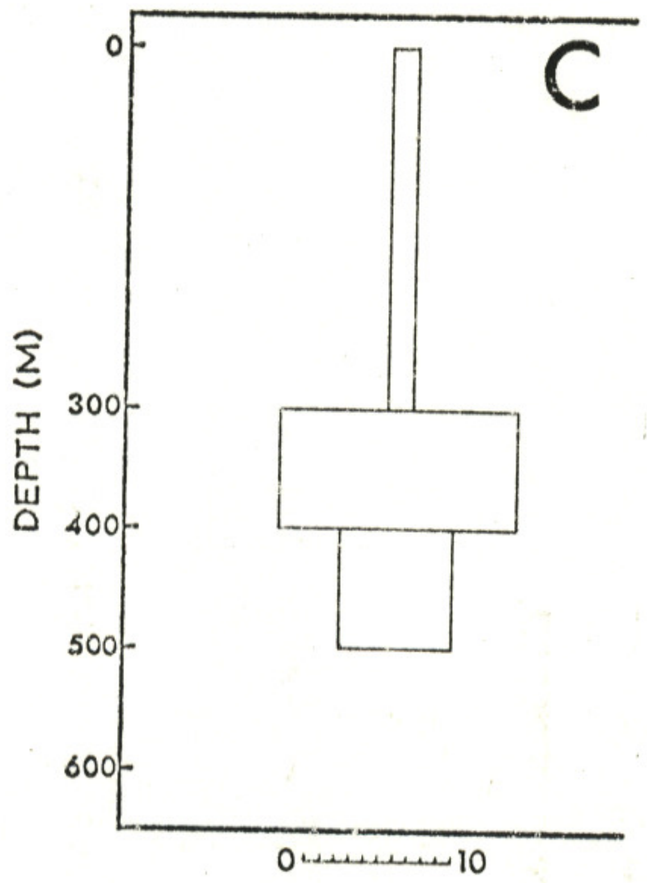
400
500
600
0
50


C
DEPTH (M)
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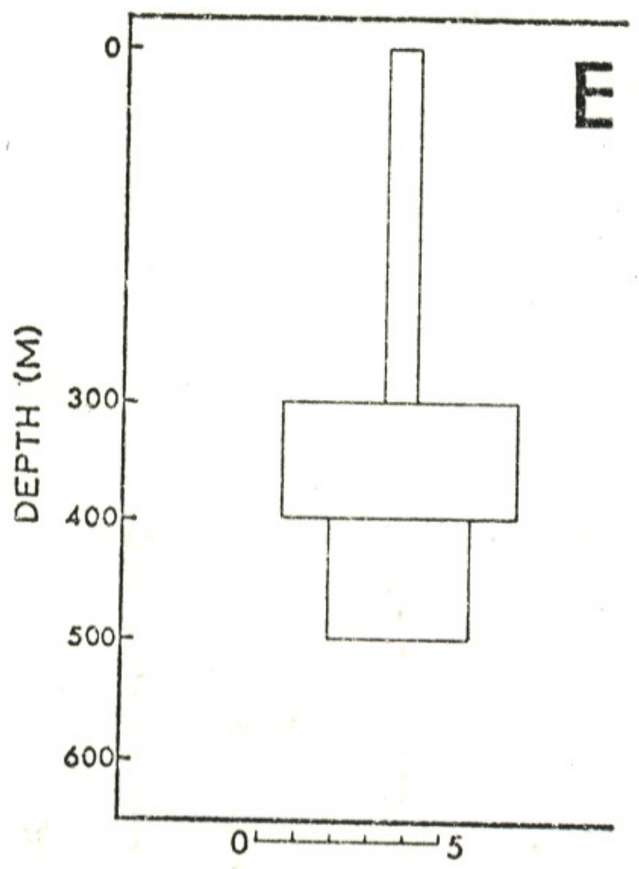
400
500
600
0
10


E
DEPTH (M)
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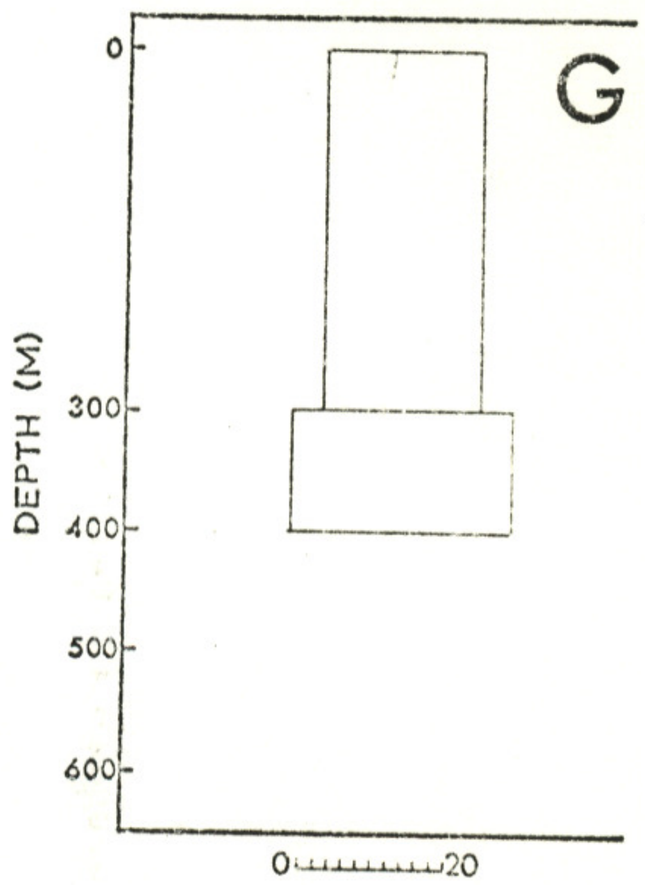
400
500
600
0
5


G
DEPTH (M)
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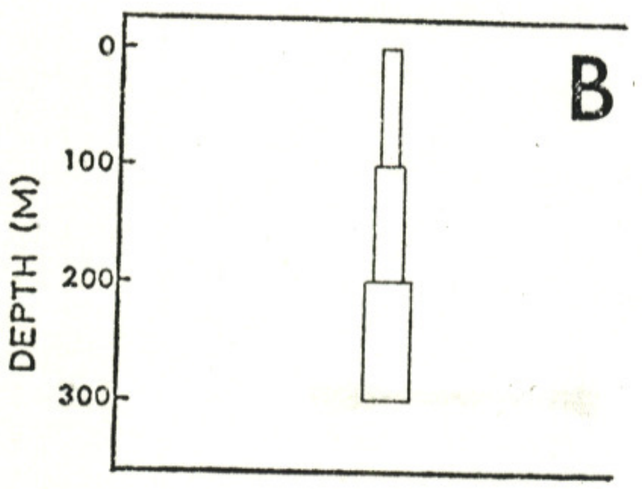
400
500
600
0
20


B
DEPTH (M)
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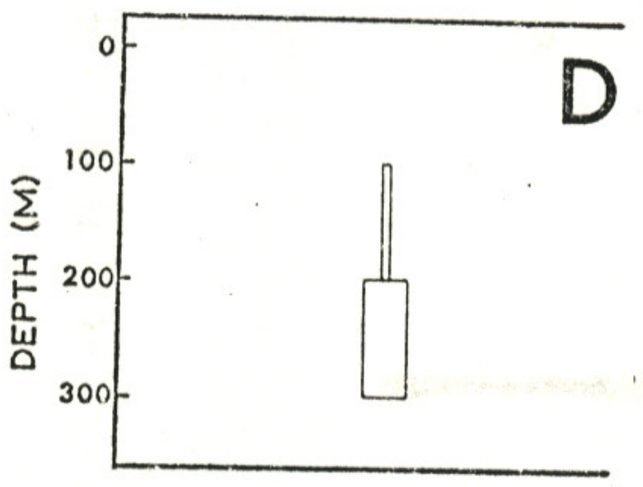
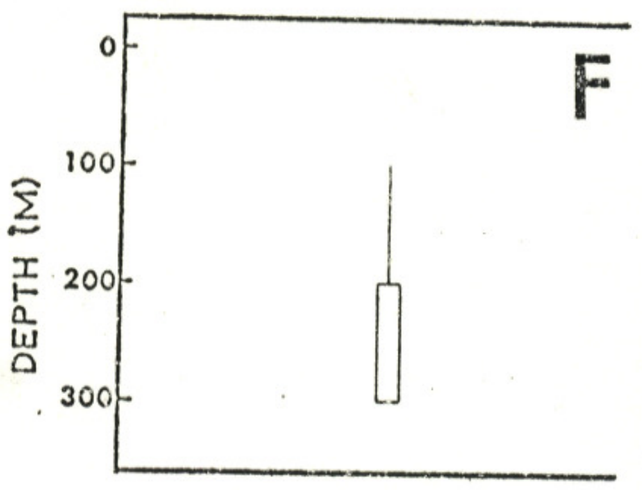
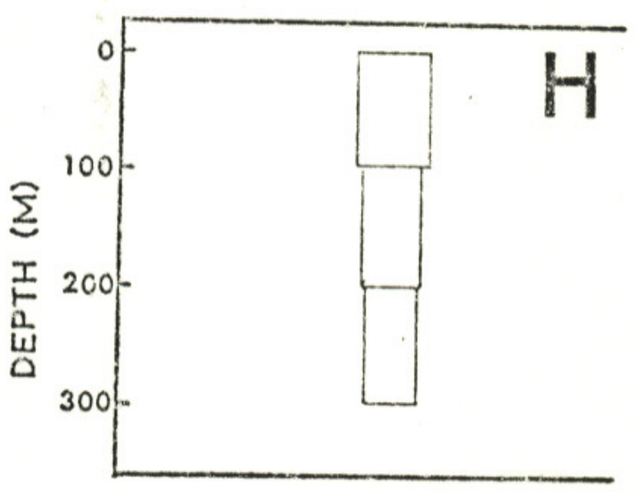
100
200
300


D
DEPTH (M)
0
100
200
300


F
DEPTH (M)
0
100
200
300


H
DEPTH (M)
0
100
200
300

the animals in the 0-300 meter interval were concentrated at the lower end of this interval peak concentrations for these species would have been between 200 and 300 meters. This is 100 meters higher for *C. glacialis* and 200 meters higher for *P. minutus* than in January at Jervis 3. *C. glacialis, C. plumchrus* and *E. bungii bungii* concentrated in the lowest depth interval at GN 1. *P. minutus* was more or less evenly distributed throughout the water column at this station.

Gadius columbiae was most abundant at Bute 2 where it concentrated between 300 and 500 meters. In January this species had been more abundant in the Strait of Georgia. *M. pacifica* was found mainly above 300 meters at Bute 2 and concentrated between 100 and 200 meters at GN 1 (Fig. 16).

Unfortunately the upper limits for *Spinocalanus brevicaudatus, Scaphocalanus brevicornis* and *H. tanneri* cannot be determined. However, similarities can be seen with the vertical distribution of these species in January (Figs. 16 and 17). Both *Spinocalanus* and *Heterorhabdus* appear to be present throughout the water column. Relatively low concentrations are present in the 300-400 meter interval for *Spinocalanus brevicaudatus* and in the 400-500 meter interval for *H. tanneri*. These intervals correspond to the absences found in January. As in January, the males of *Spinocalanus brevicaudatus* were found in the deepest hauls. The main population of females and juveniles of this species was again found in the lowest depth intervals. The vertical distribution of *Scaphocalanus brevicornis* however appears to be significantly different from January. A peak in concentration is present between 200 and 300 meters, and no animals appeared below 500 meters.

FIGURE 16.

Vertical distribution of copepods in February, 1973.

Gadius columbiae

A. Bute 2
B. GN 1

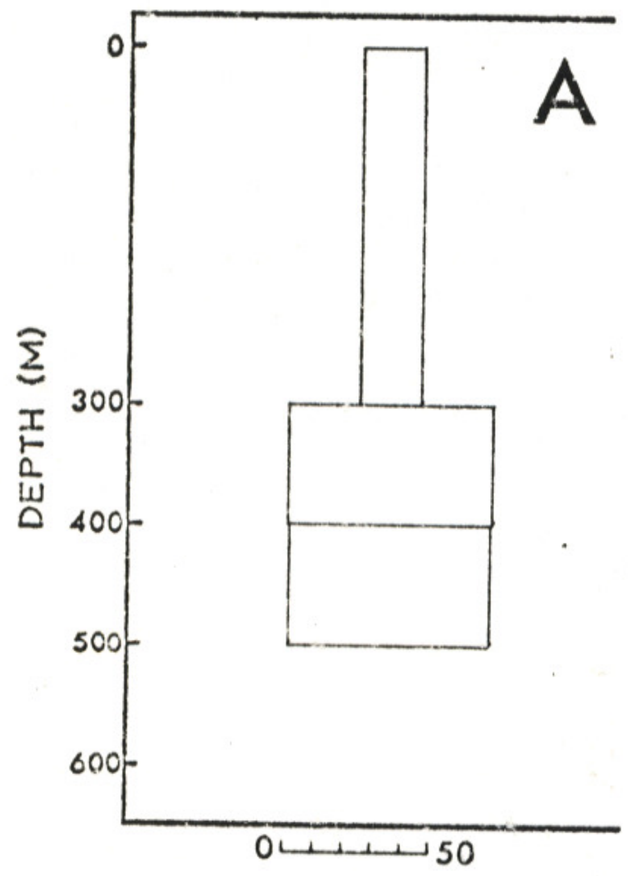
Metridia pacifica

C. Bute 2
D. GN 1

Scaphocalanus brevicornis

E. Bute 2
F. GN 1

Scales in numbers/cubic meter


A
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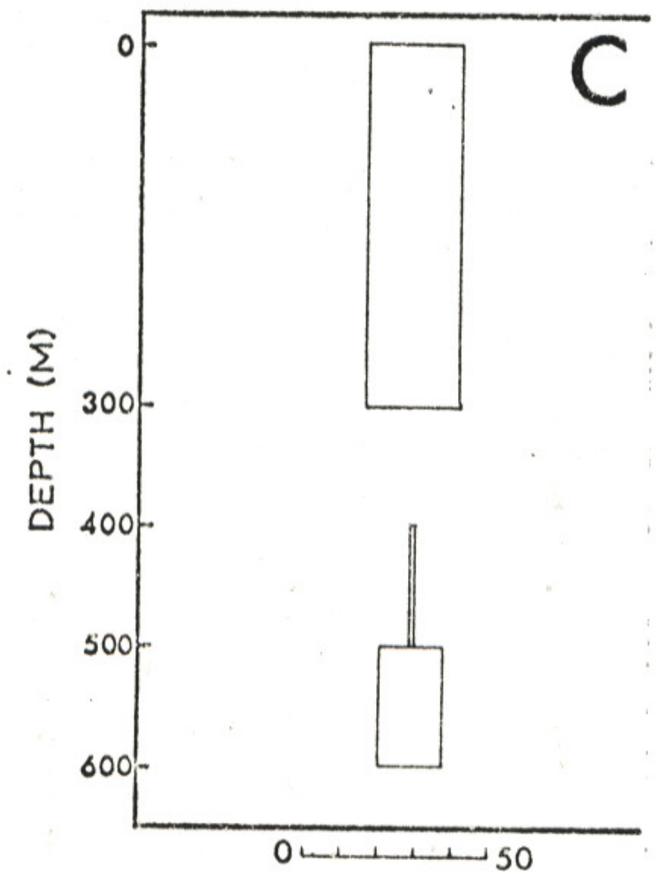
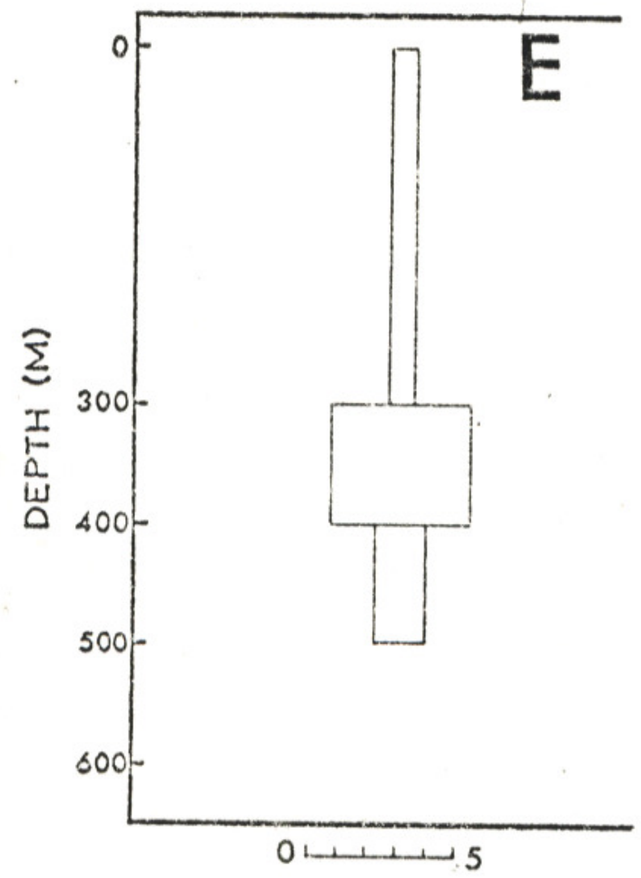
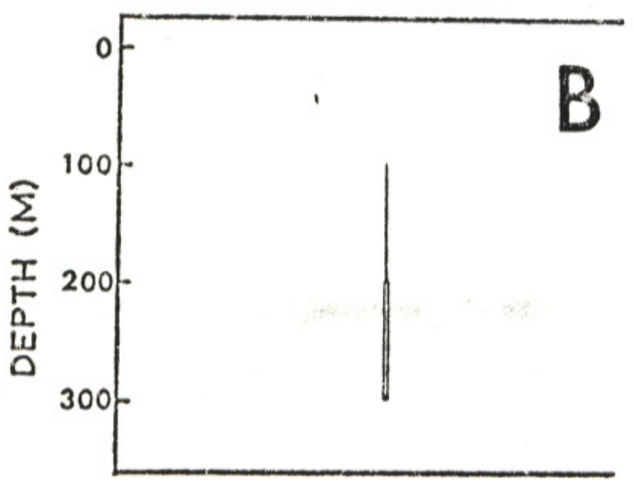
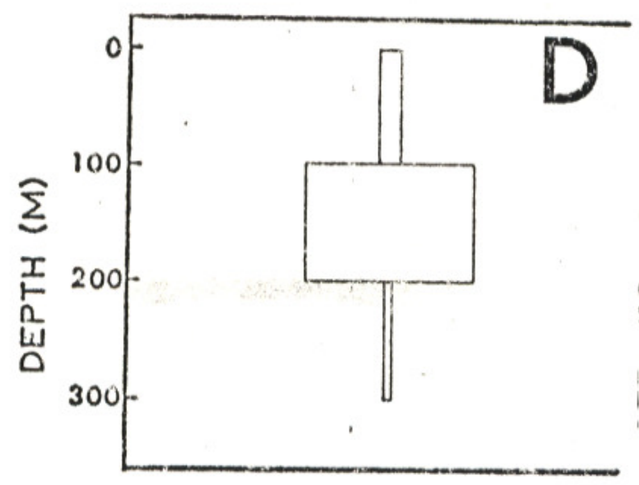
400
500
600
0
50


C
DEPTH (M)
0
300
400
500
600
0
50


E
DEPTH (M)
0
300
400
500
600
0
5


B
DEPTH (M)
0
100
200
300


D
DEPTH (M)
0
100
200
300

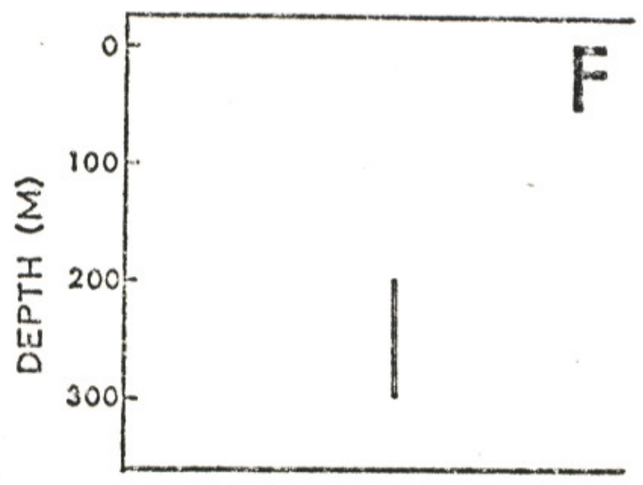

F
DEPTH (M)
0
100
200
300

FIGURE 17.

Vertical distribution of copepods in February, 1973.

Spinocalanus brevicaudatus

A. Bute 2
B. GN 1

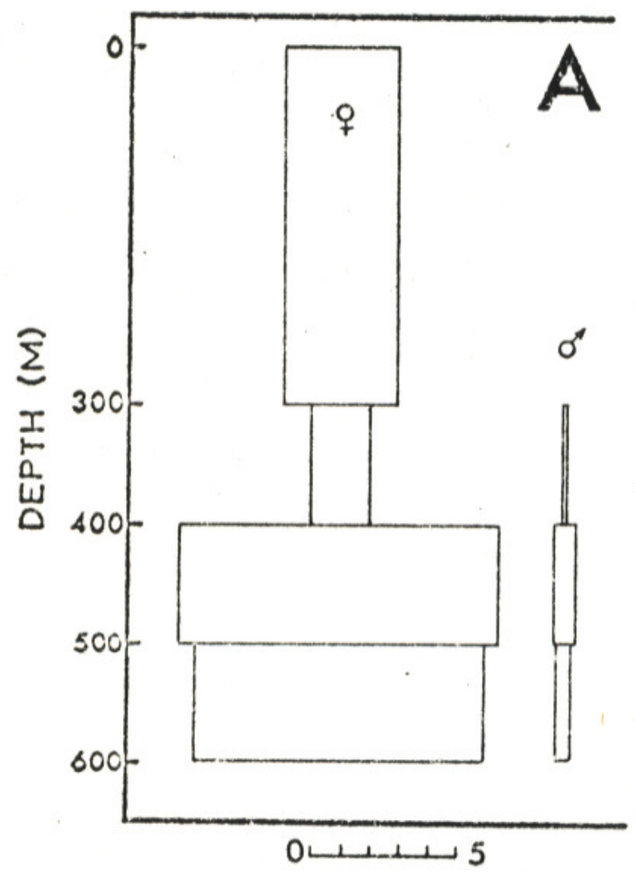
Comantenna columbiae

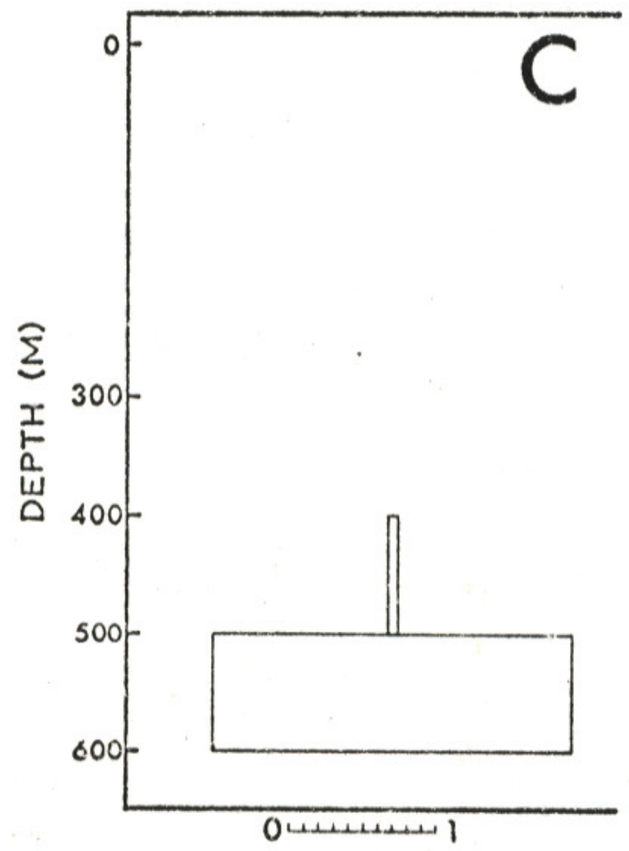
C. Bute 2

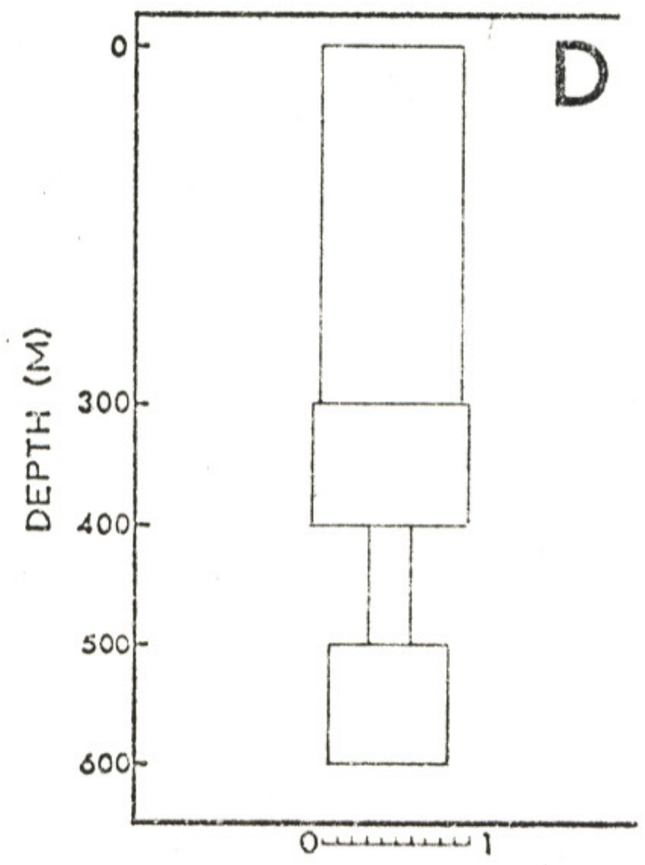
Heterorhabdus tanneri

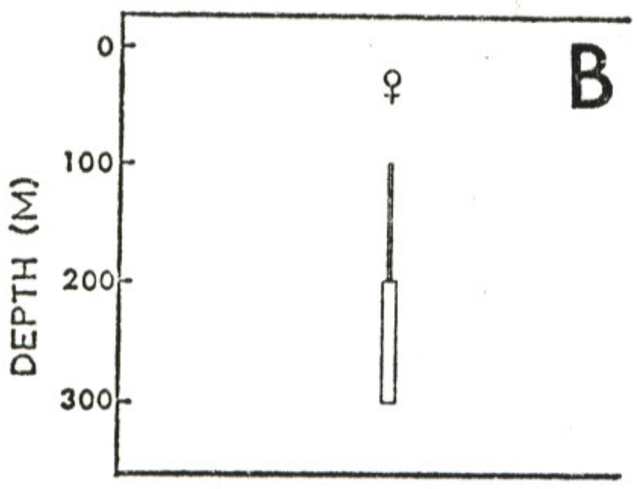
D. Bute 2
E. GN 1

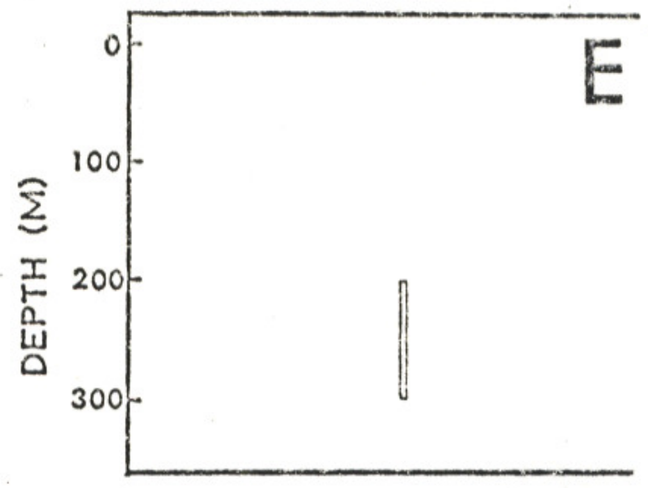
Scales in numbers/cubic meter


A
0
300
400
500
600
DEPTH (M)
♀
♂
0
5


C
0
300
400
500
600
DEPTH (M)
0
1


D
0
300
400
500
600
DEPTH (M)
0
1


B
0
100
200
300
DEPTH (M)
♀


E
0
100
200
300
DEPTH (M)

Comantenna columbiae was most abundant in the deepest haul (Fig. 17) at Bute 2. It was not found outside the inlet.

For all species, with the exception of *M. pacifica*, concentrations were greater at Bute 2 than at GN 1 at the same depth. When total numbers from the bottom-to-surface hauls are considered *M. pacifica* was also more abundant at Bute 2. Table VII shows that the difference in concentrations between stations is more pronounced for *Scaphocalanus*, *Spinocalanus* and *Heterorhabdus* than for the common interzonal species.

TABLE VII. Total numbers of 5 copepods at Bute 2 and GN 1, bottom-to surface hauls. February, 1973.

Species	Bute 2	GN 1	% GN 1/Bute 2
Spinocalanus brevicaudatus	950	15	1.5
Scaphocalanus brevicornis	200	3	1.5
Heterorhabdus tanneri	70	1	1.4
Calanus glacialis	4648	928	20
Pseudocalanus minutus	2240	612	27

4. Vertical distribution and abundance of copepods at GN 1 and Bute Inlet stations in summer.

The most extensive sampling of Bute Inlet occurred in July, 1973 when a large closing net (BOGO net) was used to obtain profiles of plankton concentrations throughout the water column at dusk, midnight, dawn and noon. In general, data from these samples confirmed findings from the previous cruises.

Calanus glacialis, *C. plumchrus*, *Eucalanus bungii bungii* and *Pseudocalanus minutus* preferred definite depth intervals (Fig. 18 and 19). At GN 1 this was the deepest interval for all four species. The depth interval of highest concentration for *C. glacialis* and *C. plumchrus* is lower at Bute 2 than at Bute 4 (Fig. 18). It is possible that the 400-600 meter tow at Bute 2 (noon) sampled an unduly dense patch of plankton, or that the net was incompletely tripped. Although only one other haul was taken from this depth at Bute 2 the close agreement of other hauls suggests this (Table VIII). The derivation of confidence limits for the distribution diagrams as well as other statistical procedures employed in this thesis are explained in Appendix 2.

At Bute 4 *C. glacialis*, *C. plumchrus* and *P. minutus* concentrated in the 300-400 meter interval. *E. bungii bungii* preferred a deeper level, as in January. At GN 1 these species concentrated in the depth interval immediately above the bottom (200-300 meters), much as in January and February at the deep stations in the Strait of Georgia. This "hugging" of the bottom is not as apparent, or is absent at the shallow station

FIGURE 18.

Vertical distribution of copepods at noon in July, 1973.

A. *Calanus glacialis*

B. *Calanus plumchrus*

C. *Eucalanus bungii bungii*

----- Bottom

Scales in numbers/cubic meter.

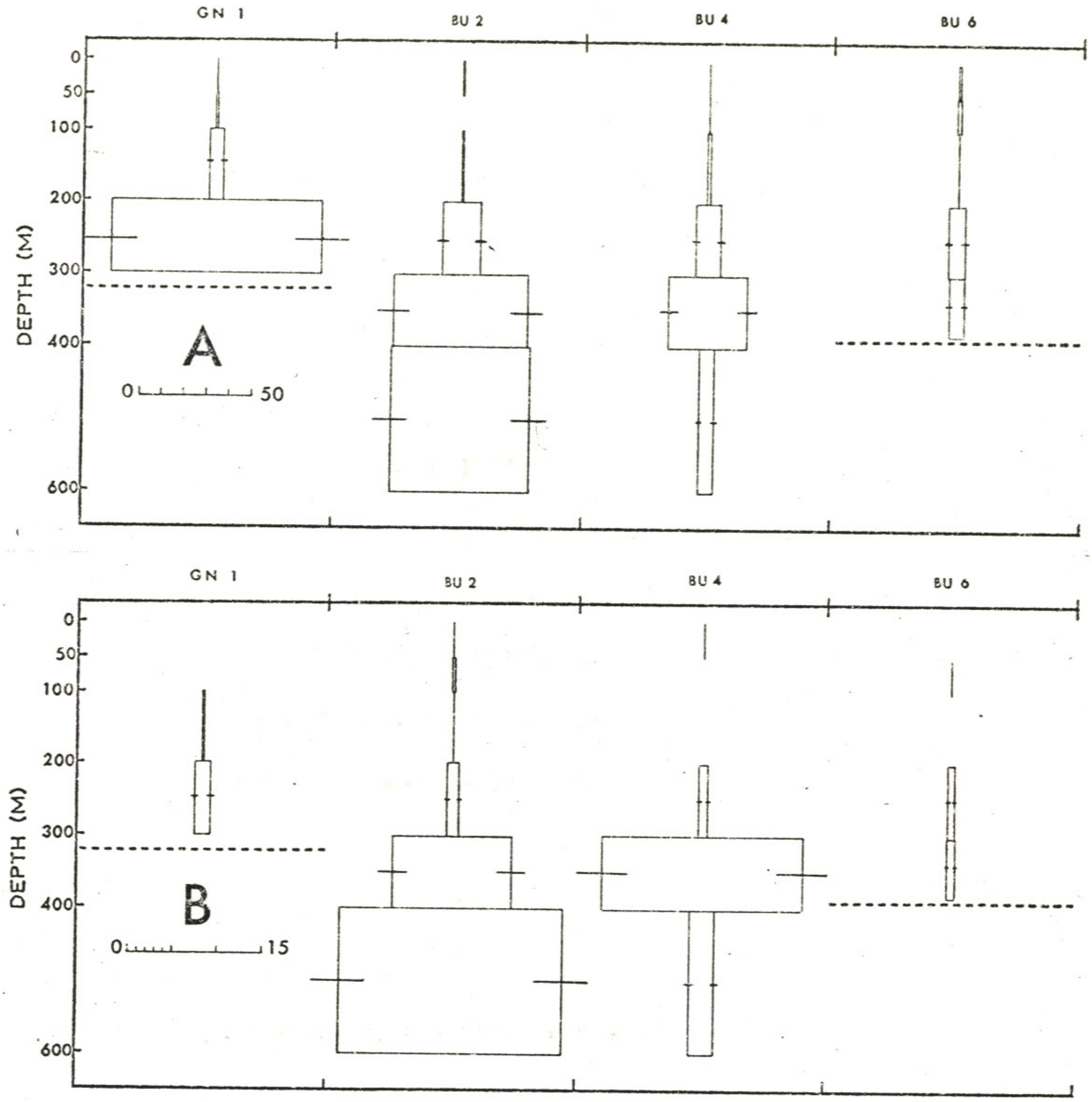

GN 1
BU 2
BU 4
BU 6
DEPTH (M)
0
50
100
200
300
400
600
A
0
50
B
15
C
10

FIGURE 19.

Vertical distribution of copepods at noon in July, 1973.

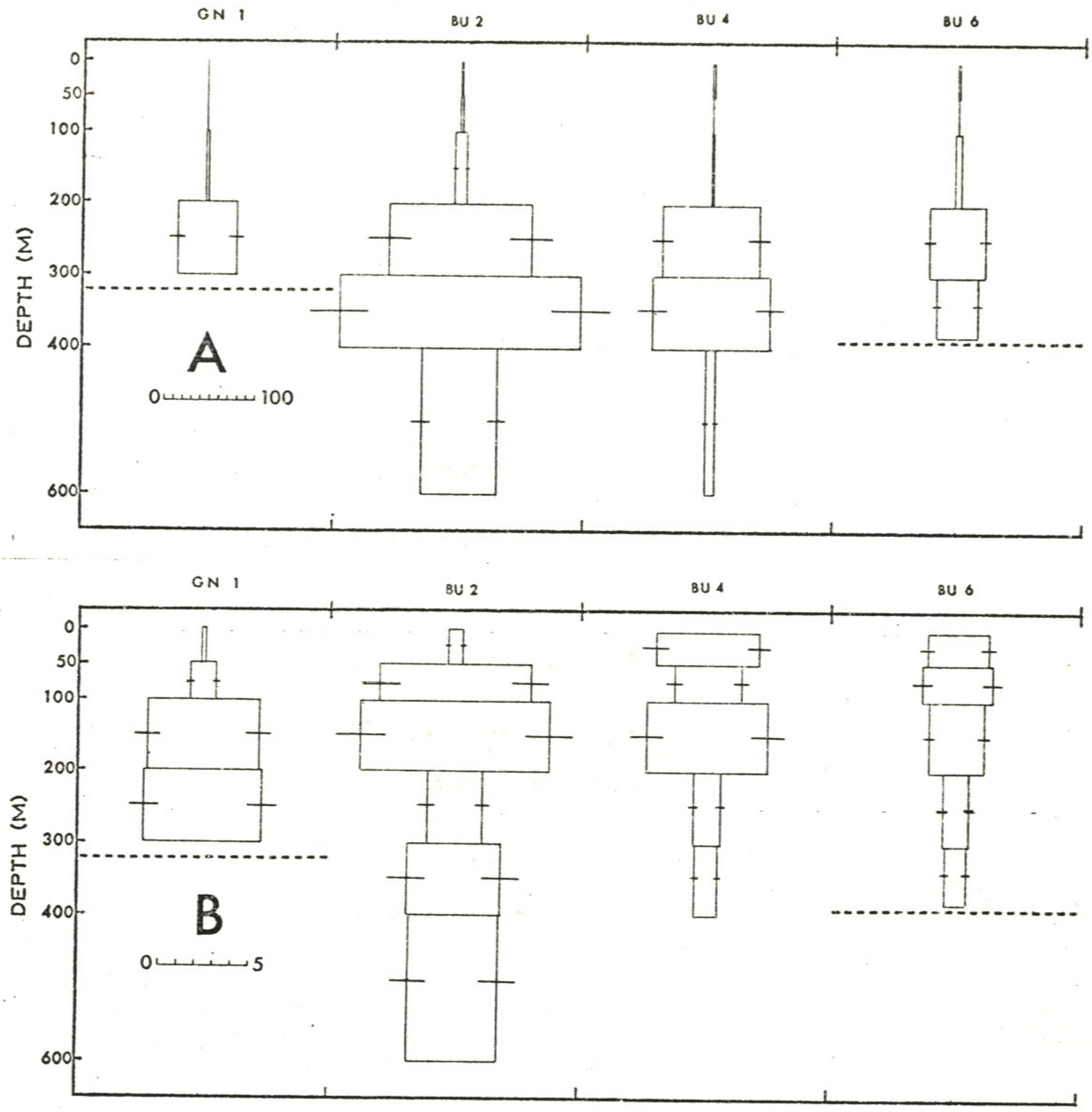
A. *Pseudocalanus minutus*

B. *Euchaeta japonica*

C. *Scolecithricella minor*

----- Bottom

Scales in numbers/cubic meter


GN 1
BU 2
BU 4
BU 6
DEPTH (M)
0
50
100
200
300
400
600
A
0
100

GN 1
BU 2
BU 4
BU 6
DEPTH (M)
0
50
100
200
300
400
600
B
0
5

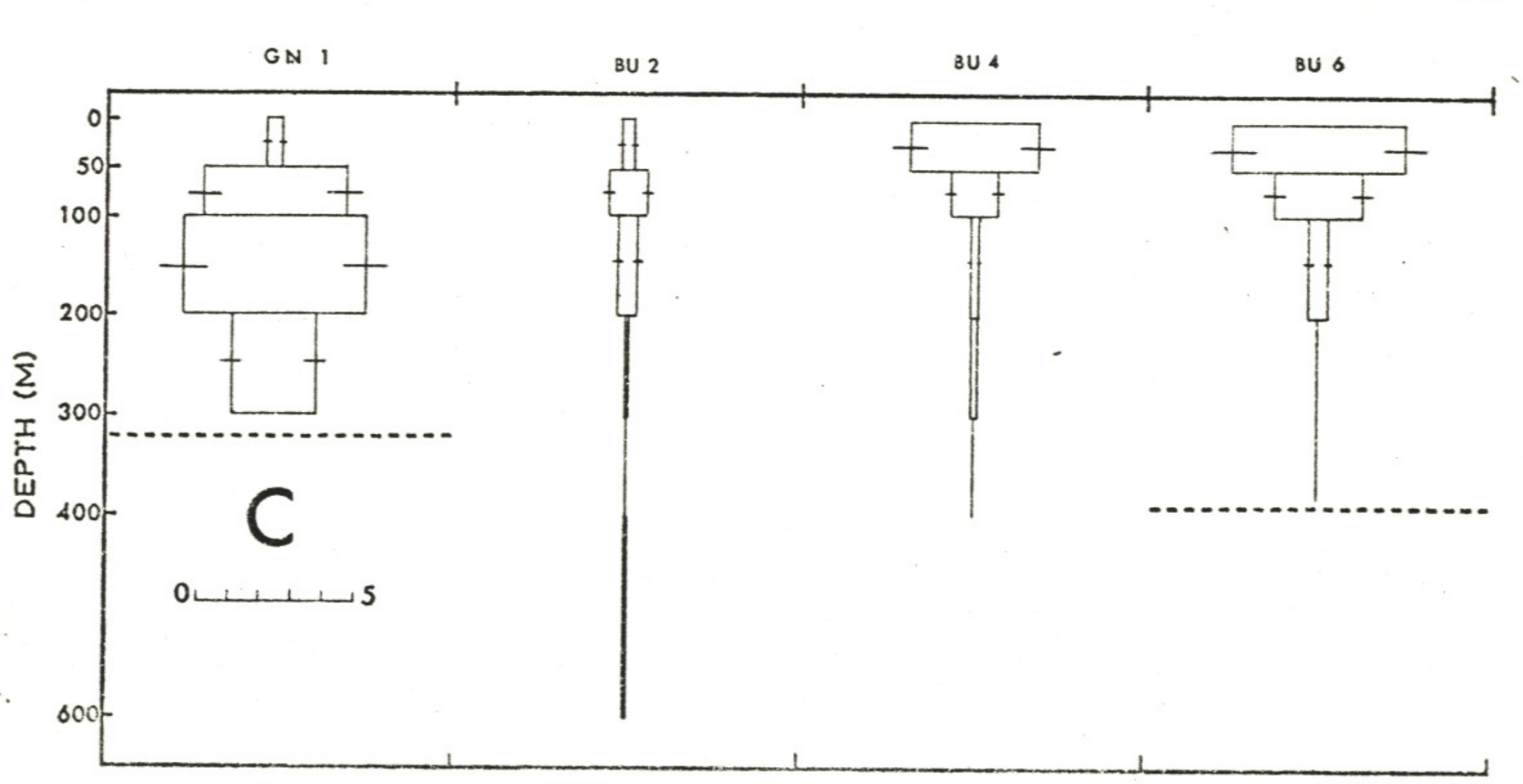

GN 1
BU 2
BU 4
BU 6
DEPTH (M)
0
50
100
200
300
400
600
C
0
5

TABLE VIII. Concentrations of *Calanus glacialis* at Bute 2 in numbers/ cubic meter. July, 1973.

Depth interval (meters)	Midnight	Dawn	Noon
0-50	2.4	3.4	.4
50-100	0.2	0.1	0.0
100-200	0.2	0.3	0.5
200-300	11.2	11.5	17.4
300-400	54.0	43.1	58.6
400-600	no data	31.9	61.5 ?

in Bute Inlet (Bute 6, 390 meters). This station has approximately the same depth as the two deep stations in the Strait of Georgia. At Bute 6 *C. glacialis* and *C. plumchrus* are evenly distributed in the two depth intervals between 200 and 390 meters. *E. bungii bungii* is relatively common at all depth intervals between 100 and 390 meters at Bute 6, with only a slight peak between 200 and 300 meters. This is higher than the peak depth at Bute 2 and 4. Similarily, the peak concentration depth for *P. minutus* is higher at Bute 6 than at Bute 2 and 4.

With the exception of *C. glacialis* at GN 1, these four species were more abundant at the two deep stations than at the two shallow ones. Within the inlet, all four species were more abundant at Bute 2 than at Bute 4, and least abundant at Bute 6.

Euchaeta japonica was present from surface to bottom at all stations except Bute 4, where is was absent from the lowest depth interval. This species was more abundant above 200 meters than below at all Bute Inlet stations. At GN 1 it was present in about equal numbers from 100 meters to the bottom (Fig. 19).

The vertical distribution of *Scolecithricella minor* shows similarities with January distribution (Fig. 19). Peak concentrations were again found in the upper water column at the inside stations. At GN 1 this species appeared more dispersed throughout the water column, but a maximum was still present between 100 and 200 meters. As in February at the same stations, greater numbers were present in the Strait of Georgia. Unlike the species mentioned above, *S. minor* appeared to increase in abundance with increasing distance from the mouth of the inlet.

Gadius columbiae was again more abundant within the inlet than

at GN 1. It was present at all depths except between 0 and 50 meters at Bute 4 and between 0 and 100 meters at GN 1. Peak concentrations occur in the 100-200 meter interval at stations within the inlet. At GN 1 the peak was less definite and 100 meters lower (Fig. 20).

Metridia pacifica was considerably more abundant at GN 1 than at the stations within the inlet (Fig. 20). As in February this species concentrated in the 100-200 meter interval. At Bute 2 two peaks of concentration are evident, one between 100 and 200 meters, and a second between 300 and 400 meters. Only one peak was seen at the other Bute Inlet stations. At Bute 6 this peak was higher than at Bute 4.

The vertical distribution of *Metridia okhotensis* appeared to be restricted almost entirely between 200 and 400 meters at all stations (Fig. 20).

Aetideus armatus, *Chiridius gracialis* and *Candacia columbiae* were the rarest copepods counted (Fig. 21). All three species, particularily *Chiridius gracialis* and *Candacia columbiae* showed avoidance of depths less than 100 meters, but were found at all deeper depths. Peaks of concentration were evident between 100 and 200 meters at Bute 2. These three species, although considered deep forms (Brodskii, 1950; Fulton, 1972) do not show a preference for the deep inlets. Indeed, *Candacia columbiae* and *Chiridius gracialis* were more abundant at GN 1 than at the deep Bute Inlet stations.

Spinocalanus brevicaudatus, *Scaphocalanus brevicornis* and *Heterorhabdus tanneri*, on the other hand, exhibit a definite preference for water inside Bute Inlet. They were found only rarely at GN 1 (Fig. 22). A distinct pattern of vertical distribution is evident which is common to the three species. As with *Aetideus*, *Chiridius* and *Candacia*, very few

FIGURE 20.

Vertical distribution of copepods at noon in July, 1973.

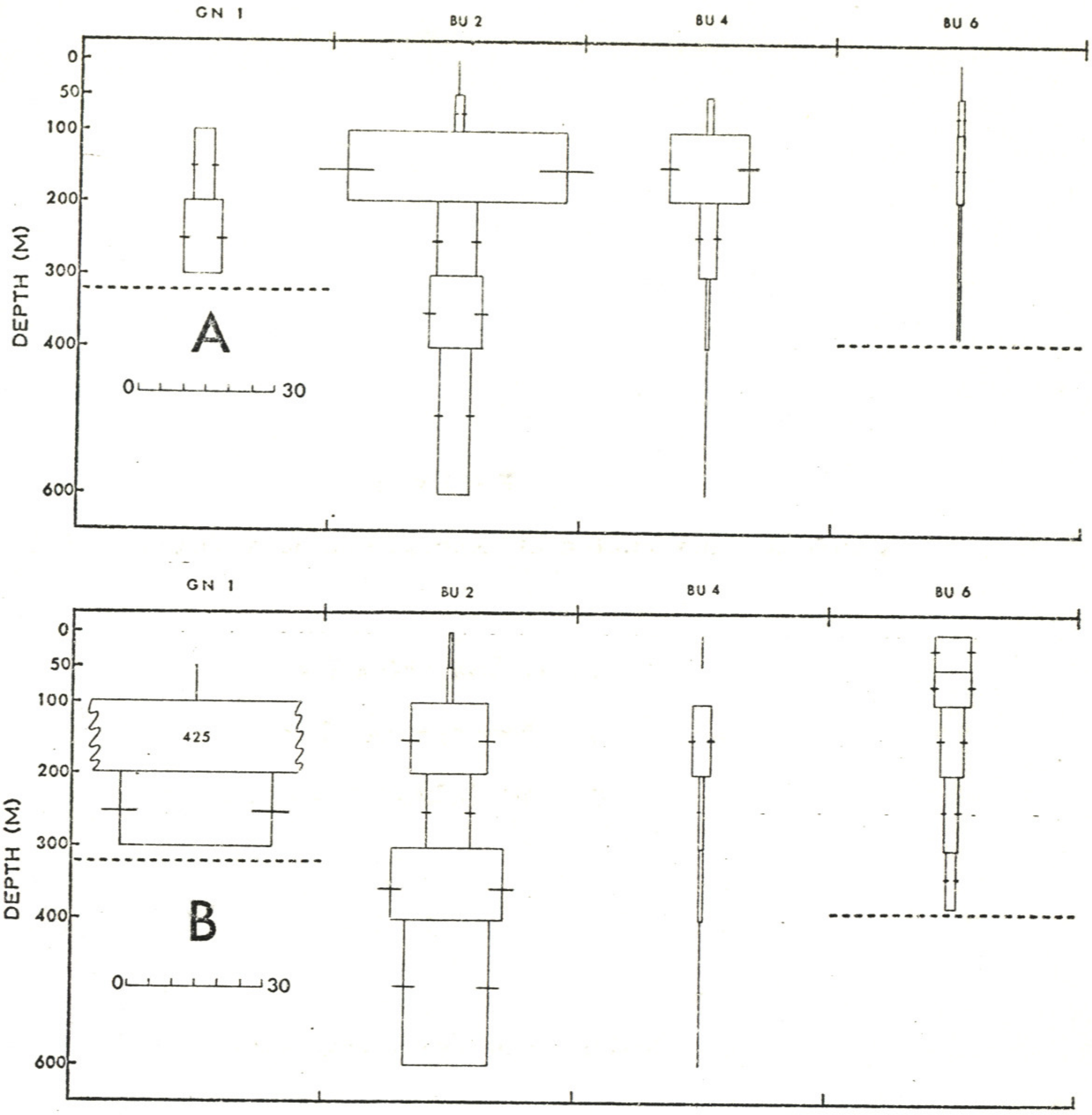
A. *Gadius columbiae*

B. *Metridia pacifica*

C. *Metridia okhotensis*

----- Bottom

Scales in numbers/cubic meter


GN 1
BU 2
BU 4
BU 6
DEPTH (M)
0
50
100
200
300
400
600
A
0
30

GN 1
BU 2
BU 4
BU 6
DEPTH (M)
0
50
100
200
300
400
600
425
B
0
30

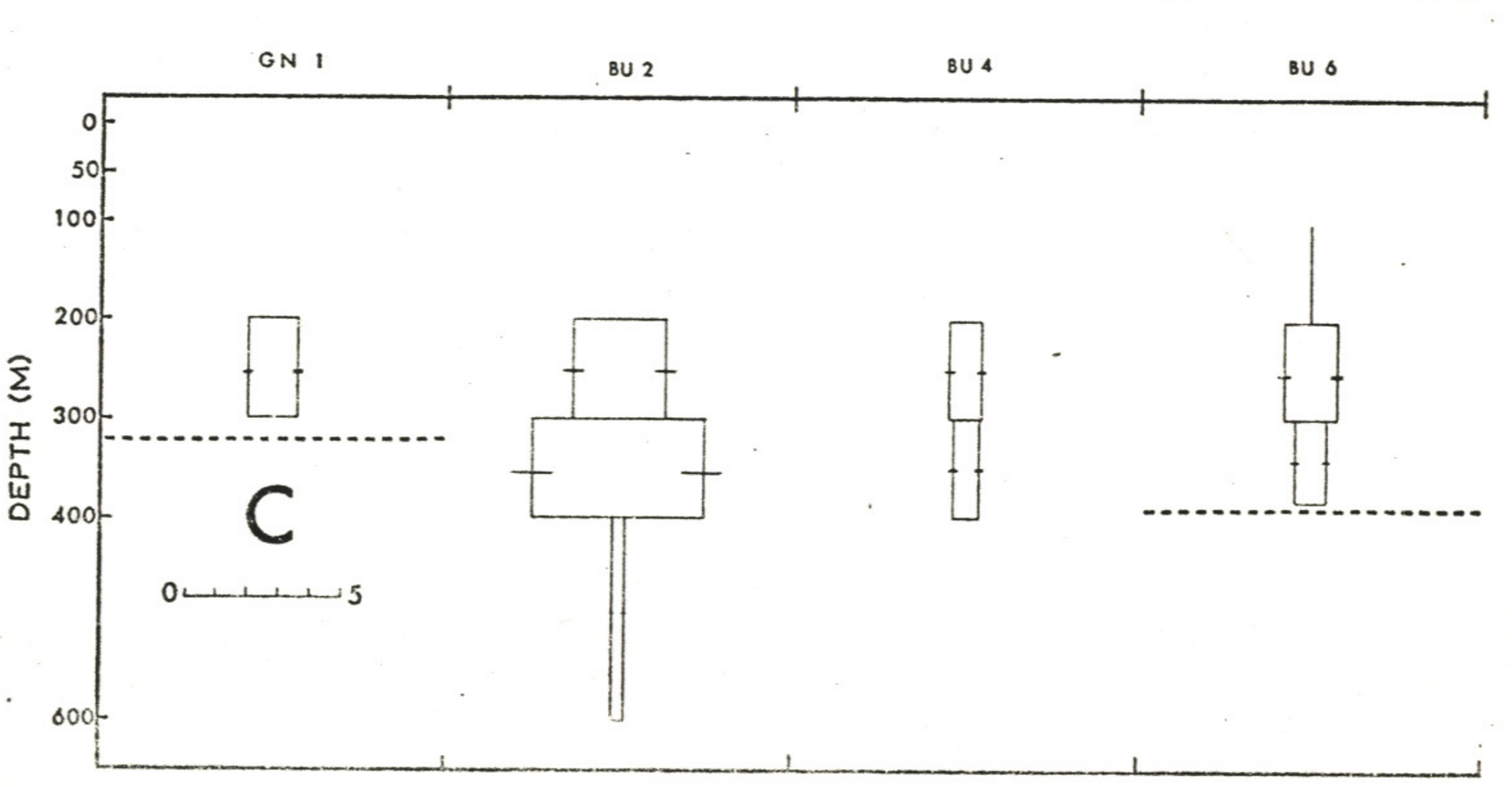

GN 1
BU 2
BU 4
BU 6
DEPTH (M)
0
50
100
200
300
400
600
C
0
5

FIGURE 21.

Vertical distribution of copepods at noon in July, 1973.

A. *Aetideus armatus*

B. *Chiridius gracilis*

C. *Candacia columbiae*

----- Bottom

Scales in numbers/cubic meter

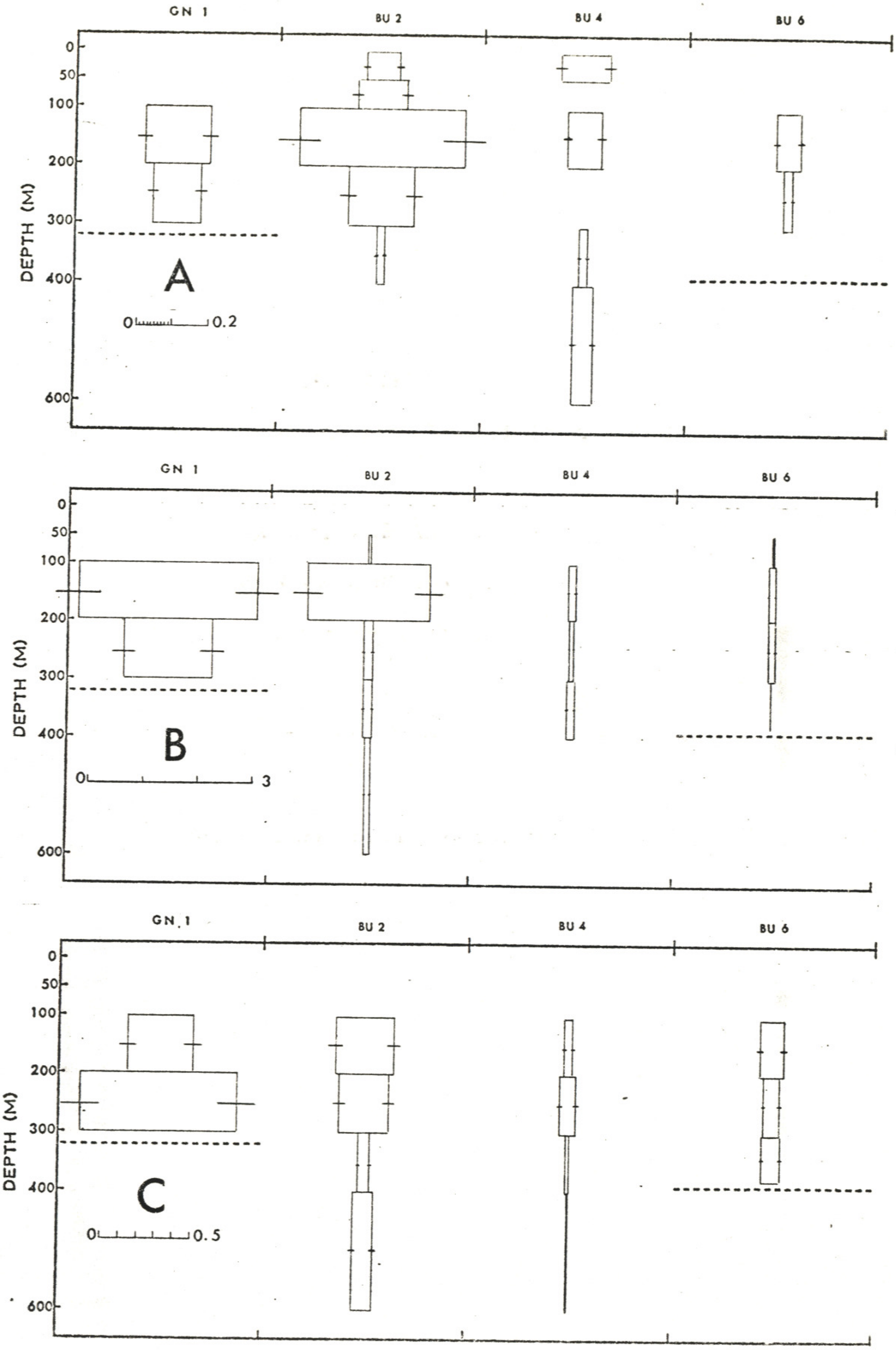

GN 1
BU 2
BU 4
BU 6
DEPTH (M)
0
50
100
200
300
400
600
A
0
0.2
B
3
C
0.5

FIGURE 22.

Vertical distribution of copepods at noon in July, 1973.

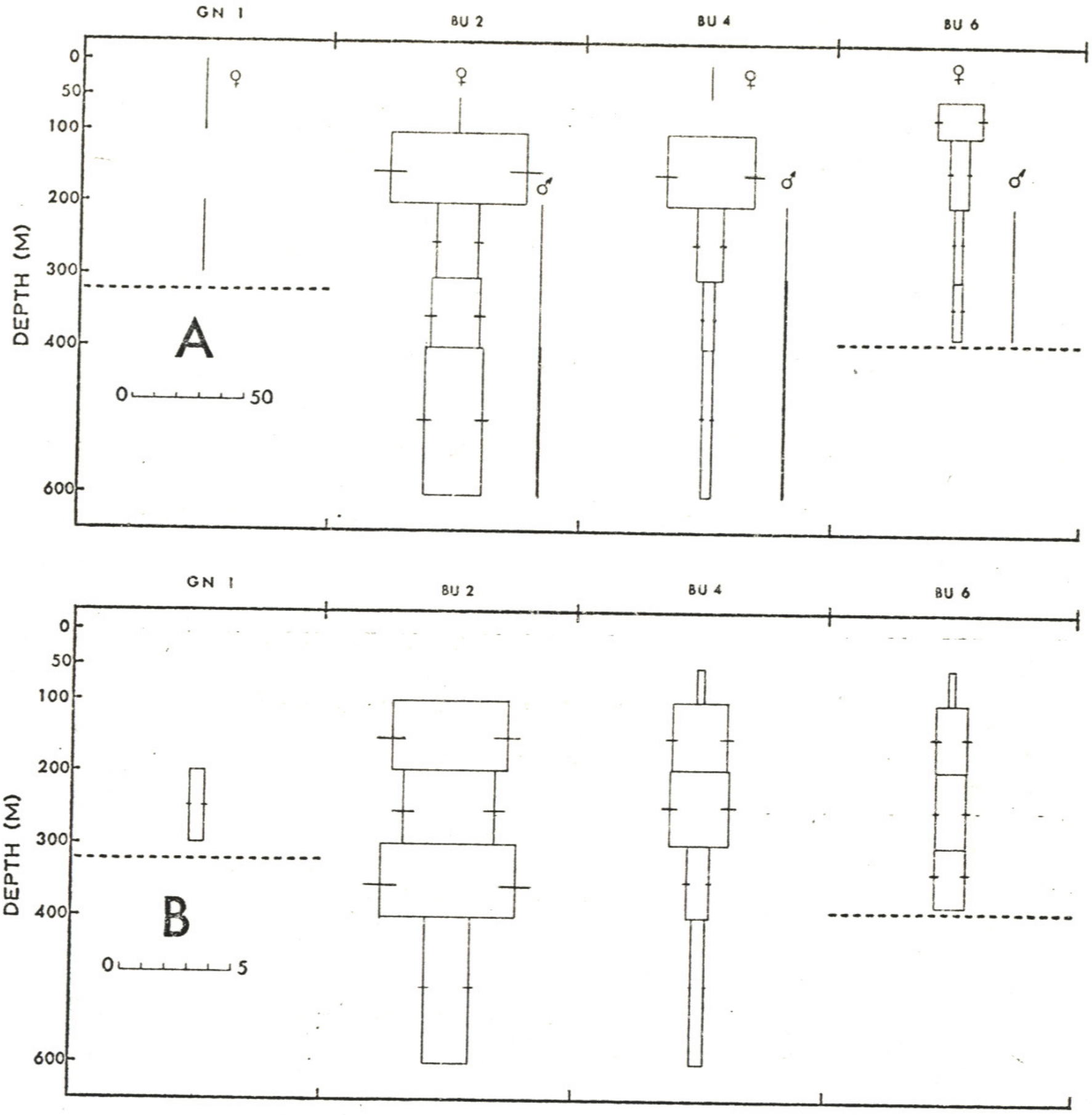
A. *Spinocalanus brevicaudatus*

B. *Scaphocalanus brevicornis*

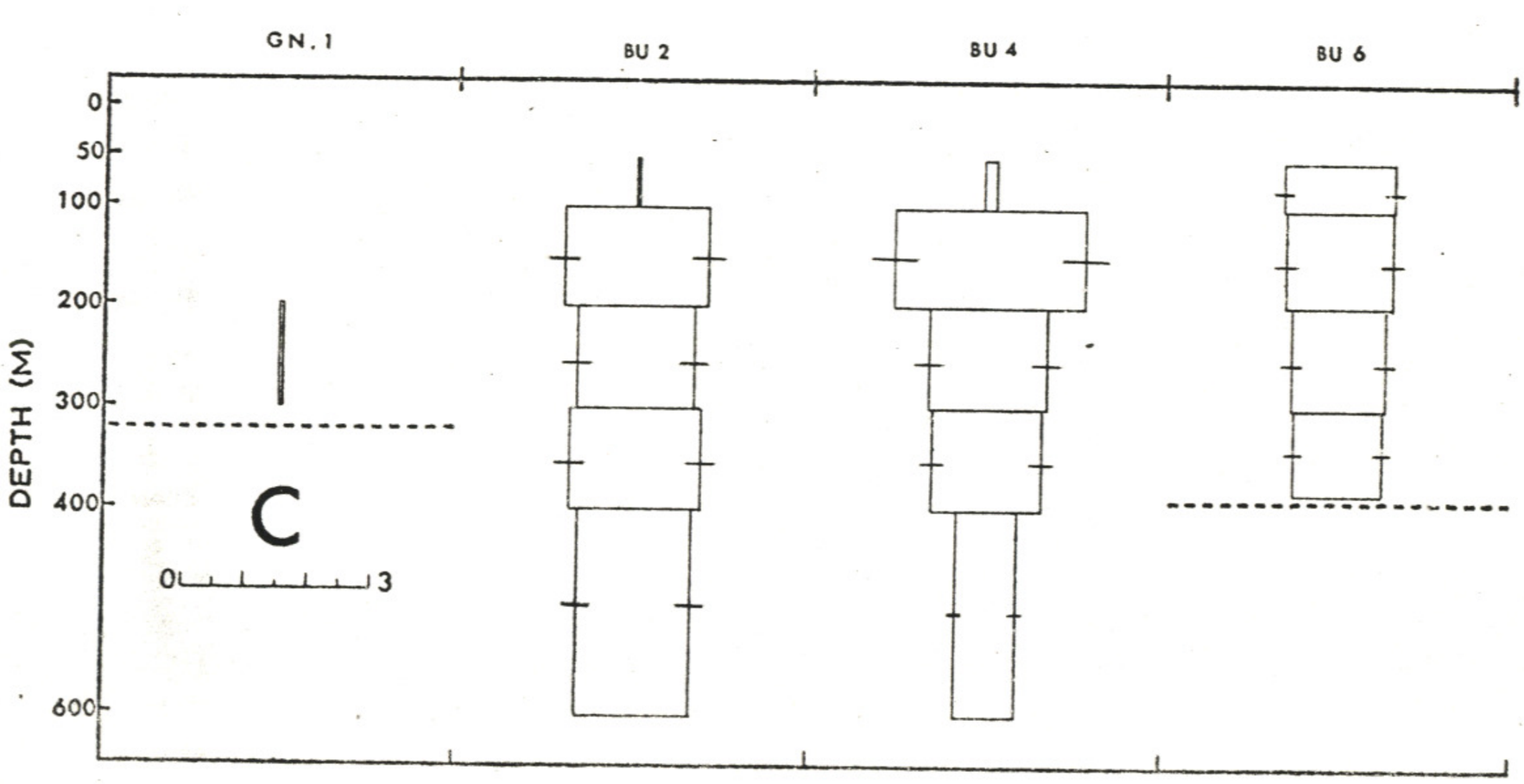
C. *Heterorhabdus tanneri*

----- Bottom

Scales in numbers/cubic meter


GN 1
BU 2
BU 4
BU 6
DEPTH (M)
0
50
100
200
300
400
600
♀
♂
A
0
50

GN 1
BU 2
BU 4
BU 6
DEPTH (M)
0
50
100
200
300
400
600
B
0
5


GN. 1
BU 2
BU 4
BU 6
DEPTH (M)
0
50
100
200
300
400
600
C
0
3

animals were found above 100 meters, but they were found in relatively large numbers at all depths below this. At Bute 6 the upper limit of distribution for *Scaphocalanus brevicornis* and *H. tanneri* is extended to 50 meters. The peak concentration within the inlet was usually just below the upper limit of distribution. As on previous sampling dates, males of *Spinocalanus brevicaudatus* were found only at the lower end of the species' vertical range.

Tharybis fultoni and *Comantenna columbiae* were found only within Bute Inlet. Highest concentrations of both species were always in the lowest depth interval sampled.

5. Ontogenetic migrations

Metridia pacifica was the only common species that was represented by all six copepodite stages in July. The vertical distribution of adult and copepodite stages at Bute 2 and 4 is shown for this species in Figure 23. Males were concentrated below the peak of females at both stations. Females were most common between 100 and 200 meters but were present at all levels down to 600 meters. The earliest copepodite stages were not found in the deeper layers. Stages C-I to C-III occupied the highest position in the water column (0-50 meters). Older stages occupied progressively deeper depth intervals.

A similar, although less pronounced pattern was seen in *Scapho-calanus brevicornis* (Fig. 23). Adults were dominant below 300 meters. The maximum concentration of males coincided with that of the females. Stage V was dominant between 200 and 300 meters and Stage IV between 100 and 200 meters. All stages except Stages C-I to C-III however were present throughout the water column. The youngest stages were found only above 300 meters. The percentage of each stage at all depth intervals at Bute 4 is shown in Table IX. No such pattern could be distinguished for *Spinocalanus brevicaudatus*, whose adults dominated all depth intervals (Table X).

The younger stages of *Heterorhabdus tanneri* were found slightly higher than the adults. Stage IV of this species was found only at Bute 2, where it occurred between 50 and 100 meters. Adults were found only below 100 meters (noon samples). Similarily, Stage V comprised 80% of

FIGURE 23.

Vertical distribution of adult and juvenile copepodites at noon in July, 1973.

A. *Metridia pacifica*, Bute 2

B. *Metridia pacifica*, Bute 4

C. *Scaphocalanus brevicornis*, Bute 4

Scales in numbers/cubic meter

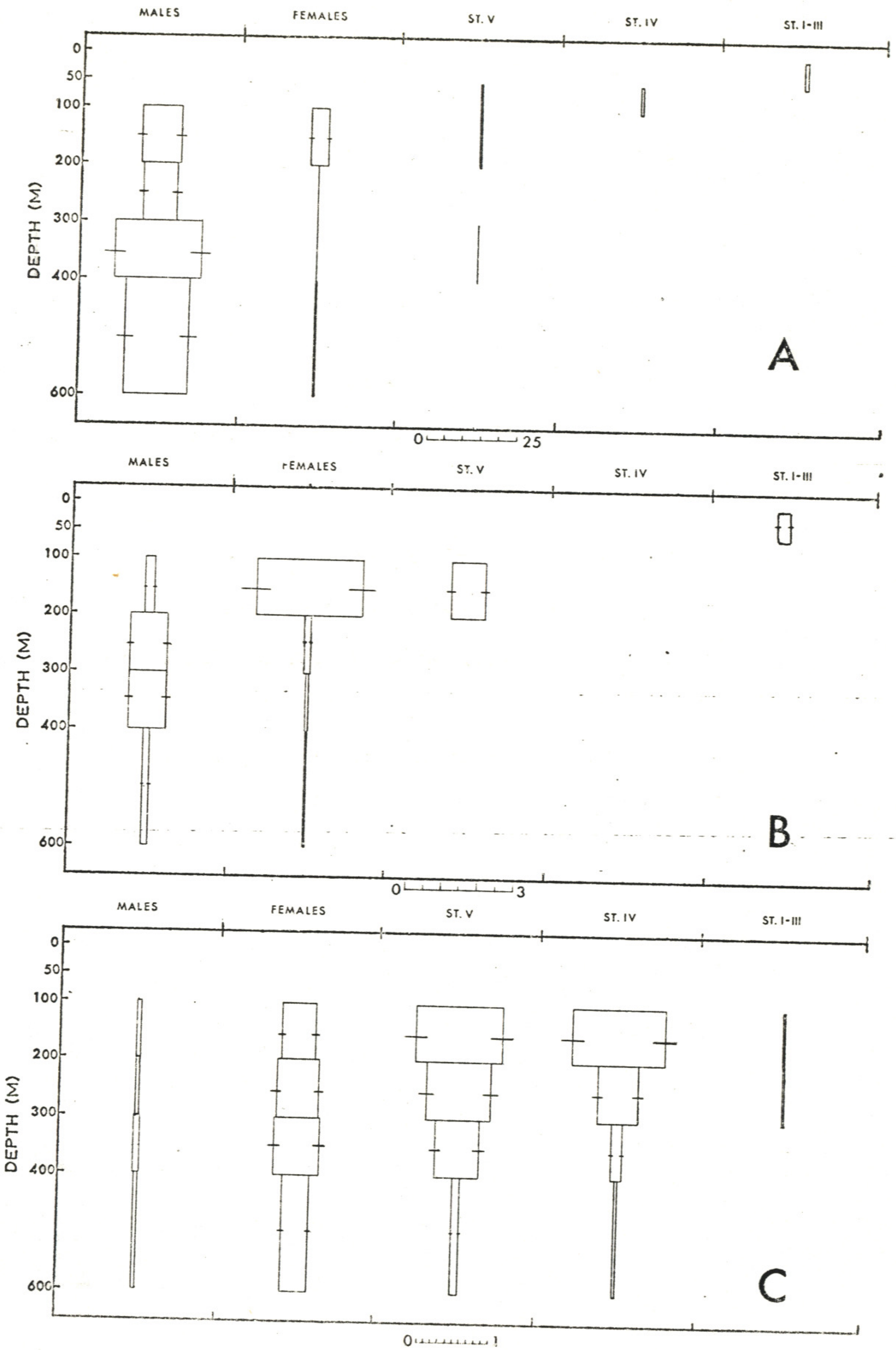

MALES
FEMALES
ST. V
ST. IV
ST. I-III
DEPTH (M)
0
50
100
200
300
400
600
0
25
A
MALES
FEMALES
ST. V
ST. IV
ST. I-III
DEPTH (M)
0
50
100
200
300
400
600
0
3
B
MALES
FEMALES
ST. V
ST. IV
ST. I-III
DEPTH (M)
0
50
100
200
300
400
600
0
1
C

TABLE IX. Percentage of each life history stage of *Scaphocalanus brevicornis* at Bute 4. July, 1973 (Noon).

Depth (m)	Adults	C-V	C-IV	C-I to C-III
100-200	17.8	39.3	42.2	-
200-300	29.8	42.6	26.6	0.75
300-400	48.5	40.9	10.6	-
400-600	73.1	19.3	7.6	-

TABLE X. Percentage of each life history stage of *Spinocalanus brevicaudatus* at Bute 4. July, 1973 (Noon).

Depth (m)	Adults	C-V	C-IV
100-200	69.9	29.4	0.7
200-300	50.3	36.6	13.1
300-400	59.2	35.4	5.4
400-600	55.4	38.1	6.5

the individuals between 50 and 100 meters at Bute 4. Adults dominated all depth intervals below this.

The vertical distribution of *Gadius columbiae* illustrates how ontogenetic migrations may coincide with seasonal ones. In February the population at Bute 2 consisted entirely of adults and Stage V and was concentrated below 300 meters (Fig. 16). In July the population at the same station consisted mainly of Stages C-I to C-III, and was concentrated in the 100-200 meter interval (Fig. 20).

6. Diurnal vertical migrations

Calanus glacialis and *C. plumchrus* did not appear to migrate diurnally. *Pseudocalanus minutus* migrated only slightly (Fig. 24). The peak in concentration of *P. minutus* shifted from the 200-300 meter interval at dusk (Bute 4) to the 300-400 meter interval at dawn. Concentrations at midnight and noon were about equal between 200 and 400 meters.

Diurnal vertical migration in *Metridia pacifica* females was much more striking at all Bute Inlet stations (Fig. 25). At Bute 2, the peak concentrations shifted from 0-50 meters at midnight and dawn to 100-200 meters at noon. The migration was less pronounced at Bute 4 where the main population of *Metridia* females moved only between the 50-100 and 100-200 meter intervals. The 0-50 meter interval was visited by a relatively small percentage of the population only at dawn. At Bute 6 migration was even less pronounced, and closer to the surface. Movement here appeared to occur mainly between the 0-50 and 50-100 meter depth intervals.

In the daytime, males of *M. pacifica* and *Spinocalanus brevicaudatus* lived below the females, and peaks of concentration for both sexes did not coincide. In *Spinocalanus brevicaudatus* these peaks were separated by 200 meters of water. Comparison of the vertical migration of both sexes in these species (Figs. 25 and 26) shows that the peaks of males and females did not coincide at any time during the diurnal migration. Although both males and females of *M. pacifica* migrated diurnally, the main population of both sexes was never found at the same depth. The males of *Spinocalanus brevicaudatus* were always most abundant where the

FIGURE 24.

Distribution of copepods at dusk, midnight, dawn and noon at Bute 4 in July, 1973.

A. *Calanus glacialis*

B. *Calanus plumchrus*

C. *Pseudocalanus minutus*

Scales in percent animals/cubic meter

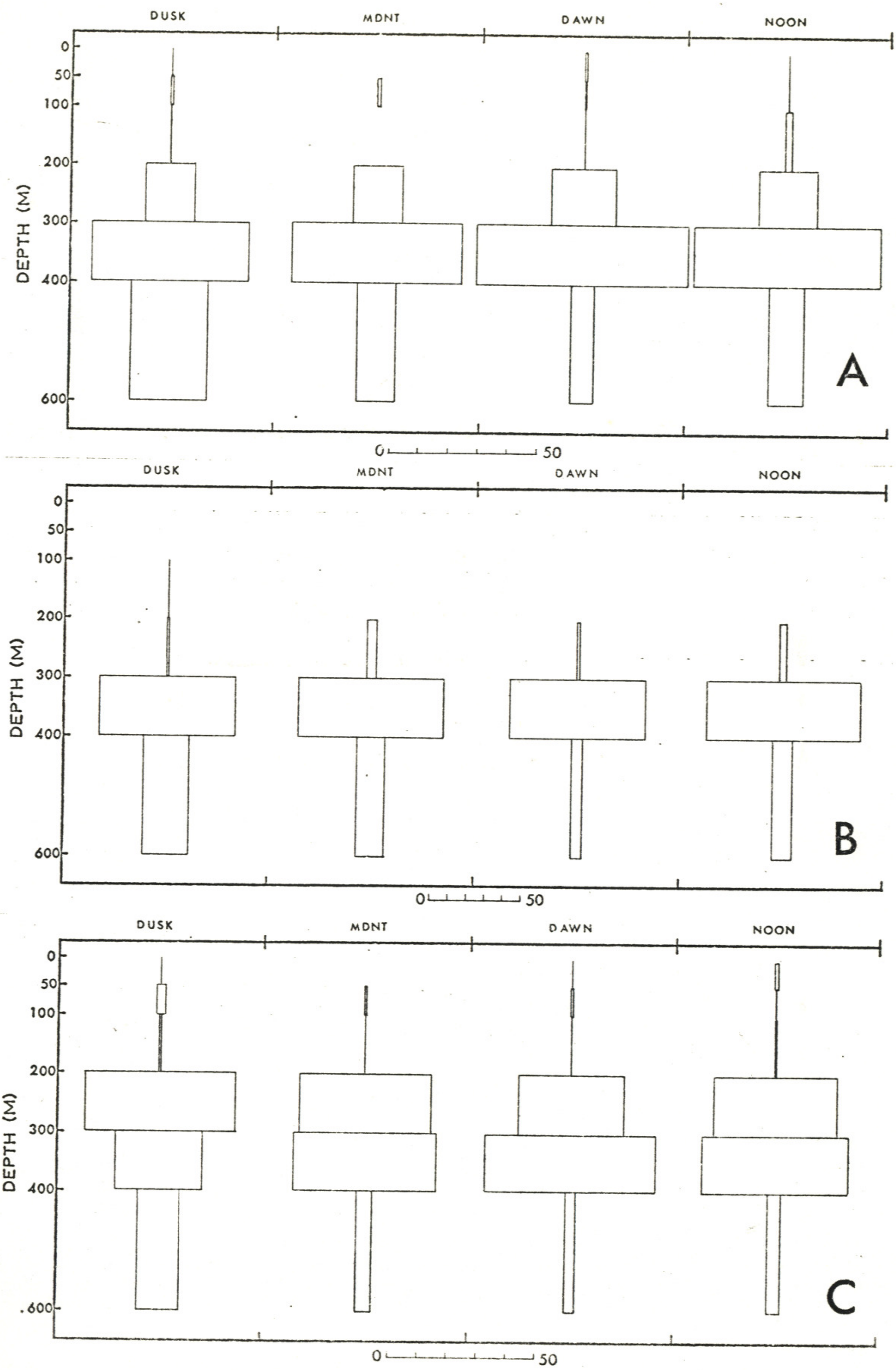

DUSK
MDNT
DAWN
NOON
DEPTH (M)
0
50
100
200
300
400
600
0
50
A
B
C

FIGURE 25.

Distribution of *Metridia pacifica* females at dusk, midnight, dawn and noon, July, 1973.

A. Bute 2

B. Bute 4

C. Bute 6

Scales in percent animals/cubic meter

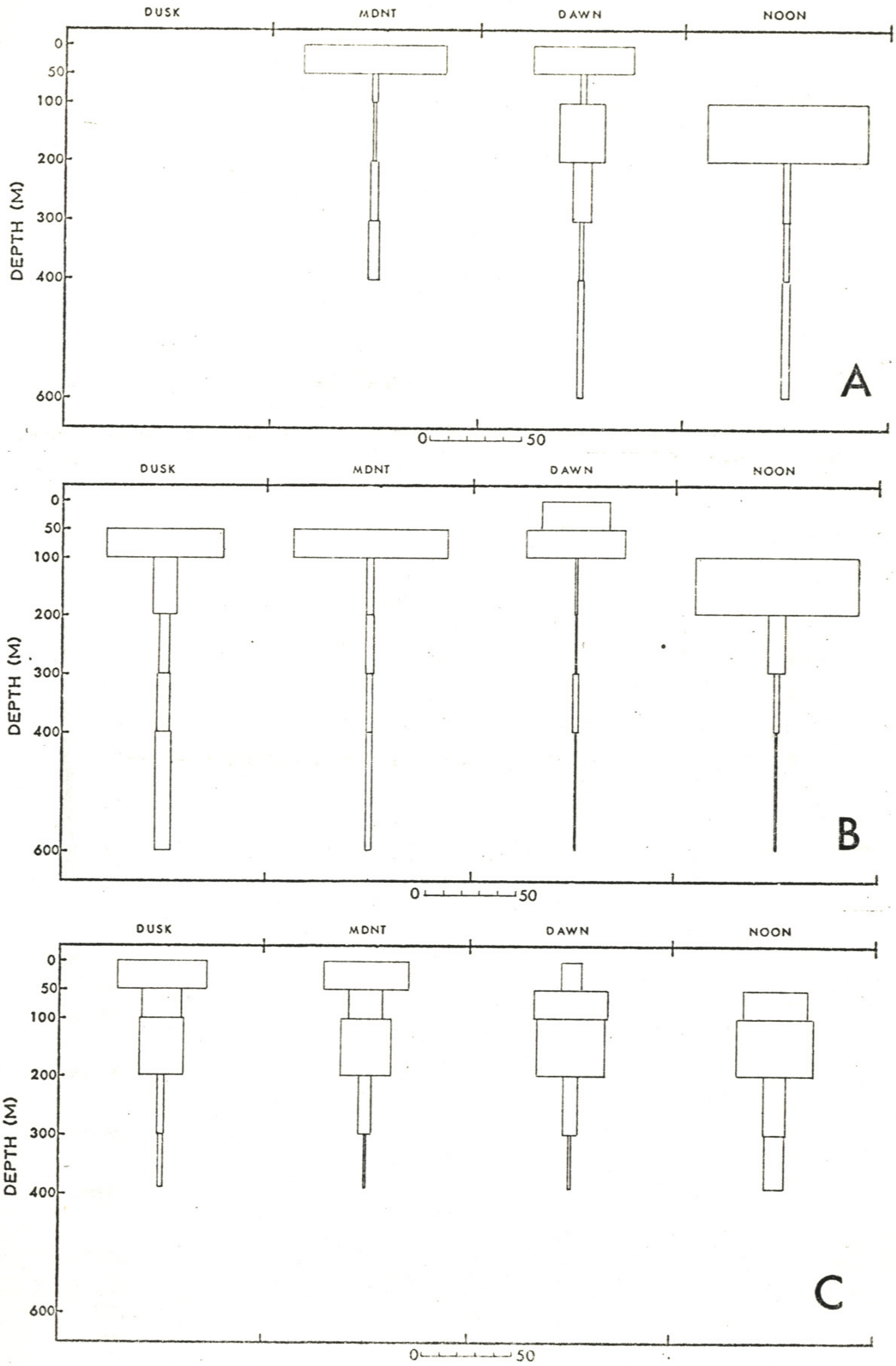

DUSK
MDNT
DAWN
NOON
DEPTH (M)
0
50
100
200
300
400
600
0
50
A
DUSK
MDNT
DAWN
NOON
DEPTH (M)
0
50
100
200
300
400
600
0
50
B
DUSK
MDNT
DAWN
NOON
DEPTH (M)
0
50
100
200
300
400
600
0
50
C

FIGURE 26.

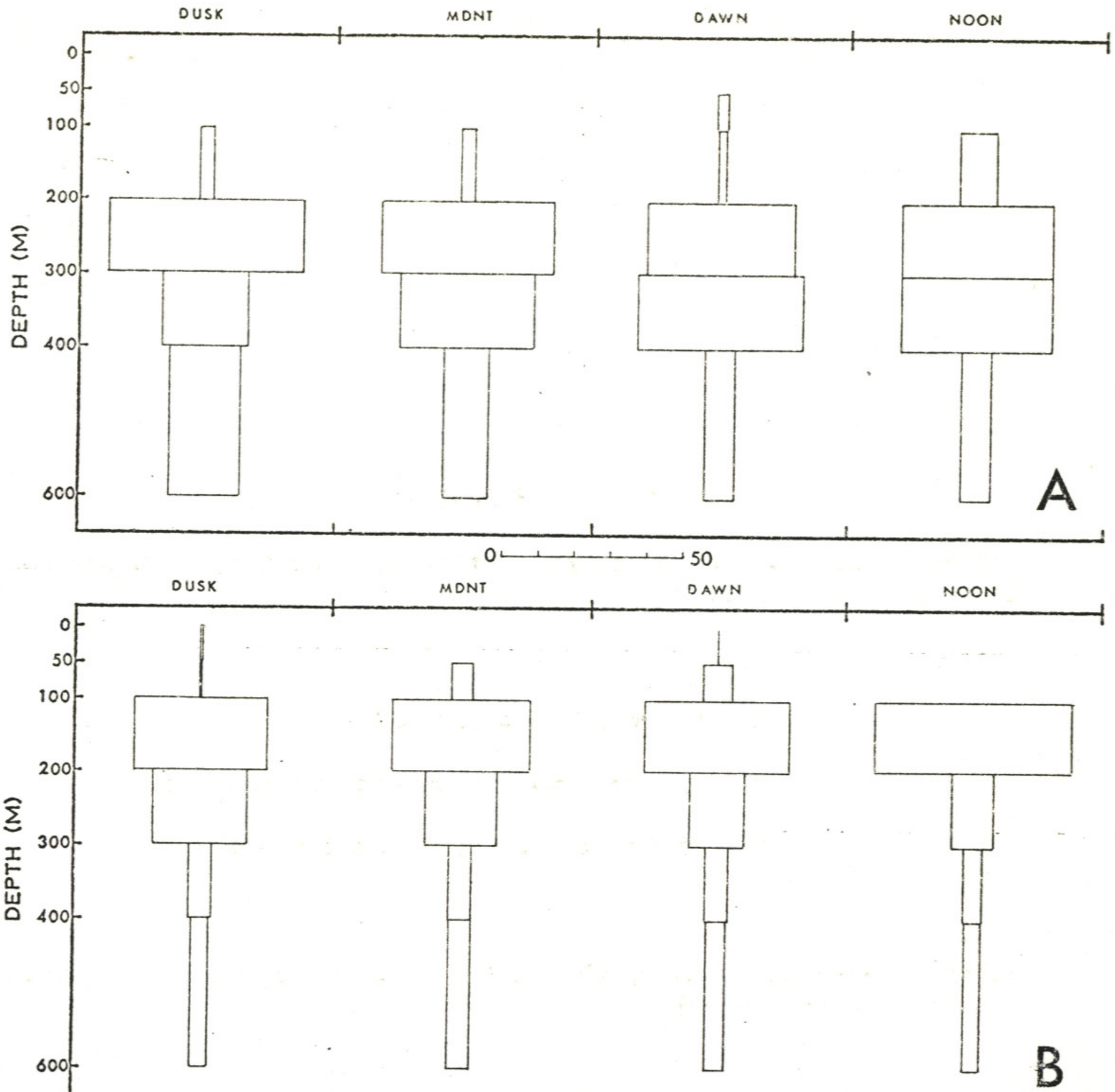
Vertical distribution of copepods at dusk, midnight, dawn and noon at Bute 4 in July, 1973.

A. *Metridia pacifica* males

B. *Spinocalanus brevicaudatus* females

C. *Spinocalanus brevicaudatus* males

Scales in percent animals/cubic meter. Scale for *S. brevicaudatus* males in percent total animals.


DUSK
MDNT
DAWN
NOON
DEPTH (M)
0
50
100
200
300
400
600
A
0
50
B
C

females were rarest.

For *Scaphocalanus brevicornis* the peaks of concentration for males and females were never so obviously separated. The peaks coincide at midnight (100-200 meters) and at noon (300-400 meters) (Fig. 27). *Heterorhabdus tanneri* males and females showed perfect compatibility. The peaks of abundance of both sexes coincide at all four times (Fig. 28).

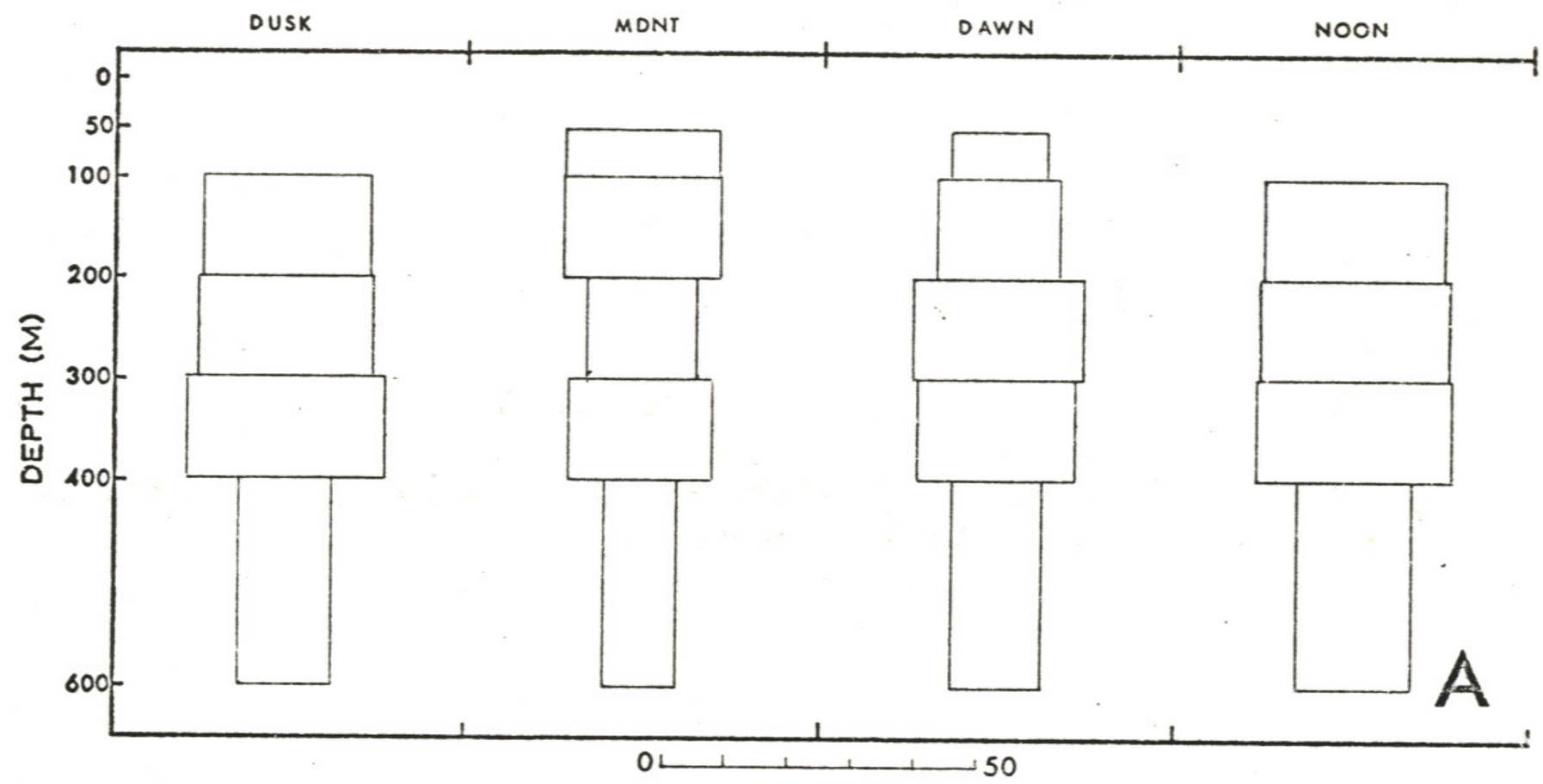
FIGURE 27.

Vertical distribution of *Scaphocalanus brevicornis* at dusk, midnight, dawn and noon at Bute 4 in July, 1973.

A. Females

B. Males

Scales in percent animals/cubic meter


DUSK
MDNT
DAWN
NOON
0
50
100
200
300
400
600
DEPTH (M)
A
0
50

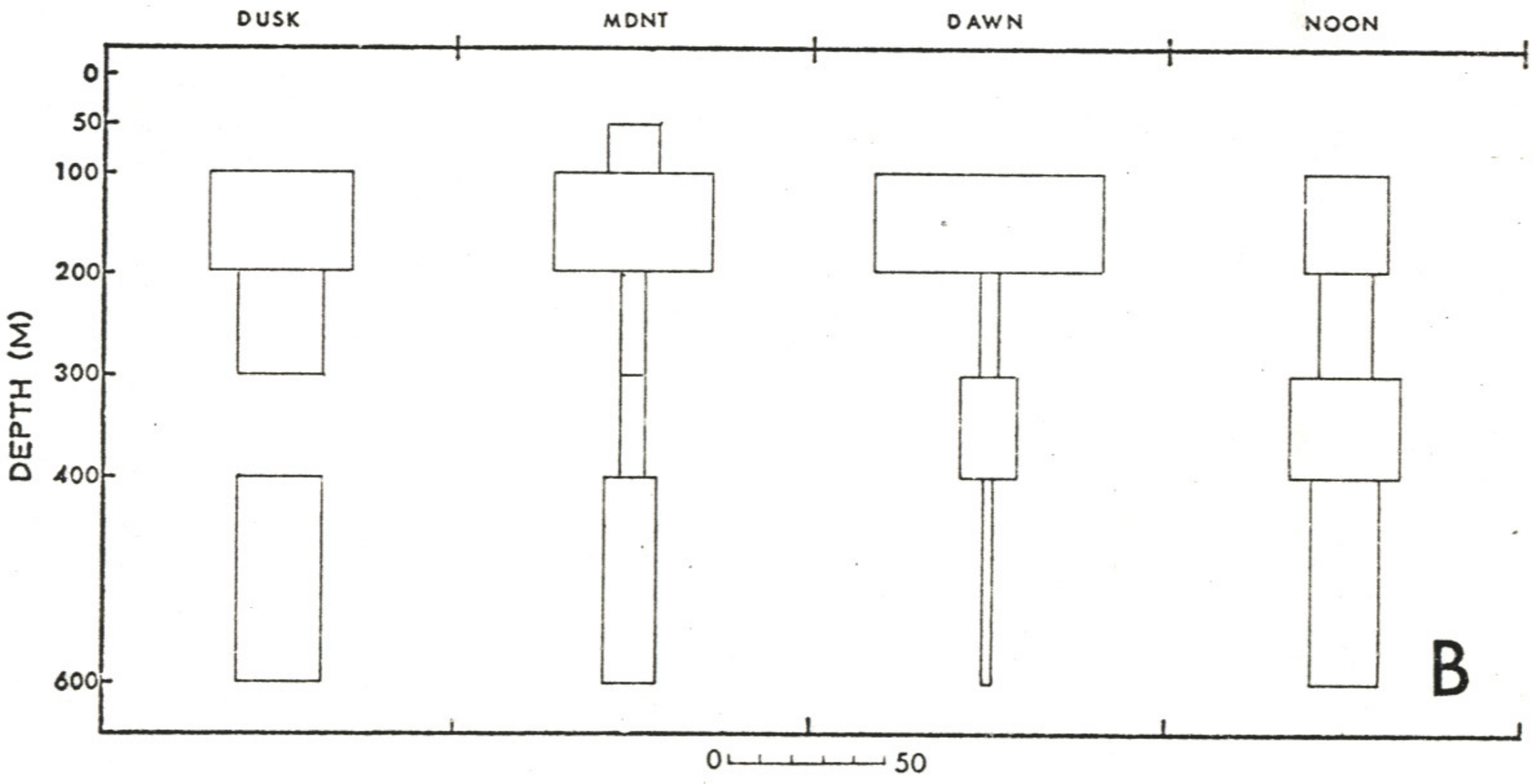

DUSK
MDNT
DAWN
NOON
0
50
100
200
300
400
600
DEPTH (M)
B
0
50

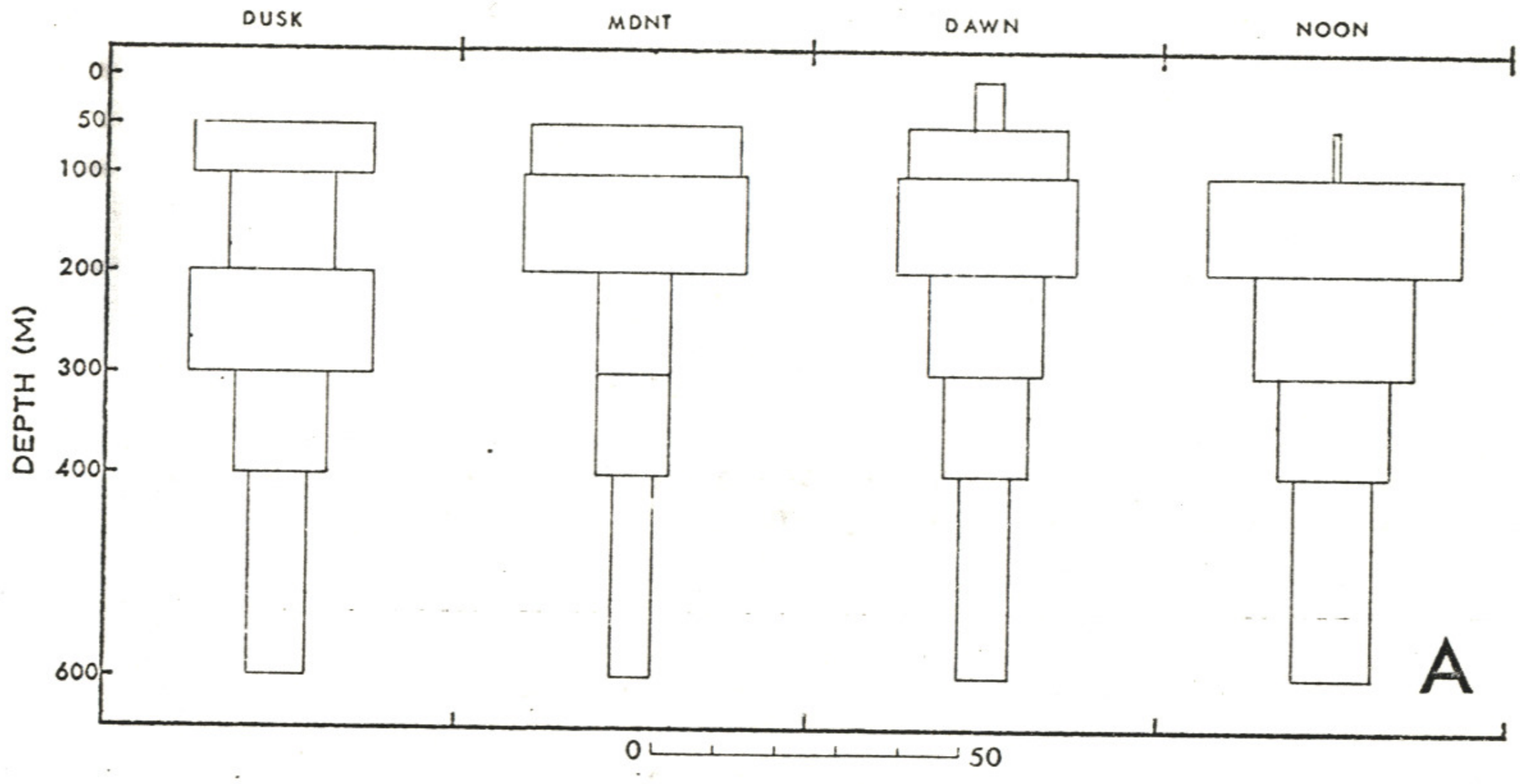
FIGURE 28.

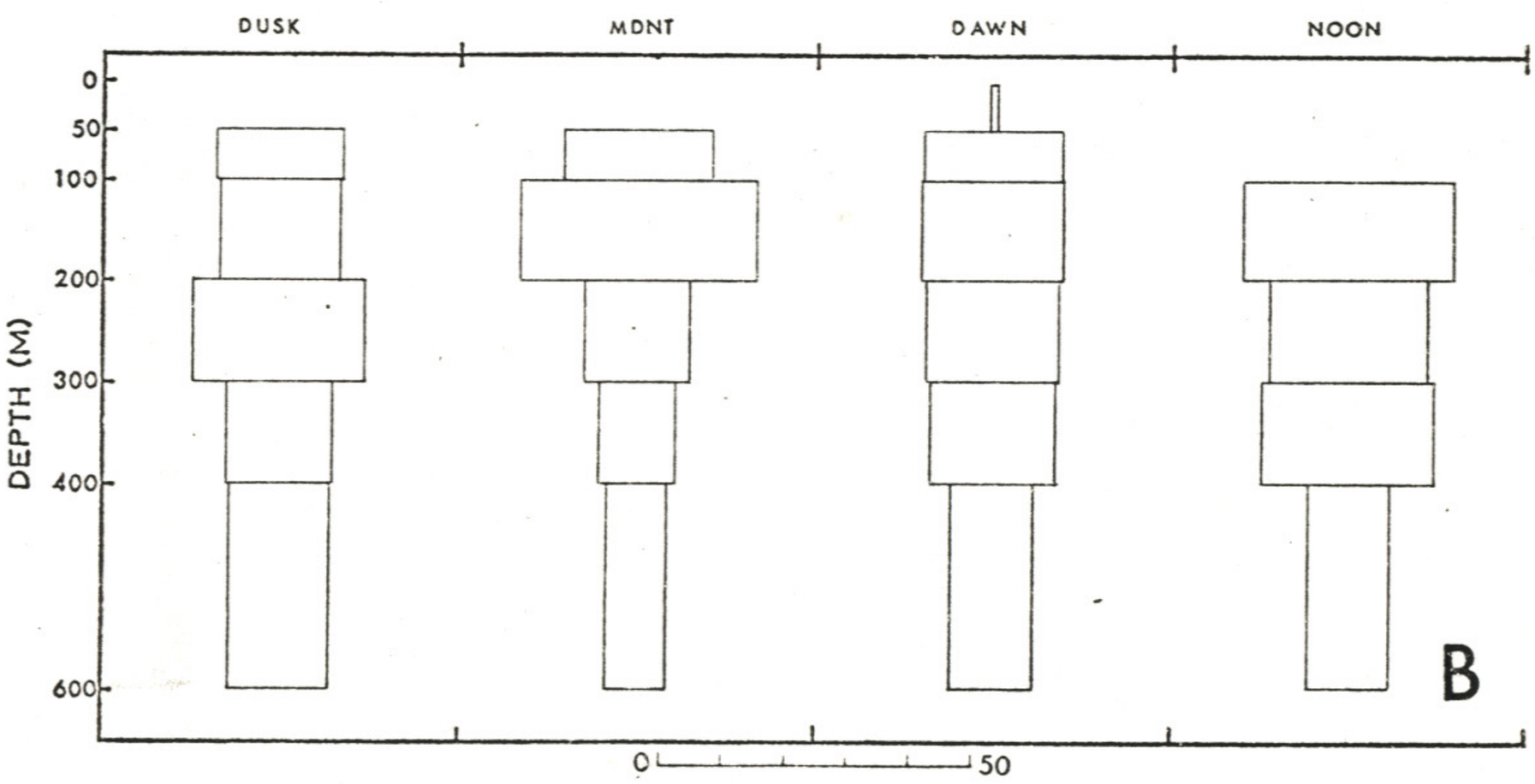
Vertical distribution of *Heterorhabdus tanneri* at dusk, midnight, dawn and noon at Bute 4 in July, 1973.

A. Females

B. Males

Scales in percent animals/cubic meter


DUSK
MDNT
DAWN
NOON
0
50
100
200
300
400
600
DEPTH (M)
A
0
50


DUSK
MDNT
DAWN
NOON
0
50
100
200
300
400
600
DEPTH (M)
B
0
50

7. Life histories

The percentage of each copepodite stage present at every sampling time in Bute Inlet is shown for eight species in Table XI. *Calanus glacialis*, *C. plumchrus* and *Pseudocalanus minutus* showed sharp fluctuations from one sampling time to another in the proportion of each stage present in the population. *Calanus plumchrus* juveniles younger than Stage V were found only in the spring (May, 1972). Adults were present in January, the males outnumbering the females, but the bulk of the population was still in Stage V. In February all of these Stage V copepodites had moulted into adults, and no juveniles were found. The females outnumbered the males at this time. In June and July only Stage V was found. These animals probably constituted the overwintering population.

C. glacialis and *P. minutus* appeared to have a yearly cycle very similar to *C. plumchrus*. Young stages of *C. glacialis* were found only in May. In January a small number of males appeared, but the great majority of the population was present as Stage V. Adults appeared in large numbers only in February, but half of the population was still in the fifth copepodite stage. In June and July only Stage V was present. *P. minutus* adults were only found in January. This copepod was present as Stage V at all other sampling times. *P. minutus* juveniles younger than Stage V were probably not retained by the mesh size used (351 microns).

Such large fluctuations in the composition of the population were less evident and somewhat different in *Metridia pacifica*. Although large

TABLE XI. Percent of each life history stage present at different sampling times. Bute 2, 0-600 meters.

Species name	Time	Males	Females	C-V	C-IV	C-I to III
	May	-	-	43	26	31
	Jan.	1	-	99	-	-
Calanus glacialis	Feb.	23	31	46	-	-
	June	-	-	100	-	-
	July	-	-	100	-	-
	May	-	-	13	-	87
	Jan.	20	6	74	-	-
Calanus plumchrus	Feb.	24	76	-	-	-
	June	-	-	100	-	-
	July	-	-	100	-	-

TABLE XI (cont'd.). Percent of each life history stage present at different sampling times. Bute 2, 0-600 meters .

Species name	Time	Males	Females	C-V	C-IV	C-I to III
	May	-	-	100	-	-
	Jan.	-	-	100	-	-
Pseudocalanus minutus	Feb.	14	65	21	-	-
	June	-	-	100	-	-
	July	-	-	100	-	-
	May	16	13	8	13	50
	Jan.	2	95	3	-	-
Metridia pacifica	Feb.	4	93	2	1	-
	June	47	51	2	-	-
	July	89	8	1	1	1

TABLE XI (cont'd.). Percent of each life history stage present at different sampling times. Bute 2, 0-600 meters .

Species name	Time	Males	Females	C-V	C-IV	C-I to III
	May	-	100	-	-	-
	Jan.	21	12	65	1	1
Gadius columbiae	Feb.	11	38	51	-	-
	June	-	1	-	13	86
	July	-	1	3	24	72
	May	4.5	59.9	34.7	1.0	-
	Jan.	2.2	59.7	35.4	2.8	-
Spinocalanus brevicaudatus	Feb.	3.7	65.5	30.8	-	-
	June	2.5	31.4	50.7	15.4	-
	July	0.6	50.8	44.5	4.1	1

TABLE XI (cont'd.). Percent of each life history stage present at different sampling times. Bute 2, 0-600 meters.

Species name	Time	Males	Females	C-V	C-IV	C-I to III
Scaphocalanus brevicornis	May	1.4	9.3	45.3	42.7	1.3
	Jan.	7.3	52.3	33.0	7.4	-
	Feb.	2.6	42.8	36.0	17.5	1.1
	June	7.0	20.9	41.9	27.9	2.4
	July	1.5	10.3	51.7	35.0	1.3
Heterorhabdus tanneri	May	16.7	15.5	62.8	5.0	-
	Jan.	58.7	41.3	-	-	-
	Feb.	41.8	54.1	2.7	1.4	-
	June	17.2	20.7	48.3	13.8	-
	July	39.7	41.7	17.3	1.3	-

numbers of juveniles were found only in the spring, males and females were present at all sampling times. The times when males were most abundant in other interzonal species (January and February) were times of least abundance for *M. pacifica* males. Stage V copepodites of *M. pacifica* never dominated the population as in other species.

Of the above four species spermatophores were seen only in February on females of *C. glacialis*.

Gadius columbiae, although belonging to a genus whose members are mostly abyssal types (Brodskii, 1950), exhibited the characteristics of the interzonal species in its life cycle. In May only females were found. In January males outnumbered females and Stage V dominated, as with *C. plumchrus* and *C. glacialis* at the same time. In February females outnumbered males, and half the population was still present as Stage V. In June and July most of the population consisted of younger stages (C-I to C-III).

The percent makeup of the various stages at the five sampling times for *Spinoocalanus brevicaudatus*, *Scaphocalanus brevicornis* and *Heterorhabdus tanneri* is in sharp contrast to that of the interzonal species. Males and females were always present. *Spinocalanus brevicaudatus* and *Scaphocalanus brevicornis* females always outnumbered the males. In *H. tanneri* the sexes were present in approximately equal numbers at all times. Juveniles of these species were present at all times in relatively small numbers. Stages C-I to C-III of *Spinocalanus brevicaudatus* were never caught, possibly due to their rarity and small size. In May and June a relatively large proportion of the population of *H. tanneri* was present as Stage V. In *Spinocalanus brevicaudatus* and *Scaphocalanus*

brevicornis as well, the largest percentage of juveniles was present during the spring and summer months, but differences in the percentages of young stages present between sampling times were never great.

In these three species, spermatophores were found on a small percentage of females at all times of year.

Comantenna columbiae was found only in February and July in Bute Inlet. Juveniles and adults of both sexes were present at these times. *Candacia columbiae* and *Chiridius gracilis* were always rare, but adults and juveniles occurred at all sampling times.

8. Changes in total numbers and in percentage of juveniles along the length of Bute Inlet.

Numbers/cubic meter for most species of copepods decreased with increasing distance from the mouth of Bute Inlet (Figs. 18 to 22). Total numbers of all copepods per cubic meter at each station, depth and time are shown in Table XII. Two missing data entries (midnight, Bute 2, 400-600; and dawn, Bute 4, 0-50) were filled by averaging the other values from the same depth and station. It is apparent from this table that total numbers of all copepods decrease with increasing distance from the mouth of the inlet.

A decrease in the percentage of juveniles present at the stations closer to the head of Bute Inlet was evident in June and July for *Scapho-calanus brevicornis*, *Spinocalanus brevicaudatus*, *Heterorhabdus tanneri* and *Gadius columbiae*. *Metridia pacifica* showed the opposite trend on both dates. These trends were not apparent in February. An increase in the percentage of *H. tanneri* juveniles with distance from the mouth of the inlet was the only trend obvious at that time.

TABLE XII. Total numbers/cubic meter of all copepods at three stations in Bute Inlet. July, 1973.

Depth (m)	Bute 2			Bute 4				Bute 6			
	MDNT	DAWN	NOON	DUSK	MDNT	DAWN	NOON	DUSK	MDNT	DAWN	NOON
0-50	45	37	5	3	14	25	14	40	27	32	20
50-100	41	4	18	141	65	75	8	40	32	42	42
100-200	55	99	161	39	42	45	76	26	29	29	32
200-300	231	298	226	186	152	149	143	87	81	102	87
300-400	253	295	417	162	188	257	201	56	61	66	68
400-600	175	97	250	89	42	37	38	-	-	-	-
Total	799	830	1077	620	503	586	480	249	230	271	249
Mean		902			547				250		

TABLE XIII. Percentage of juveniles in the population of various species at three Bute Inlet stations. 0-600 meters.

Time	Species name	Bute 2	Bute 4	Bute 6
	Spinocalanus brevicaudatus	31	29	50
	Scaphocalanus brevicornis	55	68	46
Feb.	*Heterorhabdus tanneri*	4	35	86
	Gadius columbiae	51	13	36
	Metridia pacifica	3	2	2
	Spinocalanus brevicaudatus	66	43	34
	Scaphocalanus brevicornis	72	69	50
June	*Heterorhabdus tanneri*	62	27	4
	Gadius columbiae	99	93	84
	Metridia pacifica	2	3	28
	Spinocalanus brevicaudatus	49	36	14
	Scaphocalanus brevicornis	88	68	31
July	*Heterorhabdus tanneri*	19	8	0
	Gadius columbiae	100	98	96
	Metridia pacifica	4	45	67

9. Morphological variability.

Stage V copepodites of *Spinocalanus brevicaudatus* and *Scaphocalanus brevicornis* could be divided into two size groups (Figs. 29 and 30). The smaller size group of *Spinocalanus brevicaudatus* consisted of copepodites with a biramous rudimentary fifth leg but otherwise possessed the general body shape and proportions of the female. The larger size group was also of the female type but had no fifth leg. Stage V of *Scaphocalanus brevicornis* was similarily divisible into two size groups, both of which were distinctly of the female morphology. The smaller group consisted of animals with a partially developed female fifth leg. This leg differed from the adult fifth leg only in the length of the setae and in the number of denticles on the inner seta. The larger group also had a fifth leg, but it was rudimentary and biramous, and devoid of setae. The two groups of both species were present at all sampling times.

The female of *Spinocalanus brevicaudatus* lacks a fifth leg and the fifth leg of the female of *Scaphocalanus brevicornis* is uniramous. Since the males of both species possess biramous fifth legs it was assumed that the smaller size group of *Spinocalanus* copepodites and the larger size group of *Scaphocalanus* copepodites will develope into males. The sex ratios of Stage V copepodites (as determined by the presence or absence of rudimentary biramous fifth legs) and adults are remarkably different in both species (Table XIV).

In May, 1972, a number of specimens of *Scaphocalanus brevicornis*, *Heterorhabdus tanneri* and *Chiridius gracilis* Stage V copepodites were

FIGURE 29.

Prosome measurements of *Spinocalanus brevicaudatus*. Frequency distribution of randomly selected individuals.

A. Stage V, rudimentary fifth leg

B. Stage V, no fifth leg

C. Adult female

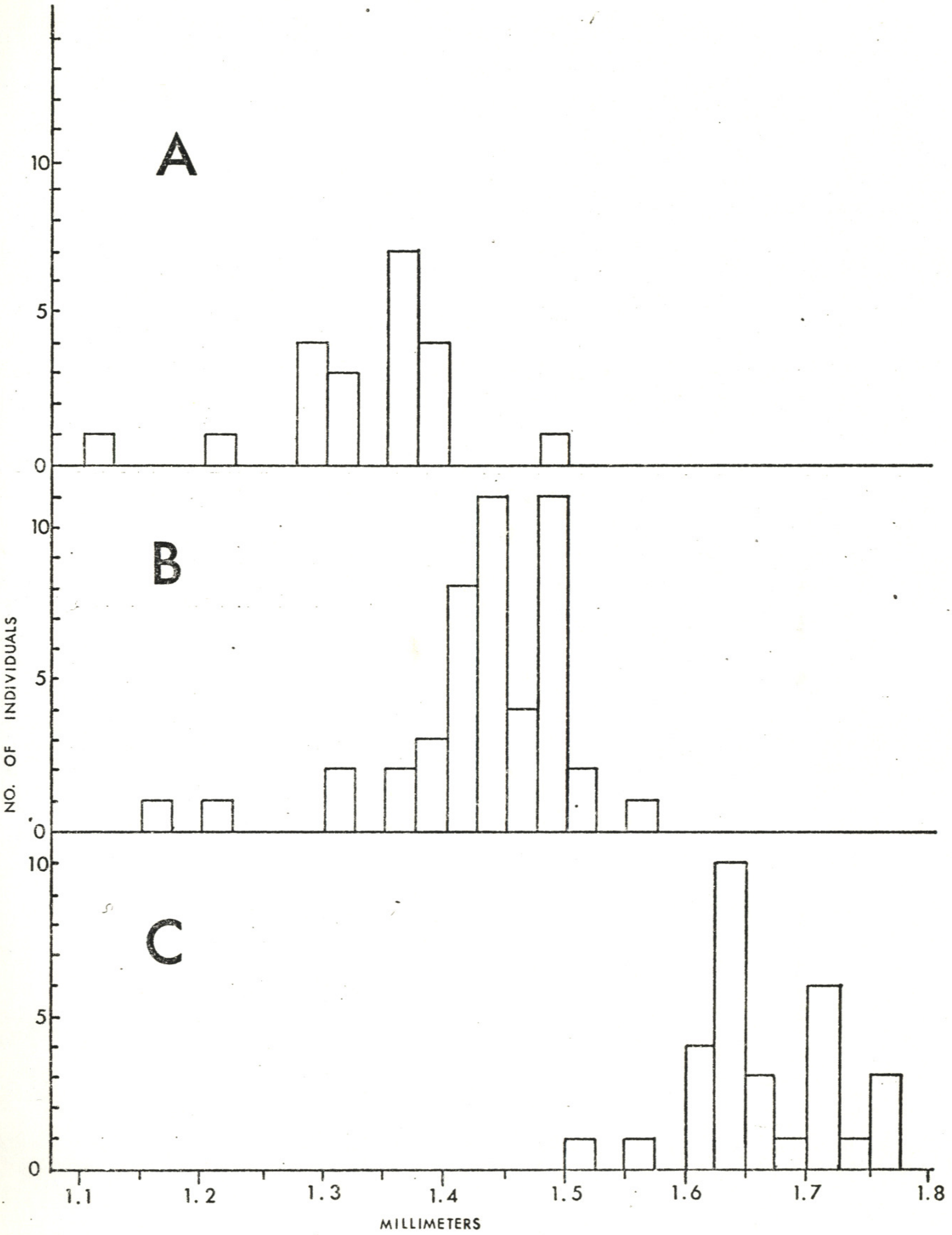

A
B
C
10
5
0
NO. OF INDIVIDUALS
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
MILLIMETERS

FIGURE 30.

Prosome measurements of *Scaphocalanus brevicornis*. Frequency distribution of randomly selected individuals.

A. Stage V, undeveloped female fifth leg

B. Stage V, rudimentary biramous fifth leg

C. Adult female

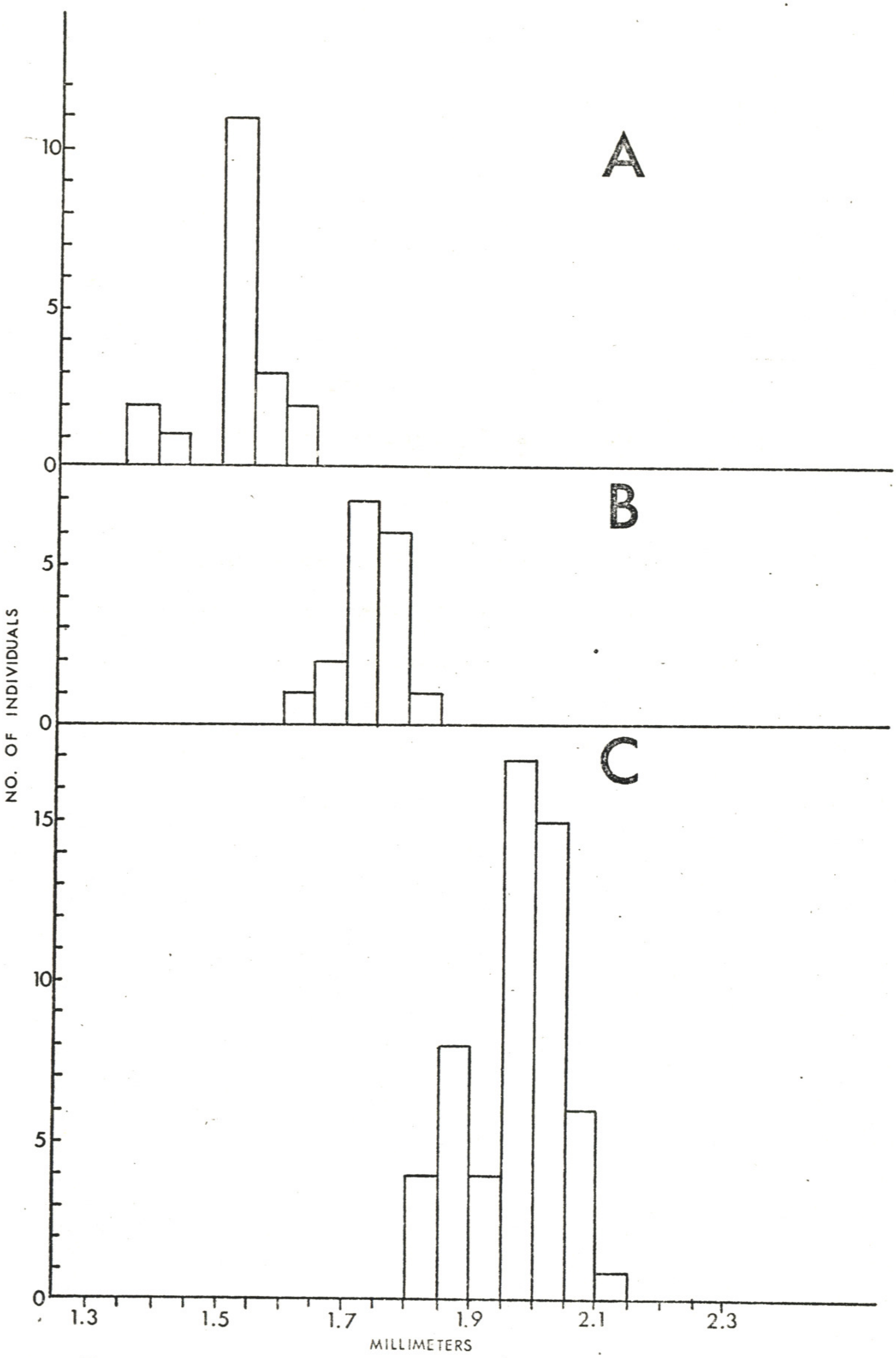

A
B
C
10
5
0
5
0
15
10
5
0
NO. OF INDIVIDUALS
1.3
1.5
1.7
1.9
2.1
2.3
MILLIMETERS

TABLE XIV. Male:female sex ratios of *Spinocalanus brevicaudatus* and *Scaphocalanus brevicornis* for adults and Stage V copepodites.

Species name	Place	Date	Depth (m)	C-V	Adult
	Bute 2	Feb.	0-600	1.7:1	1:20
Spinocalanus brevicaudatus	Bute 2	Feb.	0-600	3.6:1	1:13
	Bute 2	June	0-600	1.5:1	1:6
	Jervis 3	Jan.	0-600	1.1:1	1:5
	Jervis 3	Jan.	0-400	1.4:1	1:10
Scaphocalanus brevicornis	Bute 2	Feb.	0-600	1:1	1:16
	Bute 2	Feb.	0-600	1:1.2	1:8
	Bute 6	June	0-390	1.6:1	1:4

observed which were somewhat larger and "fatter" than most Stage V copepodites of these species. These "fat" specimens were not observed at other sampling times.

Another variation in morphology is worthy of mention. This concerns the presence or absence of spines on the last thoracic segment of *Gadius* spp. In the present collection the genus *Gadius* appears to be represented by two varieties both of which fall within the size range given for *G. columbiae* and *G. pungens* by Fulton (1972). One variety is identical with *G. columbiae* Park. It has the typical blunted protrusions on the last thoracic segment described by Park (1967) and was found in the Strait of Georgia and the inlets south of Burke Channel. The other variety, here called *G. pungens*, is identical with *G. columbiae* but possesses sharp spines on the last thoracic segment. It was found only in Burke and Dean Channels. The spines reach to the middle of the genital segment in the female as in *G. pungens*, but appear to be more delicate than pictured by Brodskii (1950). The geographical distribution of these two varieties is shown in Figure 31. The protrusions on the last thoracic segment of the various species of *Gadius* reported from the Vancouver Island region are pictured in Figure 32.

FIGURE 31.

Geographical distribution of *Gadius columbiae* and *G. pungens* in May, 1972.

● *Gadius columbiae*

⊙ *Gadius pungens*

○ both species absent

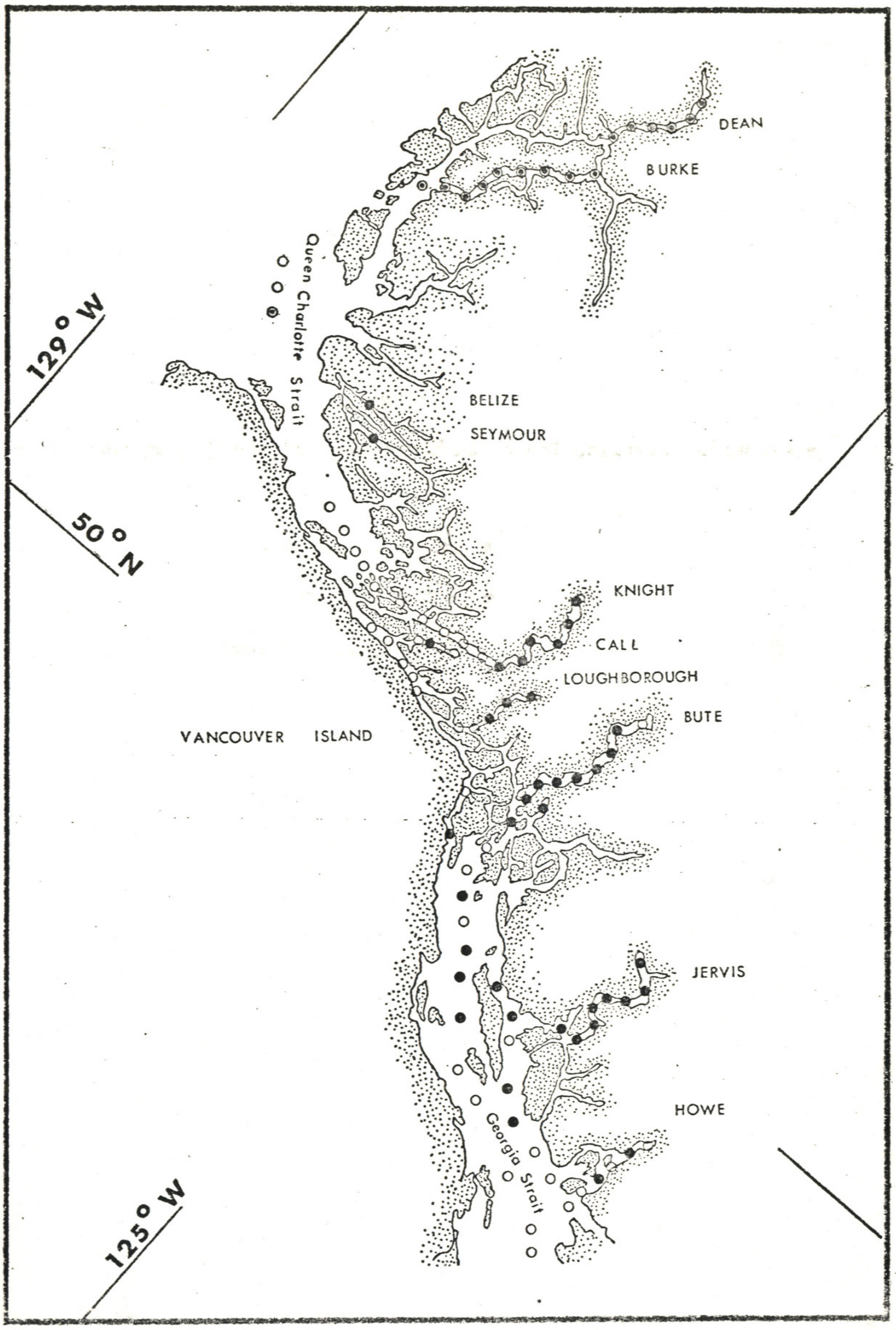

129° W
50° N
125° W
DEAN
BURKE
Queen Charlotte Strait
BELIZE
SEYMOUR
KNIGHT
CALL
LOUGHBOROUGH
BUTE
VANCOUVER ISLAND
JERVIS
HOWE
Georgia Strait

FIGURE 32.

Last thoracic segment and terminal spine of various species of *Gadius*.

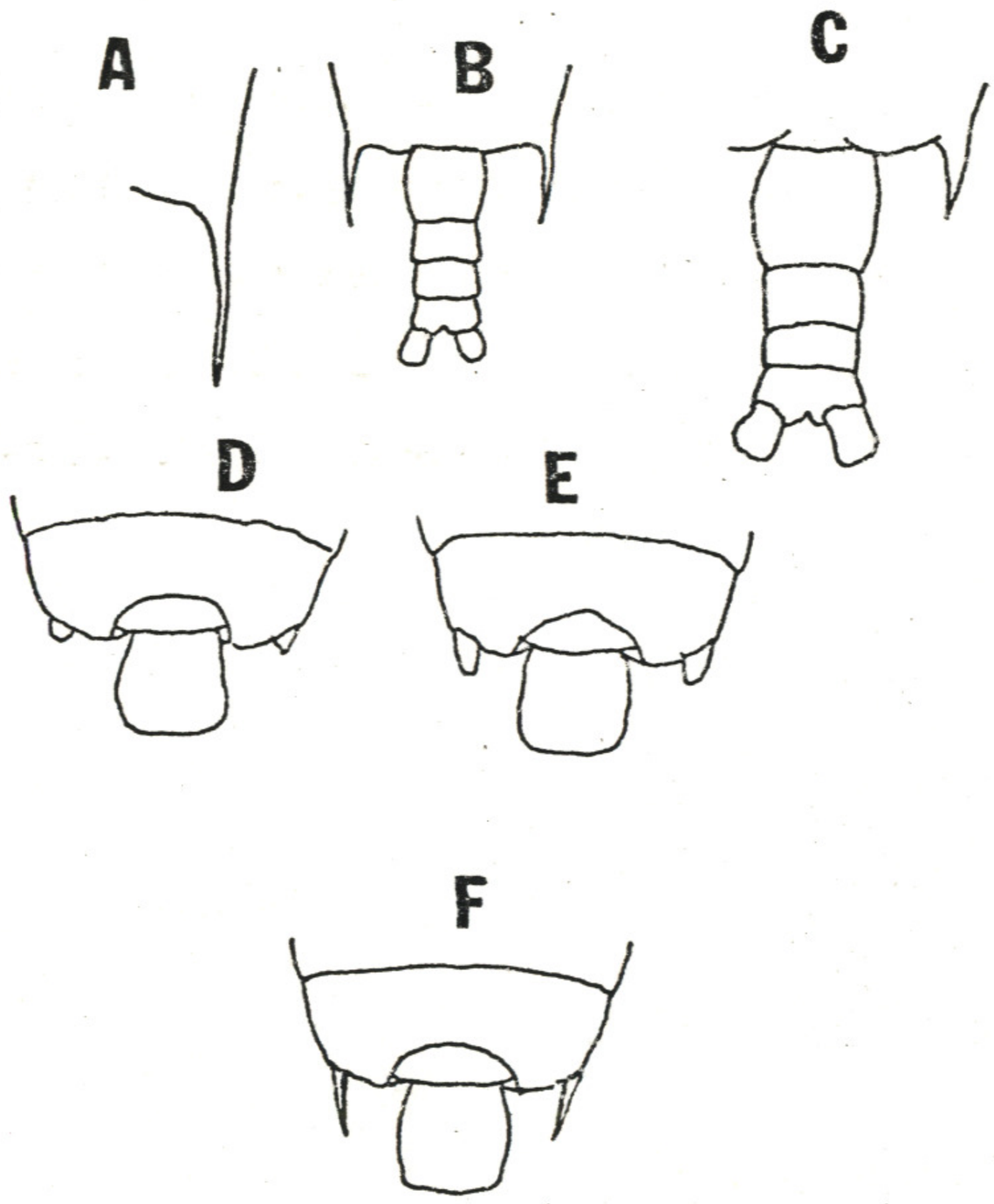
A. *Gadius tenuispinus* (after Sars, 1903)

B. *Gadius tenuispinus* (after Brodskii, 1950)

C. *Gadius pungens* (after Giesbrecht, from Brodskii, 1950)

D. and E. *Gadius columbiae* (after Park, 1967)

F. *Gadius pungens* from Burke Channel


A
B
C
D
E
F

DISCUSSION

1. Geographical distribution

The presence of adults and juveniles as well as spermatophores on females of *Spinocalanus brevicaudatus*, *Scaphocalanus brevicornis* and *Heterorhabdus tanneri* throughout the sampling period shows that these animals have established permanent breeding populations in the deeper mainland inlets. The greater concentration always found in the deeper inlets indicates their preference for these areas as opposed to the shallower Strait of Georgia.

These three species are identical with, or closely related to animals inhabiting the open ocean. In general, the copepod fauna in the North East Pacific Ocean closely resembles that of the Strait of Georgia, and it is reasonable to assume that the isolated inlet populations were seeded from the Pacific Ocean through Johnstone and Juan de Fuca Straits. The upper vertical range of their copepodites is about 100 meters. Since nauplii may occupy even shallower depths it would appear that these species have no trouble traversing the submarine barriers separating the B.C. inlets from the open sea. Without previous records from the inlets it is difficult to determine how long these populations have been present. Their absence from records prior to 1968 in the Strait of Georgia may be due to their scarcity in that body of water. Comparitively large populations may have already existed in the inlets before this date.

On a geological time scale it seems unlikely that these species have inhabited the inlets for long since submarine barriers such as inlet sills effectively isolate deep living species which may then evolve independantly from the outside population. To date, three benthic and two deep-living

calanoids have been described which appear to be endemic to the Strait of Georgia and its adjoining inlets (Campbell, 1930; Park, 1966, 1967). An inquiry into the distribution and taxonomy of epi-benthic copepods in this region and a consideration of their evolution with special regard to the events of the Pleistocene Epoch would provide valuable information on the origin of isolated species.

A parallel phenomenon may exist in the Norwegian fjords. The original description of *Spinocalanus brevicaudatus* (as *S. abyssalis* and *S. longicornis*) was made from specimens taken in the Osterfjord between 400 and 600 meters (Sars, 1903). Gundersen (1953) noted its presence in several Norwegian fjords, along with species from the genera *Heterorhabdus* and *Scaphocalanus*. Lie (1967) included the same species in his list from the Hardangerfjord. It is also noteworthy that *Comantenna brevicornis*, until now the only member of the genus, is commonly found in Norwegian fjords.

In the case of the three local benthic species and the deep-living *Gataenus intermedius* isolation has been long enough to complete the speciation process. *Gadius columbiae* differs from the species of *Gadius* found outside the Strait of Georgia only in the absence of sharp spines on the last thoracic segment. This may be an aberration of the type described by Brodskii (1950) which has appeared only recently. Brodskii pointed out that abnormalities among copepods are rare, but may affect large numbers of the population in protected bays and other isolated biotopes. Isolation over a period of several generations of zooplankton

is sufficient to cause genetic changes within the zooplankton stock (allopatric speciation) (McGowan, 1971). The blunt protrusions on the last thoracic segment of *G. columbiae* are probably of recent appearance since the species, although very common in the Strait of Georgia, was not described until 1967 (Park, 1967). Campbell (1930) included *G. pungens* in her list from the Strait of Georgia, but remarked that the specimens had shorter *spines* on the last thoracic segment than those described by Esterly (1905). It is likely that the specimens described by Campbell belong to the same species found in the inlets north of the Strait of Georgia during the present study. This species may have developed blunted protrusions on the last thoracic segment sometime after 1930 only in the Strait of Georgia and subsequently became known as *G. columbiae*.

The preference shown by *Spinocalanus brevicaudatus*, *Scaphocalanus brevicornis* and *H. tanneri* for the inlets does not appear to be related to differences in the water properties for which measurements were taken. This suggests that depth is an important factor influencing the geographical distribution of these species. Since all three species are found in considerable numbers above 400 meters it is likely that the greater depths found in the inlets are preferred, or are essential, for only part of their life cycle. In *Spinocalanus brevicaudatus* the bulk of the male population is always found below 400 meters at the deep stations in Bute and Jervis Inlets. Consequently the majority of male-female encounters must occur at these depths. The majority of males and females of *Scaphocalanus brevicornis* congregated between 300 and 400 meters by day. This somewhat higher distribution may account for its

relatively more frequent occurrence in the Strait of Georgia, which reaches a depth of 400 meters in the southern trough. Unfortunately the vertical distribution of *H. tanneri* did not reveal which life history stages prefer deep water.

2. Vertical distribution

Two general patterns of distribution were observed among calanoids at the deep stations. The first showed a maximum usually in the mid-water region. This distribution is characteristic of the later stages of the common interzonal species *Calanus glacialis, C. plumchrus, Eucalanus bungii bungii* and *Pseudocalanus minutus*. These species spend the winter in deep water and are found near the surface only in spring as young stages (Vinogradov, 1968). In the second pattern animals were distributed more or less evenly throughout the water column below the thermocline. This pattern was shown by the deep-living forms such as *Spinocalanus brevicaudatus, Scaphocalanus brevicornis, Heterorhabdus tanneri, Candacia columbiae, Aetideus armatus* and *Chiridius gracilis*.

Paradoxically, these deep forms were the most common calanoids in the upper 200 meters, particularily in July when they congregated just below the thermocline. *Spinocalanus brevicaudatus*, for example, was always the dominant calanoid in the 100-200 meter interval at the deep stations. At Bute 6 it dominated the 50-100 meter layer.

Oceanic deep-sea species often show remarkably wide vertical ranges. Grice and Hulseman (1965) found that the family *Spinocalanidae* contained the two species of copepods with the largest continuous vertical range

in their samples. They were present in all depth intervals between 200 and 5000 meters. *Scaphocalanus brevicornis* and *Heterorhabdus norvegicus* were found between 200 and 2000 meters. Similar wide ranges in these and other genera have been noted by many authors (reviewed by Roe, 1972).

The shift in the concentration maximum for some species (e.g. for *Spinocalanus brevicaudatus* and *H. tanneri* from 100-200 meters at Bute 2 and 4 to 50-100 meters at Bute 6) at the head of Bute Inlet may be attributed to the strong winter thermocline remnant present here. The cold water present at a depth of 50 meters at Bute 6 may allow these presumably cold-loving species to penetrate further into the surface zone. However, the cold water remnant is also present at Bute 4 at 50 meters. Here maximum concentrations were found just below 100 meters, as at Bute 2. The great reduction of submarine light at Bute 6 due to glacial silt from the Homathko River may therefor be the cause of this shift.

Ontogenetic and diurnal vertical migrations are well documented for the common calanoids (reviewed by Vinogradov, 1968). In general younger stages are found at progressively shallower depths, and individuals migrate toward the surface at night. Vertical migration for the three isolated species was slight at Bute Inlet in July. However, *Scaphocalanus brevicornis* and *H. tanneri* showed the typical ontogenetic separation of stages seen in *Metridia* and other common genera. The distinct separation of males and females in *Spinocalanus brevicaudatus* may also be classed as an ontogenetic migration. Roe (1972) found a marked difference in vertical distribution and behaviour between sexes in

Scaphocalanus brevicornis. Males were non-migratory and were found above the females by day. Some females migrated through the male population at night to form two separate populations of females, one above and one below the males. At Bute 4 in July males concentrated above females at dusk and dawn. Both sexes migrated somewhat higher at midnight and lower at noon and at these times maximum concentrations of both sexes corresponded in depth. Such diurnal migration patterns may enhance the chances of male-female encounters in deep-living species. Although the main male and female populations of *Spinocalanus brevicaudatus* never cross, their peculiar distribution also increases the chance of sexual encounters by restricting mating to the lower 200 meters of the water column. Of the many theories advanced to explain the adaptive advantages of vertical migrations the possibility that they increase sexual encounters in rare species has been largely ignored.

3. Abundance

It is difficult to compare abundance data from the present study with published data because of the great variety of methods and equipment used, and because of the lack of quantitative data. However, in oceanic studies *Spinocalanus brevicaudatus*, *Scaphocalanus brevicornis* and *H. tanneri* are relatively rare. Often only several specimens are found in hauls considerably longer than those taken in Bute Inlet. Males are often not found at all. Only *Spinocalanus brevicaudatus* has been taken in large numbers, but only in coastal areas (Gundersen (1953) captured up to 4000 individuals with a Nansen 8/72 net). The rarity

of these species in deep oceanic hauls reflects (1) the low productivity of oceanic compared to coastal water and (2) the animals' trophic and spatial distance from the relatively productive surface zone.

The deep sea community is indirectly dependant on surface primary productivity (Vinogradov, 1962, 1968). The decrease in numbers near the head of Bute Inlet of both deep and interzonal forms may be related to the decrease in primary production near the heads of large runoff inlets. Lebrasseur (1955) attributed the decrease in phytoplankton concentration near the heads of these inlets to the shallow compensation depths of silt laden water entering here. To some extent the decrease in zooplankton near the head of the inlet may also be due to an adverse effect of river water on surface-dwelling naupliar stages.

4. Biology

The vertical distribution of *Spinocalanus brevicaudatus* suggests that females are divided into two categories; feeding females and breeding females. The majority of females congregated just below the thermocline where no males were present, but where a relatively large quantity of food is likely to be found. These females may have been building up food reserves prior to mating and egg-laying in deeper water. *Calanus plumchrus* and *C. cristatus* build up oil reserves in the young stages (C-I to C-IV), then migrate to deeper water as the fifth and adult stages (Heinrich, 1962; Fulton, 1973).

Spinocalanus brevicaudatus and *Scaphocalanus brevicornis* show a remarkable similarity in the small and relatively stable male:female

sex ratio, and in the reduced mouth parts of the adult males. Mazza (1966) also found this in the bathypelagic copepods *Gataenus kruppi*, *Euchirella messinensis*, *Euchaeta acuta* and *E. spinosa*. The reduction of the male mouth parts and the decline in the male:female sex ratio also occurred during or after the last moult. Males probably do not feed and die shortly after mating, leading to the unequal sex ratios. *Heterorhabdus tanneri* does not undergo reduction of mouth parts in the male and has a sex ratio close to unity at all times.

On the other hand, a rearing experiment by Mathews (1964) indicates that sex determination can occur up to the last moult in copepods. He separated Stage V copepodites of *Chiridius armatus* into male and female using the presence or absence of fifth limbs as a distinguishing characteristic. The animals moulted successfully and a number of healthy females without trace of fifth limbs were found among the males. These had apparently moulted from "male" copepodites. A number of authors have reported on the effect of various environmental factors on the sex ratio of marine organisms (Takeda, 1950; Egami, 1951; Kinne, 1957). Moraitou-Apostolopoulou (1972) found that the sex ratio of two epipelagic copepods showed seasonal fluctuation. The lowest male: female sex ratio occurred during the period of adverse environmental conditions and scarcity of food. Under such conditions (such as those found in the bathypelagic realm) a large number of females and high fecundity will favour the survival of the species (Mednikov, 1961; Moraitou-Apostolopoulou, 1972; Mauchline, 1972).

The present evidence reinforces Mauchline's hypothesis that bathypelagic organisms do not have a well-defined breeding season. However,

the decrease in the proportion of juveniles to adults near the head of Bute Inlet and during the winter suggests that breeding and/or egg-laying are food-dependant and would increase in a period of abundance in the surface zone. Mathews (1964) found that peaks in abundance of benthic copepods were evident, although much less marked than fluctuations in the surface zone. Times of abundance in the benthic community generally coincided with declines in the upper layers. Unfortunately the few sampling times and different nets used do not allow comparison of abundance data between seasons in the present study.

SUMMARY

1. *Spinocalanus brevicaudatus*, *Scaphocalanus brevicornis* and *Heterorhabdus tanneri* have established permanent breeding populations in Bute and Jervis Inlet, British Columbia. Up to 50 individuals of *Spinocalanus brevicaudatus*, 5 individuals of *Scaphocalanus brevicaudatus* and 3 individuals of *H. tanneri* per cubic meter were captured in the inlets. These species are found only rarely in the shallower Strait of Georgia.

2. The male of *Spinocalanus brevicaudatus* was always most abundant below 400 meters. Most adults of *Scaphocalanus brevicornis* were found between 300 and 400 meters in July. Thus the deep living habits of breeding adults probably restricts these species to the deep inlets.

3. The deep-living species were found throughout the water column below the thermocline in the inlets. Peaks of abundance often occurred in the depth interval immediately below the thermocline. In contrast the common interzonal species preferred a definite depth interval near mid-water.

4. *Metridia pacifica*, *Scaphocalanus brevicornis* and *H. tanneri* showed the usual ontogenetic migration pattern in July. Younger stages were found near the surface and older stages occupied progressively deeper depth intervals. In *M. pacifica* and *Spinocalanus brevicaudatus* males were found below the females.

5. Only females of *M. pacifica* showed a strong diurnal migration pattern in July. The intensity of this migration appeared to diminish with increasing distance from the mouth of Bute Inlet. The vertical distribution and diurnal migration patterns of *Spinocalanus brevicaudatus*

Scaphocalanus brevicornis and *H. tanneri* appeared to increase the chances of sexual encounters in these relatively rare species.

6. *Spinocalanus brevicaudatus*, *Scaphocalanus brevicornis* and *H. tanneri* appear to breed throughout the year. Males, females and juveniles were present at all sampling times. Spermatophores were found on a small percentage of females at all times. This is in contrast to the common interzonal species which had a well-defined breeding season in late winter.

7. A decrease in the total number of copepods with distance from the mouth of Bute Inlet was evident in July. A decrease in the percentage of juveniles in the population of several species with increasing distance from the inlet mouth was observed in June and July.

8. The sex ratio of *Spinocalanus brevicaudatus* and *Scaphocalanus brevicornis* changed from near unity in the fifth copepodite stage to a ratio favouring females in the adult. In these species the male has reduced mouth parts and probably dies soon after mating. *H. tanneri* males do not have reduced mouth parts. This species had a sex ratio near unity at all times.

9. Evidence from the distribution study and from the literature suggests that *Gadius columbiae* is actually a variety of *G. pungens* that has appeared only recently in the Strait of Georgia.

10. *Spinocalanus brevicaudatus*, *Scaphocalanus brevicornis* and *H. tanneri* are redescribed. *Comantenna columbiae* is described for the first time. This species was found only in Bute Inlet and was most abundant in the deepest depth interval sampled.

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APPENDIX 1. TAXONOMY

Spinocalanus brevicaudatus Brodskii, 1950

(Figs. 1-4)

Spinocalanus abyssalis Giesbrecht. G.O. Sars, 1903, The Crustacea of Norway, vol.IV, p.157, suppl.pl.III, fig.2.

Spinocalanus brevicornis G.O. Sars. G.O. Sars, 1903, The Crustacea of Norway, vol.IV, p.22, pl.XII.

Spinocalanus abyssalis Giesbrecht. With, 1915, The Danish-Ingolf-Expedition, vol.III, no.4, p.69, pl.1, figs.10a-b, textfigs. 15a-e.

Spinocalanus abyssalis Giesbrecht. Tanaka, 1937, Japanese Journ. of Zoology, vol.VII, no.2, p.253, fig.4a-c.

Spinocalanus brevicaudatus sp. nov. Brodskii, 1950, Calanoida of the Far Eastern Seas and Polar Basin of the USSR, p.136, fig.55.

Spinocalanus brevicaudatus Brodskii. Fulton, 1972, Fish. Res. Bd. Can. Tech. Rep. no.313, fig.41.

Description of female

Head fused with cephalothorax. Rostrum absent. Posterior corners of terminal thoracic segment rounded. Metasome between 3 and 3.5 times the length of the urosome. Fifth and sixth thoracic segments fused. Urosome four-segmented. Caudal rami symmetrical. Genital segment slightly longer than following segments, with fine hairs on the ventral side. First antennae almost always broken off at the first few segments, longer than body on complete specimens. Posterior surface of swimming

FIGURE 1.

Spinocalanus brevicaudatus, female

A. Dorsal view x 80

B. Side view x 80

C. First antenna x 200

D. Second antenna x 200

E. Mandible x 200

F. First maxilliped x 200

G. Second maxilliped x 200

H. Maxilla x 200

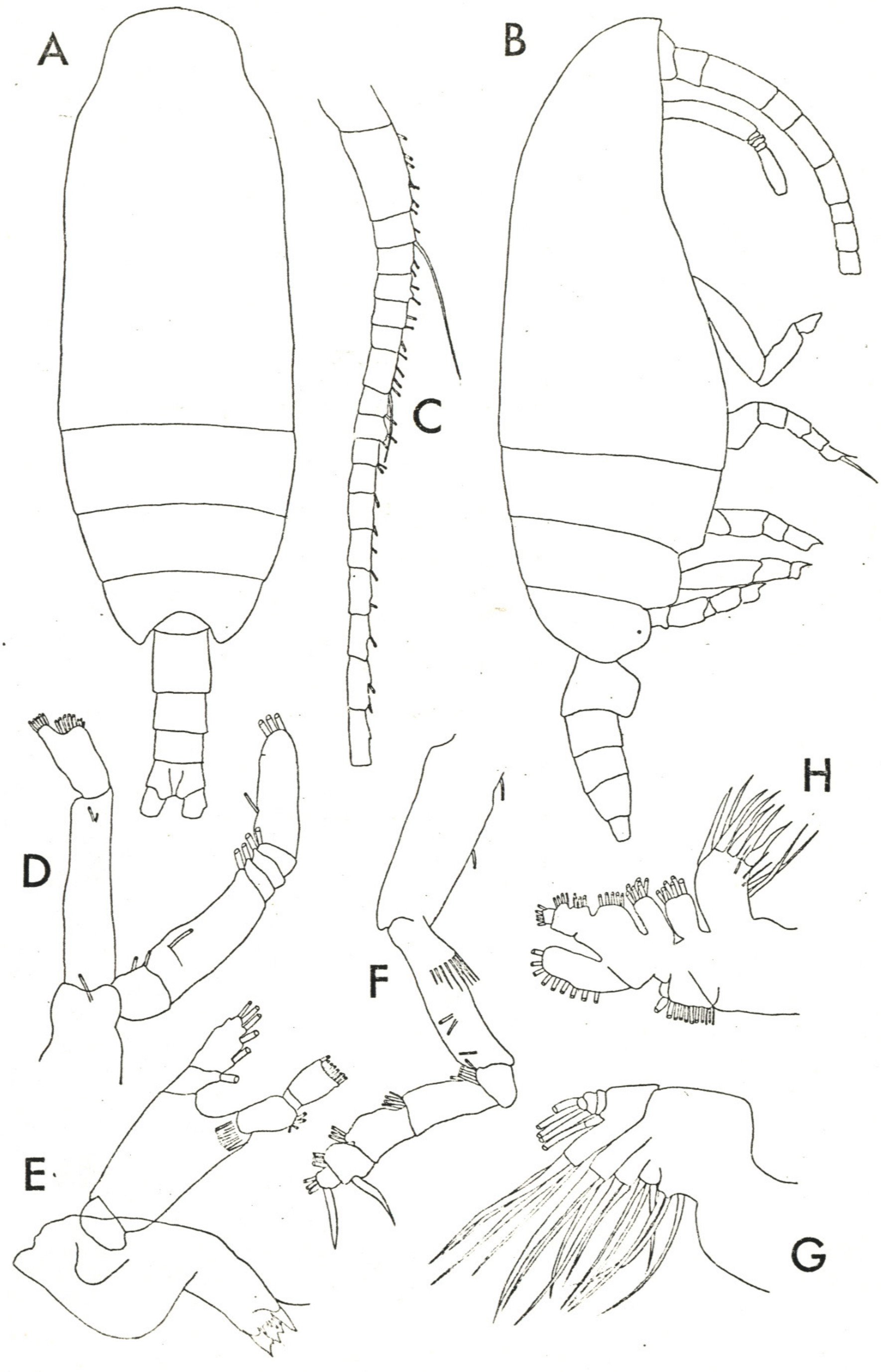
A
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FIGURE 2.

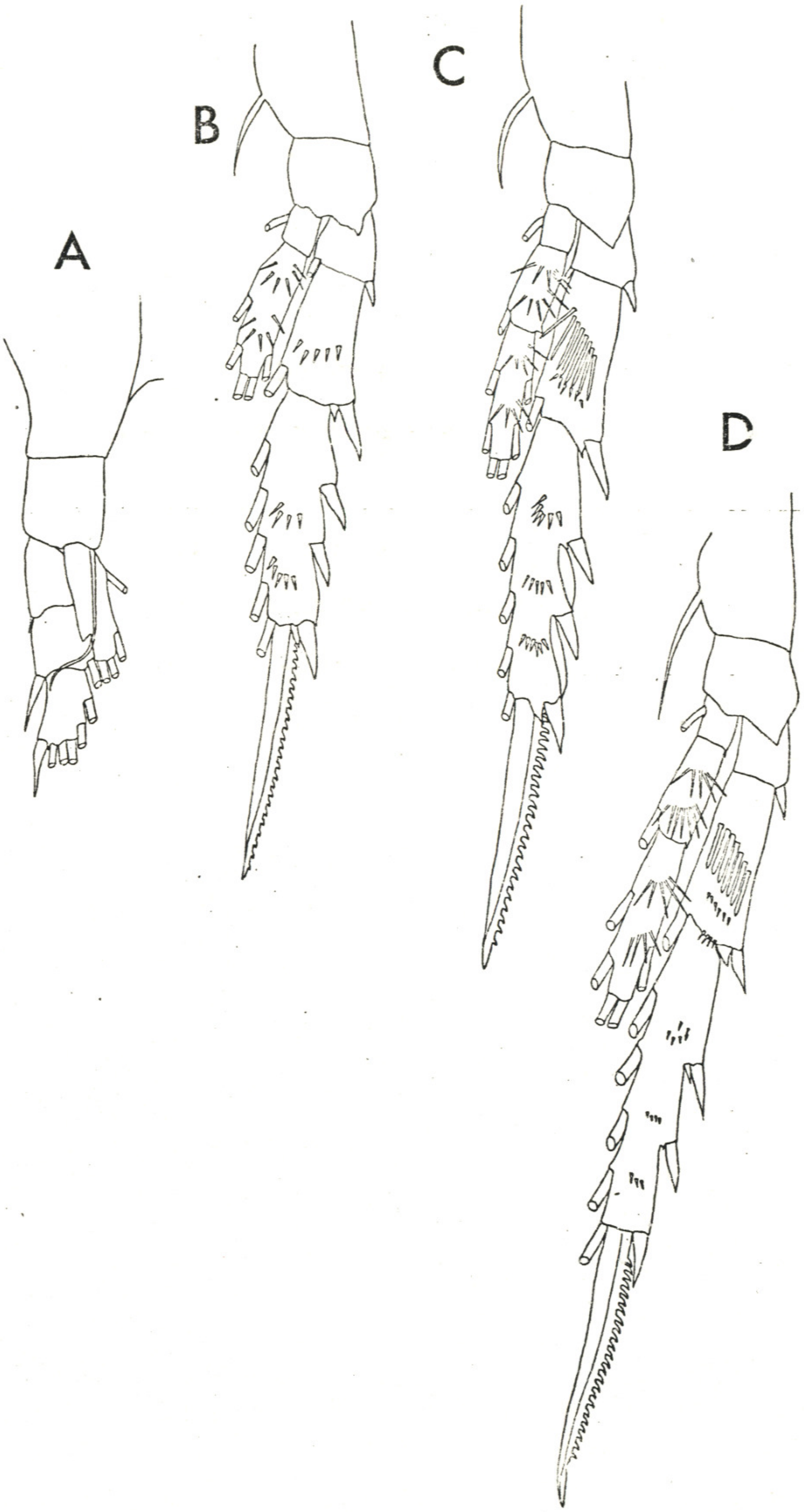
Spinocalanus brevicaudatus, female

A. First leg x 200

B. Second leg x 200

C. Third leg x 200

D. Fourth leg x 200


A
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D

legs equipped with spinules. Endopodites of first leg one-segmented, of second leg two-segmented, and of third and fourth legs three-segmented. Exopodites of all swimming legs three-segmented. Spinulation on posterior surface of third and fourth legs of two types: small spinules present on both rami; large flat spinules present on the second joint of the exopodite. The outer marginal spine on the first segment of the exopodite of the first leg is much smaller than those on the other two segments.

Total length: 1.36-1.76 mm.

Occurrance: numerous specimens below 100 meters in Bute and Jervis Inlet. at all times of year. Rare in the Strait of Georgia.

Description of male

Head fused with cephalothorax, slightly constricted. Sixth thoracic segment present only as small, rounded lappets protruding on the fifth segment. Rostrum absent. Urosome almost half length of the metasome. First antennae about as long as metasome, equipped with aesthetes. Mouth parts reduced. Second maxilliped not provided with transverse row of spinules on the second proximal joint as in female. First to fourth swimming legs much as in female. Fifth legs present, biramous, slightly assymetrical. Urosome five-segmented, first segment small, second segment longest. Anal segment reduced and almost indistinguishable.

FIGURE 3.

Spinocalanus brevicaudatus, male

A. Dorsal view x 80

B. Side view x 80

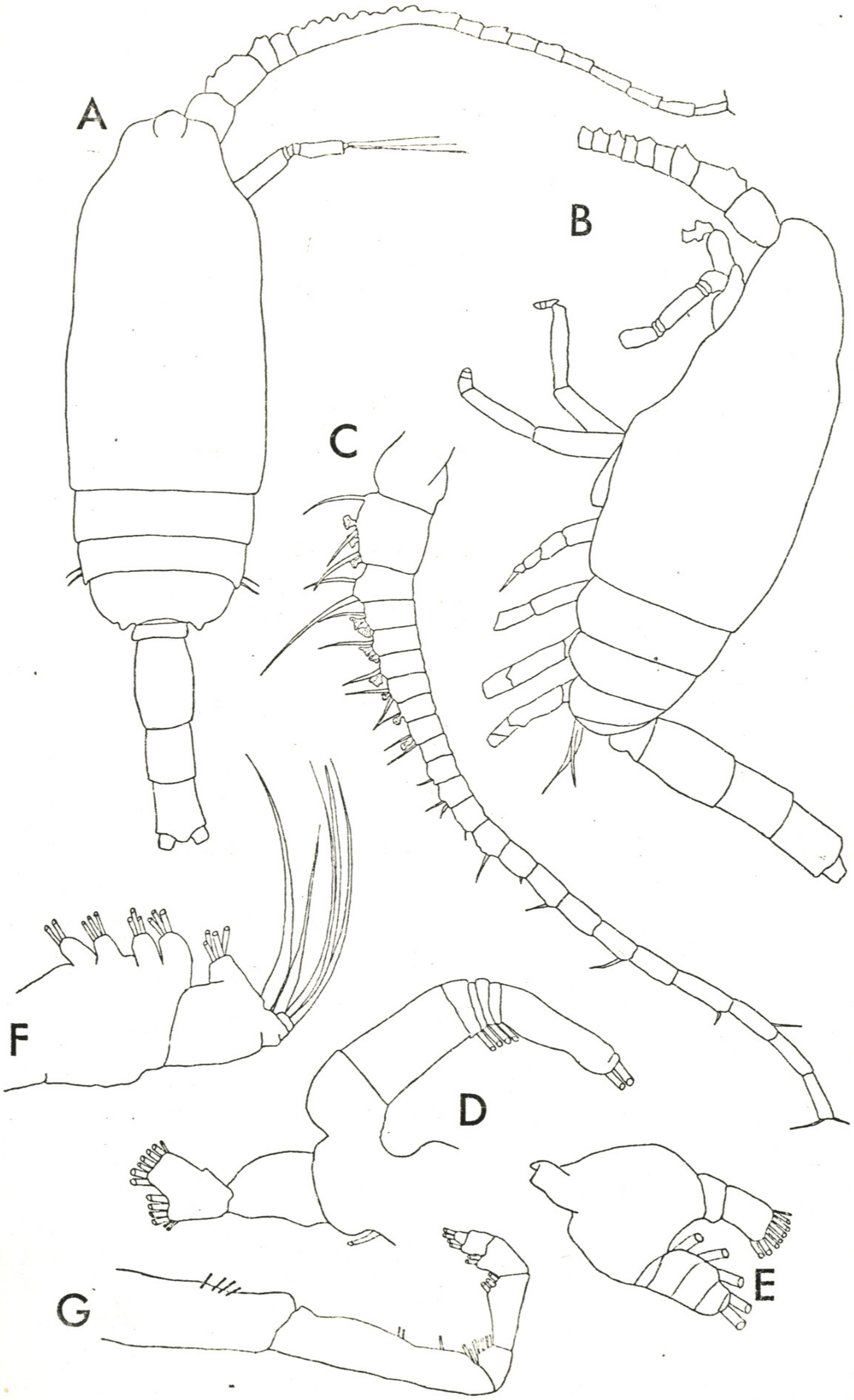
C. First antenna x 100

D. Second antenna x 200

E. Mandible x 200

F. Second maxilliped x 200

G. First maxilliped x 200


A
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G

FIGURE 4.

Spinocalanus brevicaudatus, male

A. First leg x 200

B. Second leg x 200

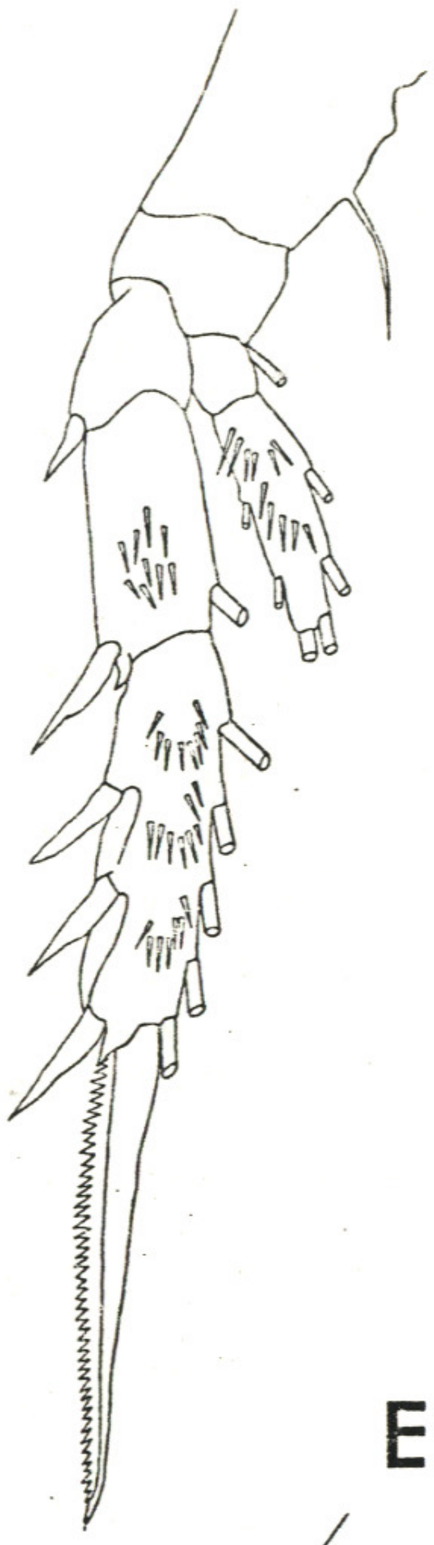
C. Third leg x 200

D. Fourth leg x 200

E. Fifth legs x 200

A

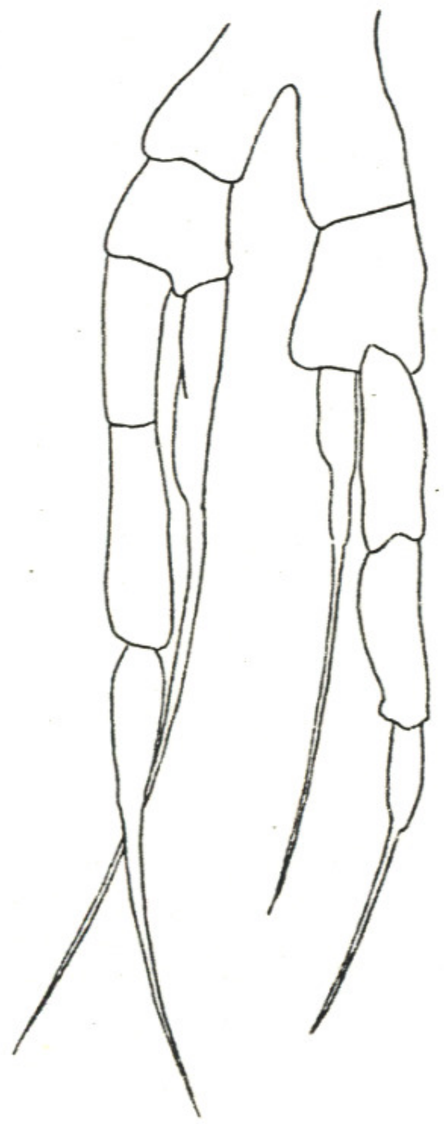
B



C

D

E



Total length: 1.48-1.72 mm.

Occurrance: Bute and Jervis Inlets at all times of year below 300 meters.

DISCUSSION

Sars (1903) first described the female of *Spinocalanus brevicaudatus* as *S. abyssalis* Giesbrecht. The male was described as *S. longicornis* Sars in the same publication. Both specimens came from the Osterfjord between 400 and 600 meters. The descriptions of Sars agree closely with the present species, particularily with regard to the total lengths of males and females and in the form of the male fifth legs. This is also true for specimens described as *S. abyssalis* by With (1915) from South Greenland and by Tanaka (1937) from Suruga Bay, Japan.

Although it did not occur in his samples, Brodskii (1950) established the new species *S. brevicaudatus* from Sars' description to distinguish it from *S. abyssalis* Giesbrecht and *S. longicornis* Sars, two distinct species with which it had previously been incorrectly identified. Brodskii considered *S. abyssalis* Giesbrecht to be a small (1.1-1.3 mm.) strictly Pacific species found in the low latitudes. *S. brevicaudatus* and *S. longicornis* are considered polar forms.

Davis (1949) described a female from off Cape Flattery as *S. abyssalis* Giesbrecht, although his specimens measured 2.0 to 2.4 mm. He cited as synonyms the *S. abyssalis* of Sars (1903) and With (1915) (= *S. brevicaudatus* Brodskii).

A number of female specimens of a species of *Spinocalanus* were examined from a deep sample (2000-0 meters) taken at Ocean Station "P" (provided by J. Fulton, Fisheries Research Board of Canada, Nanaimo). These were larger than the inlet specimens (2.15-2.27 mm.) but otherwise closely resembled them. It is possible that the specimens of Davis and those found at Station "P" are a large race of *S. brevicaudatus*. A similar phenomenon was reported by McHardy (1964). He described a new sub-species of *Conchoecia alata* (Ostracoda) from B.C. inlets which appeared to be identical with specimens taken from Station "P", except that they were about 1/3 smaller.

Comantenna columbiae, sp. nov.

(Figs. 5-8)

Phylum *Arthropoda*

Class *Crustacea*

Order *Copepoda*

Sub-order *Calanoida*

Family *Aetideidae*

Genus *Comantenna* Wilson, 1924

Bryaxis Boeck (MS). G.O. Sars, 1903, The Crustacea of Norway, vol.IV, p.35, pl.XXII, XXIII.

Comantenna Wilson, 1924. Proc. U.S. nat. Mus., vol. 64, no.17.

Type species: *Comantenna brevicornis* (Boeck, MS).

Generic description: Body short and robust with anterior division considerably tumefied. Head joined with second thoracic segment. Rostrum absent. Lateral corners of last thoracic segment of metasome produced to acute lappets. Posterior maxillipeds very large, with peculiar sensory appendage at the end of the first basal joint. Maxillae, first maxillipeds and swimming legs similar to *Undinopsis*. Fifth legs absent in female, present and biramous in male.

Description of female

Body stout in appearance, somewhat tumefied in the anterior region. Rostrum absent. Head joined with second thoracic segment. Fifth and sixth thoracic segments incompletely joined, sixth segment seen best in side view as a distinct point on the fifth segment. Metasome approximately 3.5 times the length of the urosome. Urosome four-segmented. Genital segment largest, almost sperical in appearance. First antennae almost reaching to anal segment. Second maxilliped large and conspicuous, terminal setae arranged in peculiar "broom-like" manner. Small spinules present on the second segment proximally, but no sensory appendage is present. Endopod of first swimming leg one-segmented, of second leg two-segmented, and of third and fourth legs three-segmented. Exopods of all swimming legs three-segmented. First basipodite of second and third legs provided with three transverse rows of spinules laterally. Second basipodite of the same legs with a row of shorter, stouter spinules on the distal edge. Endopods of second to fourth legs equipped with spinules on their posterior surface. Spinules of two types: large spinules on all segments of the endopodite; and much smaller, more delicate spinules on the distal end of the last segment. The spinules on the endopodite of the fourth swimming legs are much finer and more numerous than on the third and fourth legs.

Total length: 2.58-2.84 mm.

Occurrance: Bute Inlet, below 400 meters.

Holotype: National Museum of Canada # 15614. Paratypes: NMC # 15615.

FIGURE 5.

Comantenna columbiae, female

A. Side view x 50

B. Dorsal view x 50

C. First antenna x 50

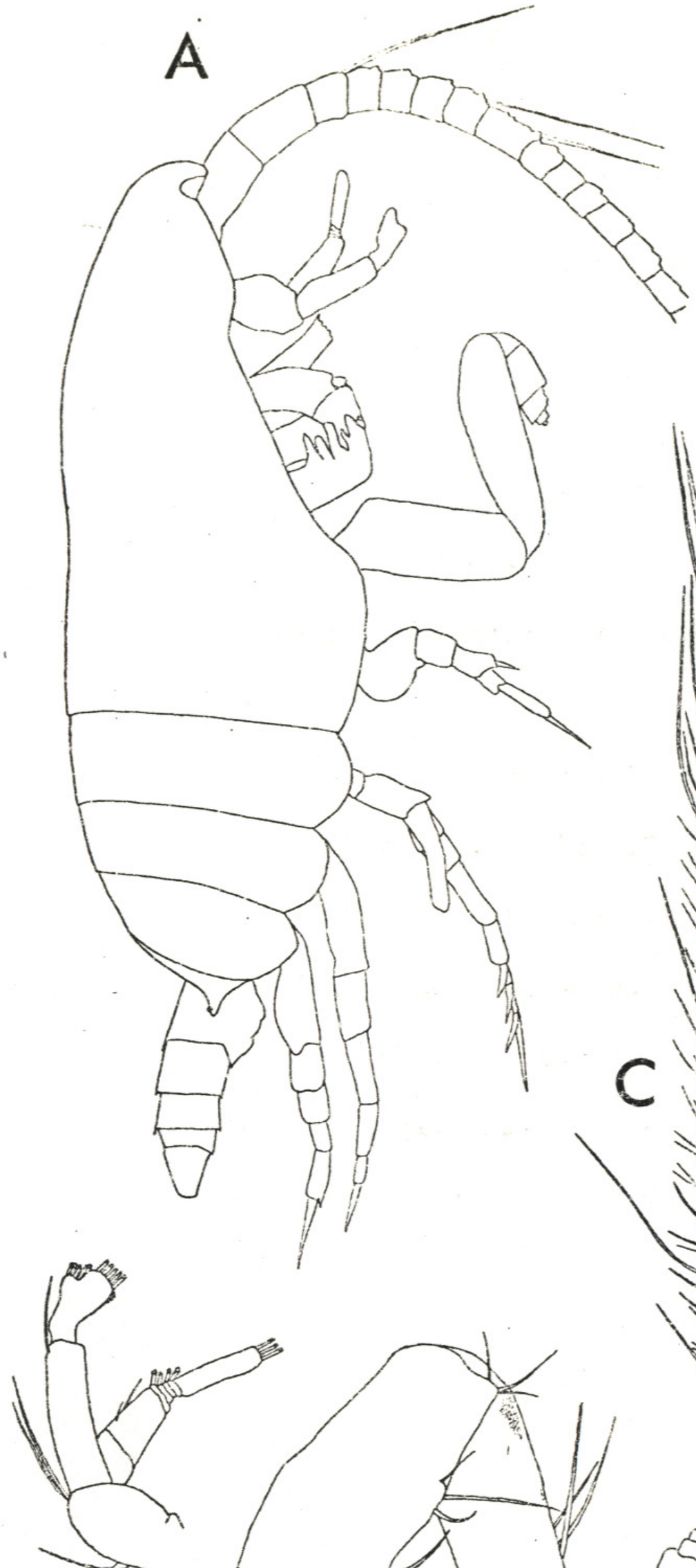
D. Second antenna x 75

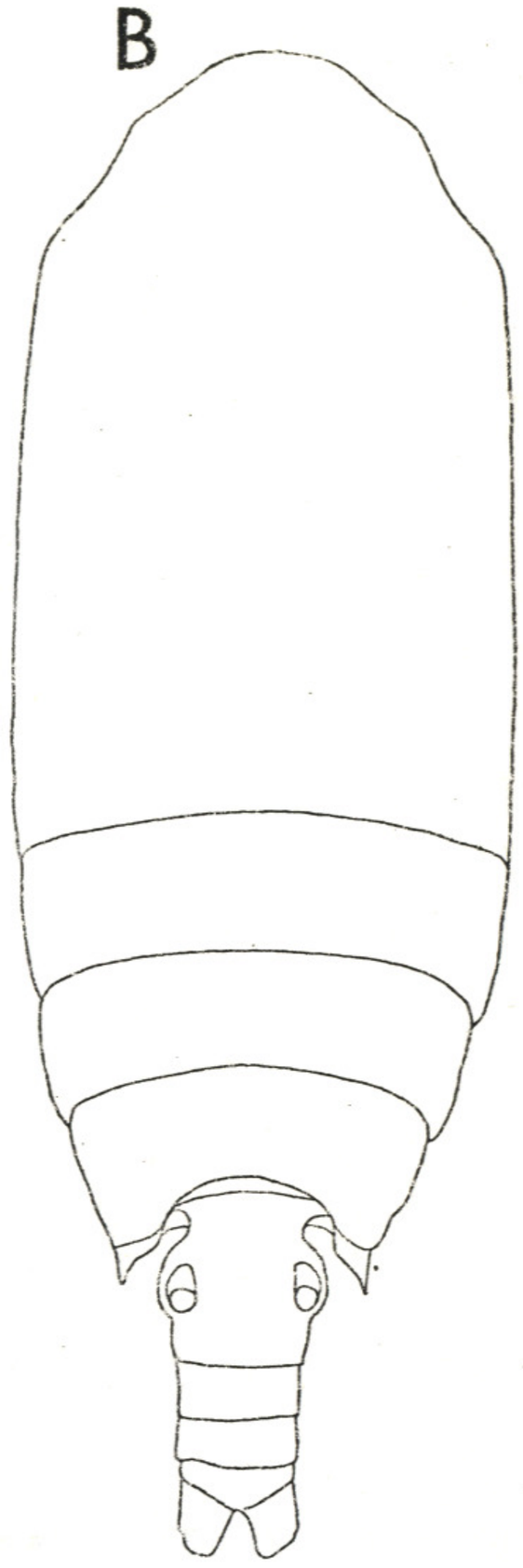
E. Mandible x 75

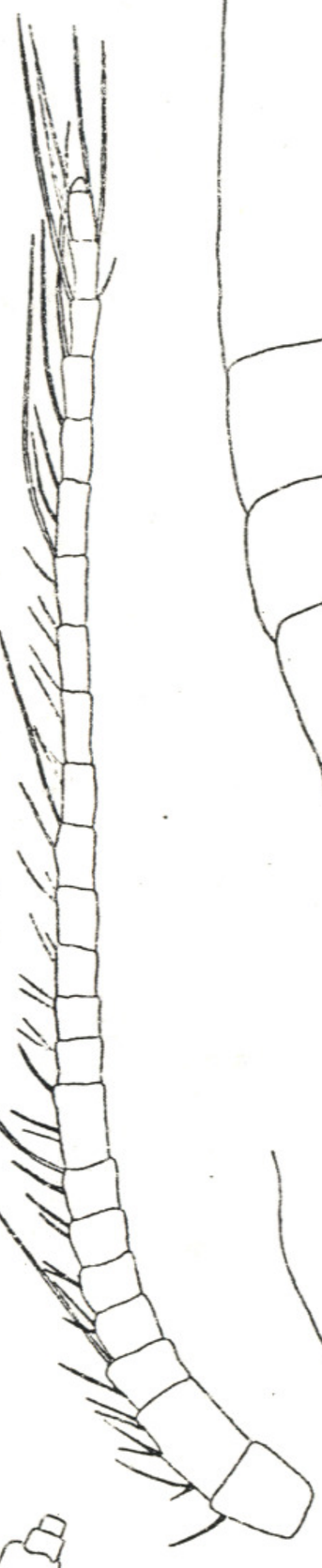
F. Second maxilliped x 75

G. Maxilla x 75

H. First maxilliped x 75

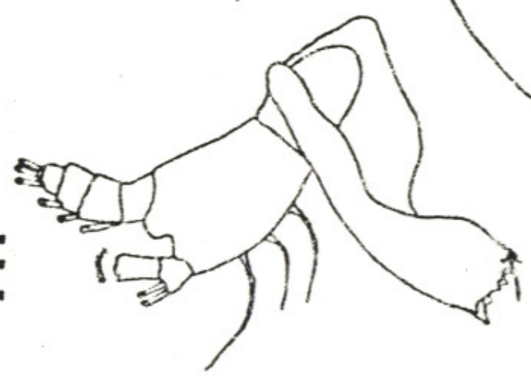

A


B


C

D

F


E

G

H

FIGURE 6.

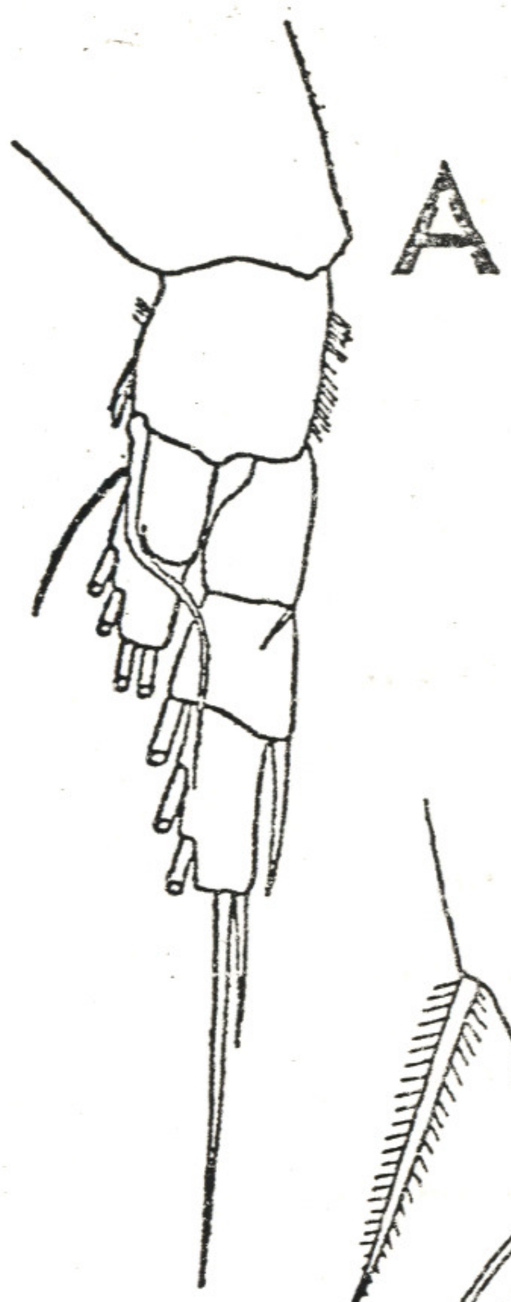
Comantenna columbiae, female

A. First leg x 100

B. Second leg x 100

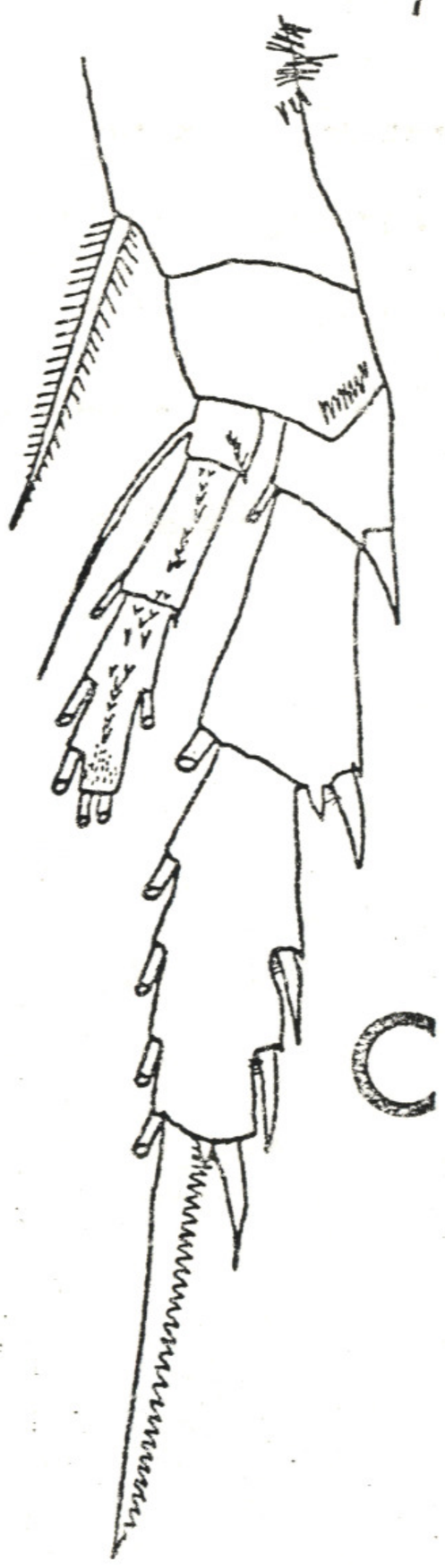
C. Third leg x 100

D. Fourth leg x 100

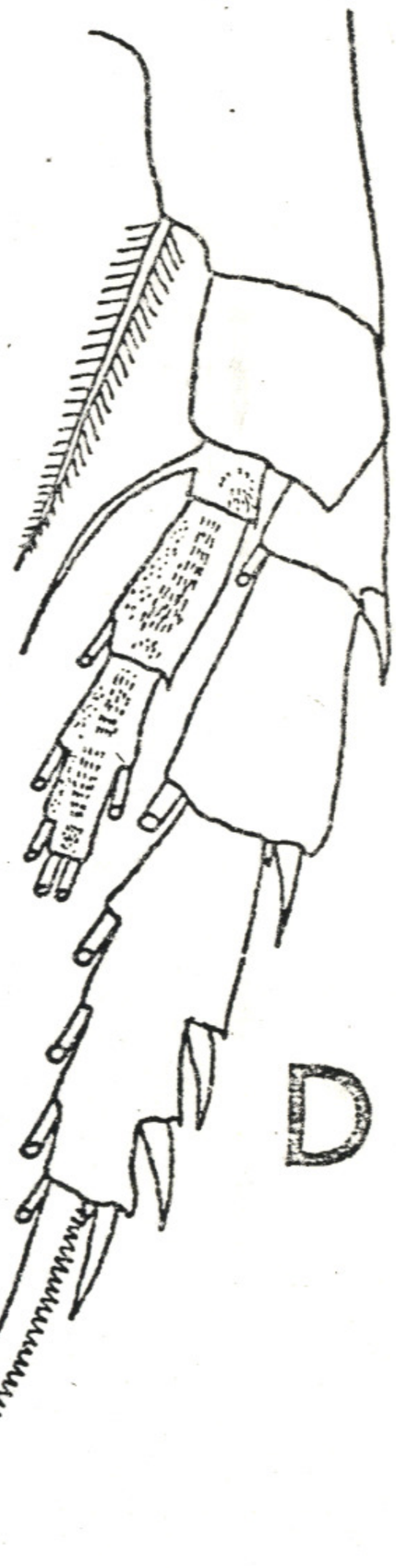


A

B



C



D

Description of male

General body form very similar to male of *Chiridius gracilis*. Head fused with second thoracic segment. Rostrum absent, two minute filaments present on anterior edge of head. Sixth thoracic segment reduced and hardly distinguishable, incompletely fused with fifth segment. Points on terminal thoracic segment present but not as pronounced as in female. Metasome about 3 times the length of the urosome. Urosome five-segmented, anal segment reduced. First antennae provided with aestetes on all segments after the third. Mouth parts reduced. Second maxilliped prominant but not as massive as in female. Swimming legs much as in female. Fifth legs biramous and assymetrical, endopods more or less rudimentary.

Total length: 2.08-2.10 mm.

Occurrance: Bute Inlet, below 400 meters. Paratypes: NMC # 15616

DISCUSSION

The genus *Comantenna* was established to accomodate a single species, *Comantenna brevicornis*. The female of this species was first described by Sars (1903), and the male by Mathews (1964).

Since the genus is established from a single species it is difficult to distinguish generic characters from specific ones. Assignment of the present species to the genus *Comantenna* must therefore be tentative until more is known about the systematics of such epi-benthic forms.

FIGURE 7.

Comantenna columbiae, male

A. Dorsal view x 50

B. Side view x 50

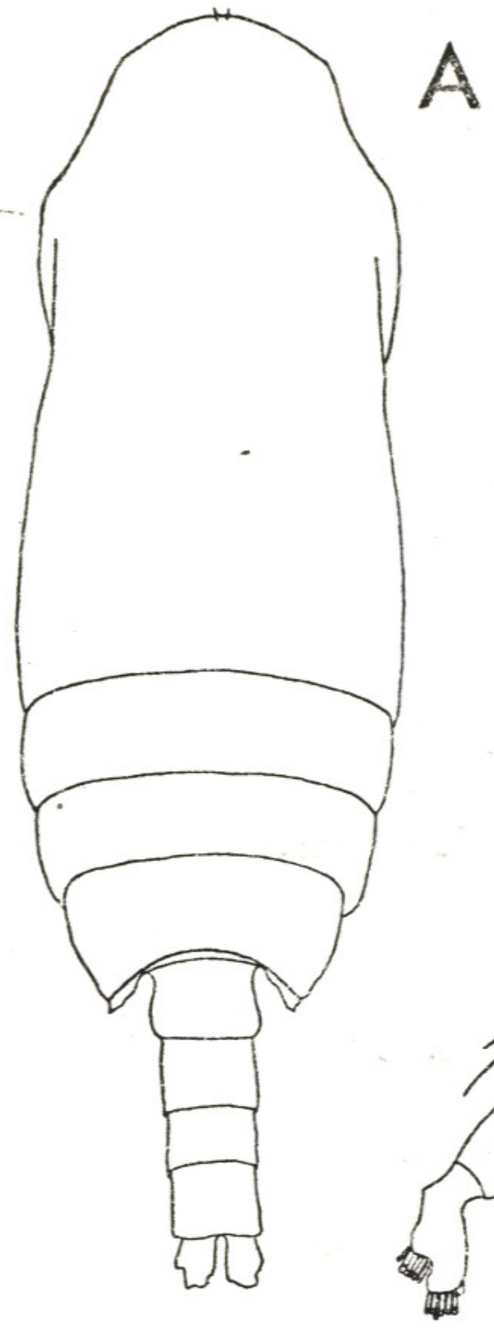
C. First antenna x 50

D. Second antenna x 75

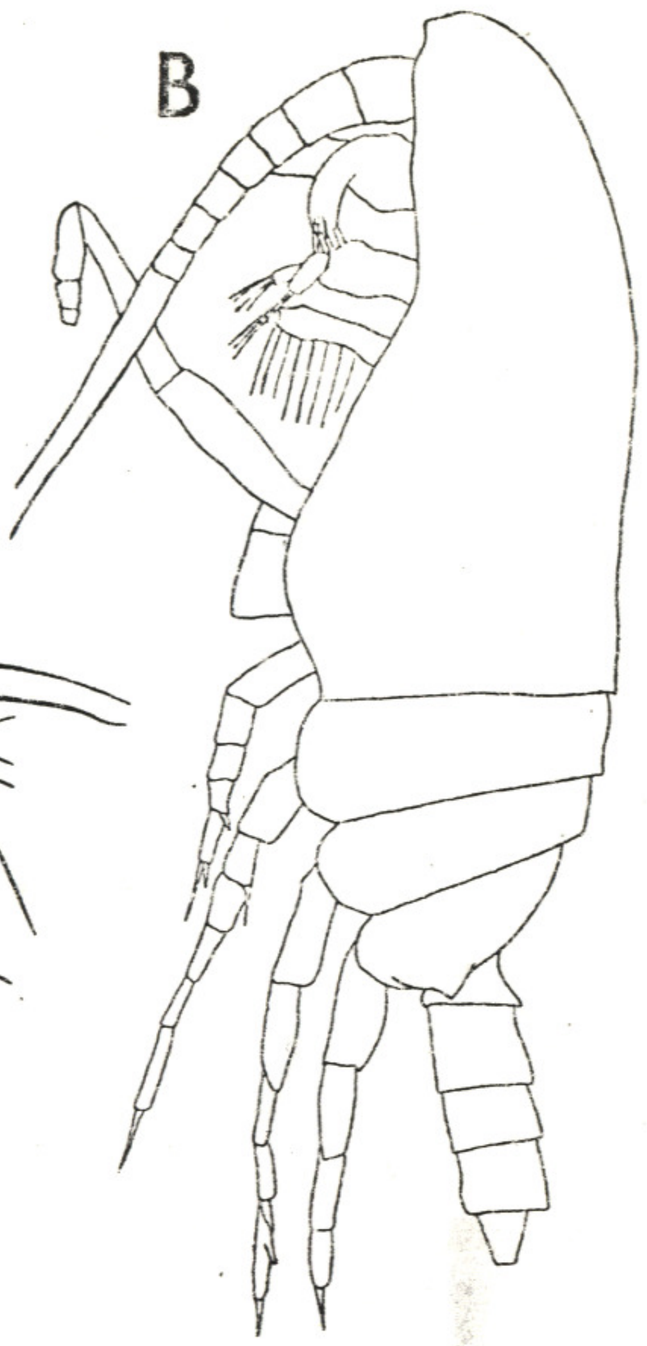
E. Mandible x 75

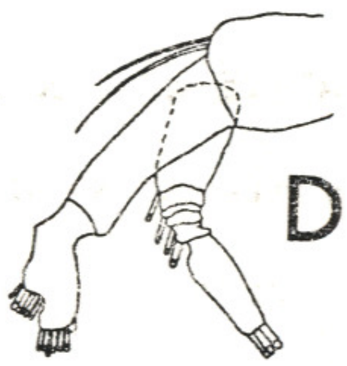
F. Maxilla x 275

G. Second maxilliped x 275


A

C


B


D

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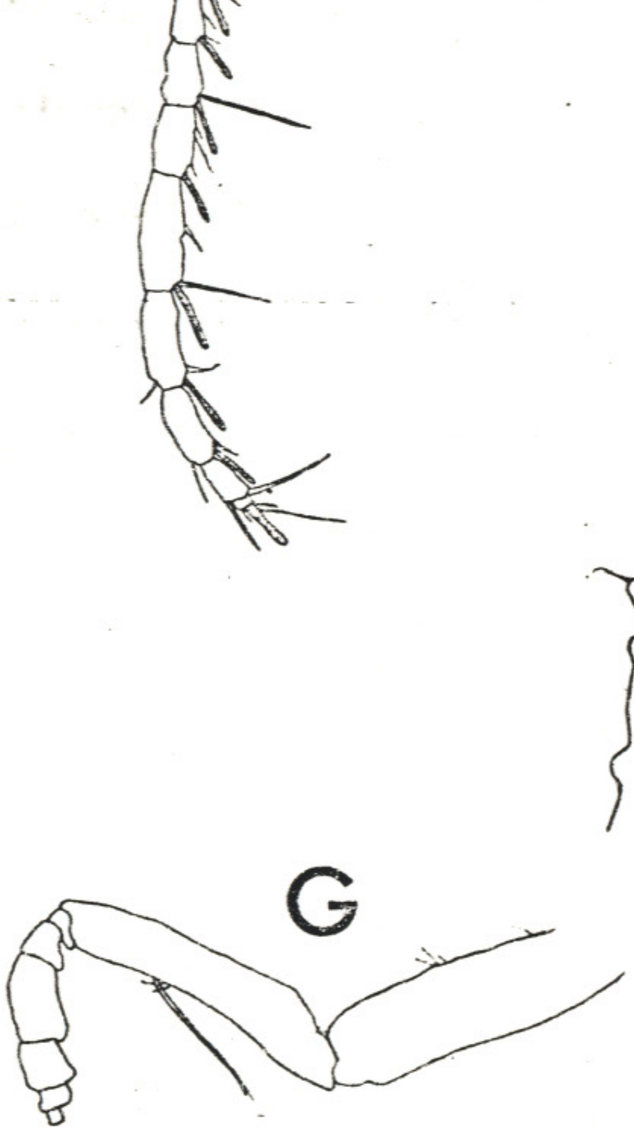
F


G

H

FIGURE 8.

Comantenna columbiae, male

A. First leg x 100

B. Second leg x 100

C. Third leg x 100

D. Fouth leg x 100

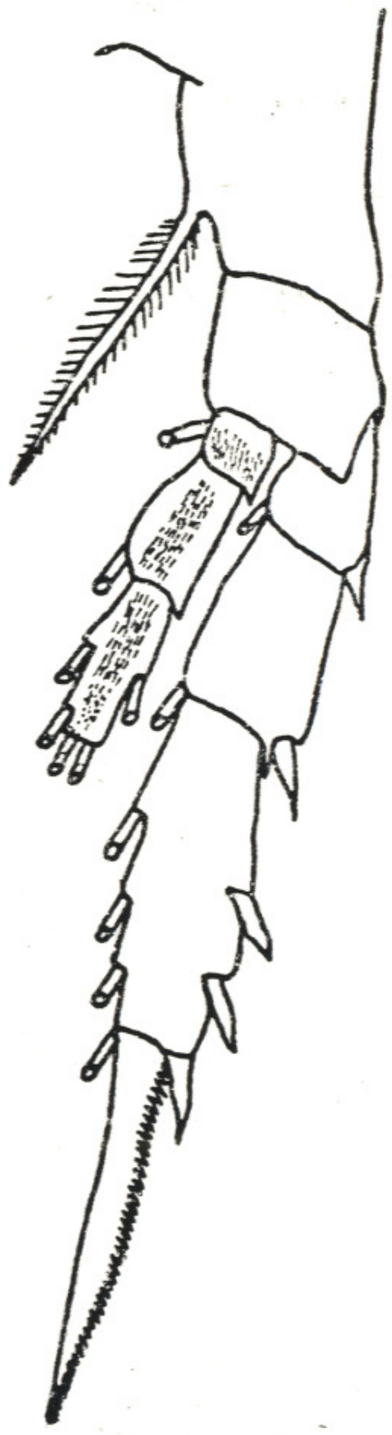
E. Fifth leg x 100

A

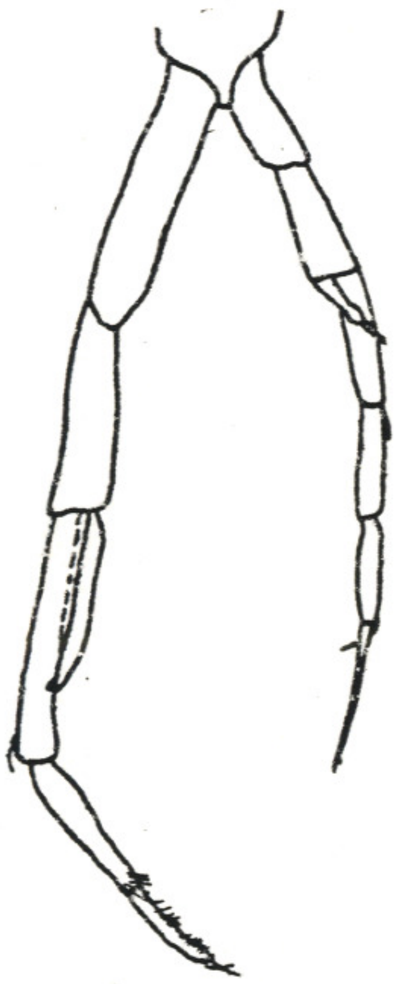
B

C

D



E



In the family *Aetideidae* only the genera *Chiridius*, *Bradyetes* and *Comantenna* lack a rostrum. The male of *Chiridius* has uniramous fifth legs and the last thoracic segment of *Bradyetes* is rounded, leaving *Comantenna* as the most suitable of established genera in the *Aetideidae*. The present species also resembles the type species in the anterior tumefication, in the prominant maxillipeds, and in the similarity of its appendages to *Undinopsis* (*Bradyidius*).

Scaphocalanus brevicornis (Sars, 1900)

(Figs. 9-12)

Scolecithrix brevicornis G.O. Sars, 1900, The Norwegian North Polar Expedition, vol.1, no.V, p.46-48, pl.X, figs.1-14.

Amallophora brevicornis G.O. Sars, 1903, The Crustacea of Norway, vol.IV, p.53-54, pl.XXXVI.

Scolecithrix gracilipes Farran, 1908, Fisheries Ireland Sci. Invest., 1906, no.2, (1908), p.52-53, pl.VI, figs. 1-4.

Scaphocalanus brevicornis (G.O. Sars). With, 1915, The Danish-Ingolf-Expedition, vol.III, no.4, p.192-193, pl.VII, figs.7a-b, textfigs.59a-b.

Scaphocalanus minuta Tanaka, 1937, Japanese Journ. of Zoology, vol.VII, no.2, p.262, pl.XVIII, figs.1-11.

Scaphocalanus brevicornis (G.O. Sars). Vervoort, 1951, Verh. K. Akad. Wet. vol.XLVII, no.4, p.113-116, textfigs.60-61.

Scaphocalanus brevicornis (G.O. Sars). Tanaka, 1961, The Pelagic Copepods of the Izu Region, Middle Japan, Systematic Account VII, p.169-172, figs.117a-h.

Description of female

Head fused with second thoracic segment. Fifth and sixth thoracic segment incompletely joined, suture line seen laterally. Metasome about 3.5 times the length of the urosome. Last thoracic segment rounded. Rostrum present, consisting of two fairly long filaments. Abdomen four-segmented, genital segment slightly longer than other segments. The

first three segments of the abdomen fringed with fine teeth on their distal margin. First antennae always broken off at first few segments in adult. They extend barely to the end of the metasome in complete Stage V specimens. First segment of first antennae fringed with fine teeth on the distal margin. The terminal segment of the first maxillipeds equipped with vermiform and amalliform sensory filaments. The second maxilliped also equipped with a long sensory appendage on the proximal part of the first segment. Exopods of swimming legs three-segmented. Endopods of first pair of legs one-segmented, of second pair two-segmented and of third and fourth pair three-segmented. Posterior surface of second to fourth legs provided with spinules, the larger being on the endopods. Anterior surface also spinulated, but spinules are much finer and more numerous. The fifth pair of legs two-jointed and uniramous, the distal segment provided with three spines. The inner marginal spine is about 1.5 times that of the terminal spine and extends well beyond it. Inner spine provided with about 17 coarse teeth on its inner margin, with two or three teeth extending to the outer margin of the distal end. The outer marginal spine divides the outer margin of the segment in the proportions 3:1.

Total length: 2.39-2.79 mm.

Occurrance: Present in the Strait of Georgia, Jervis and Bute Inlet, more numerous in the inlets.

FIGURE 9.

Scaphocalanus brevicornis, female

A. Dorsal view x 50

B. Side view x 50

C. Rostrum x 62

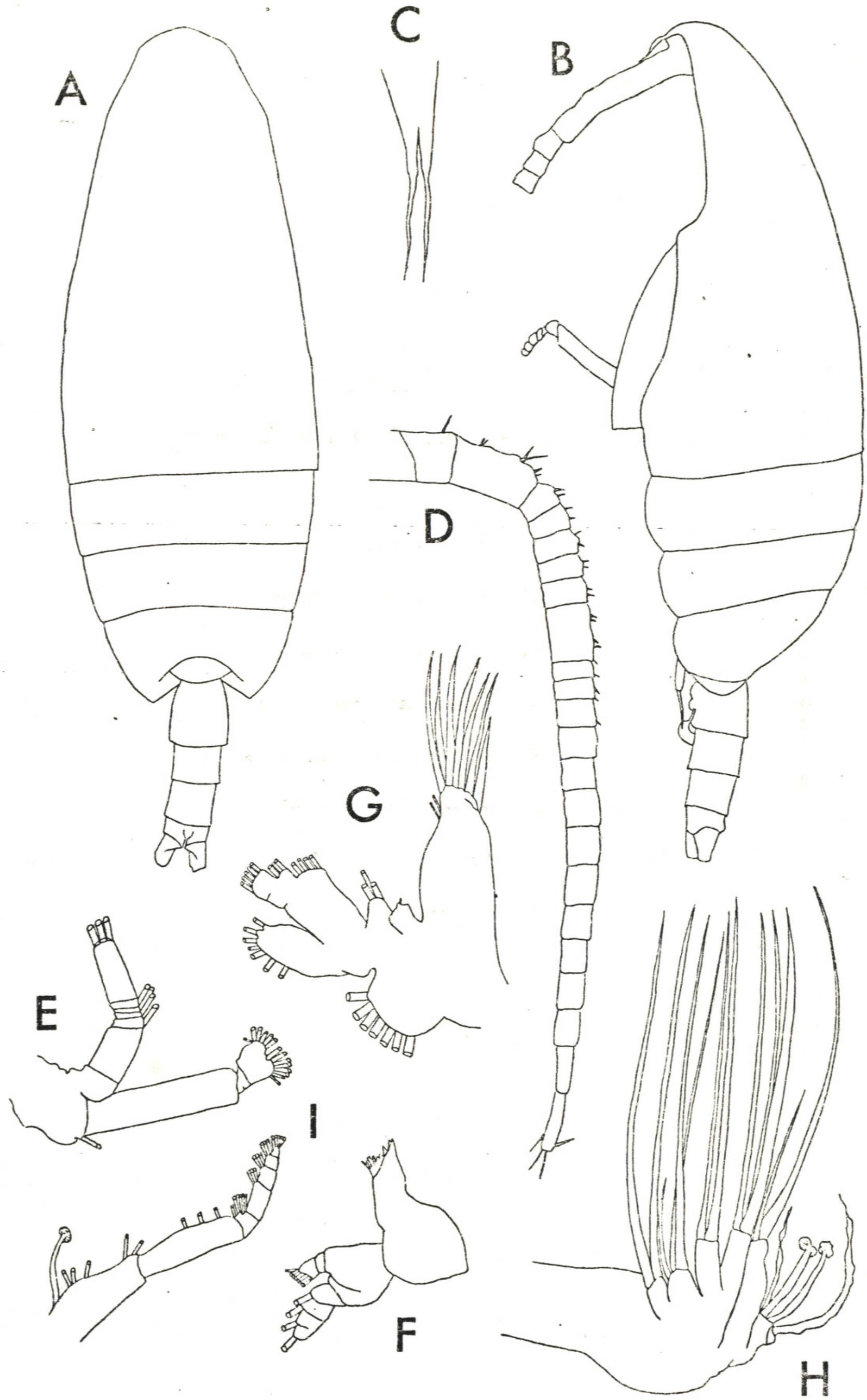
D. First antenna x 62

E. Second antenna x 33

F. Mandible x 33

G. Maxilla x 200

H. First maxilliped x 200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H

FIGURE 10.

Scaphocalanus brevicornis, female

A. First leg x 110

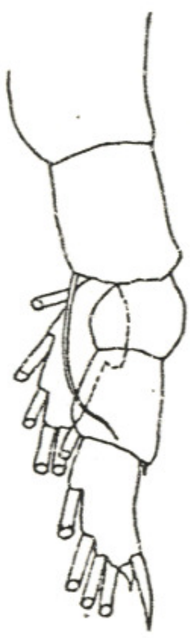
B. Second leg x 110

C. Third leg x 110

D. Fourth leg x 110

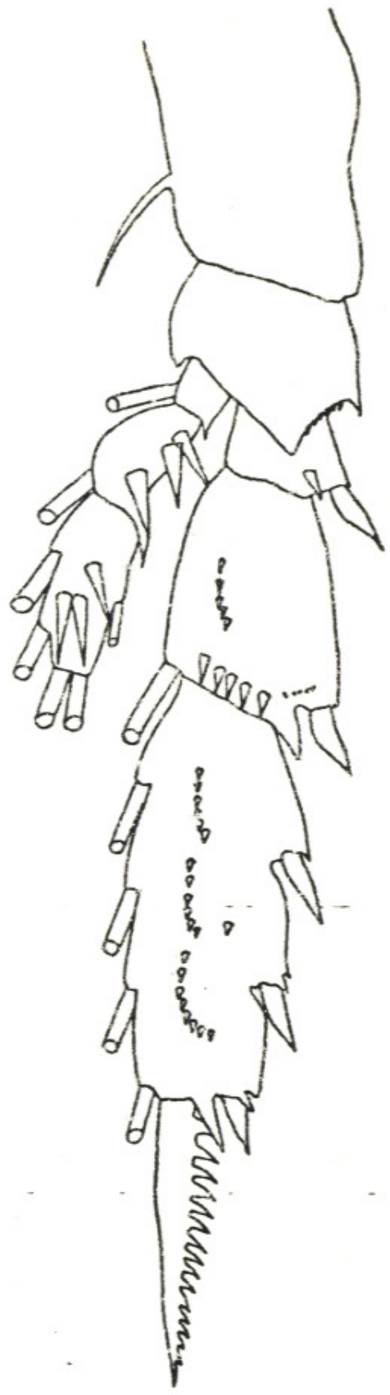
E. Fifth leg x 345

A



B

C



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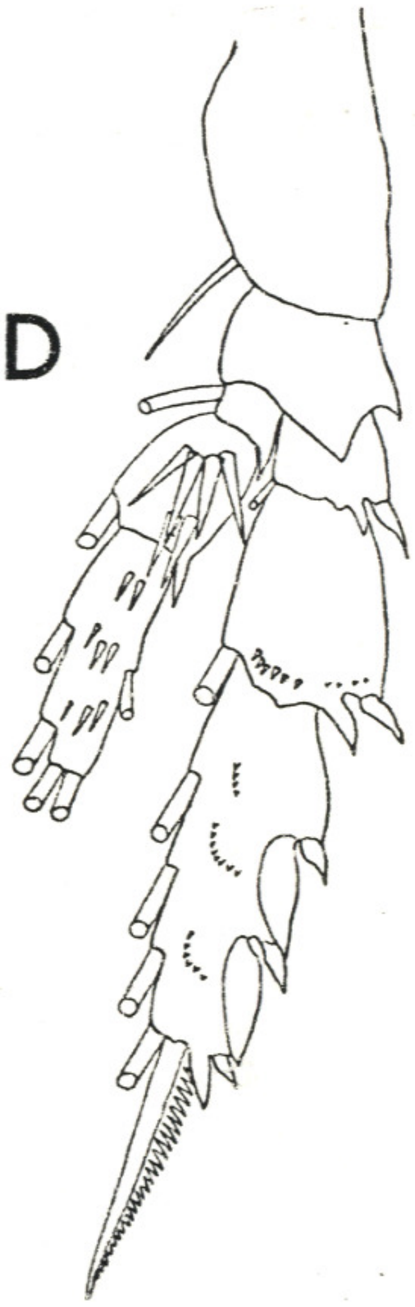
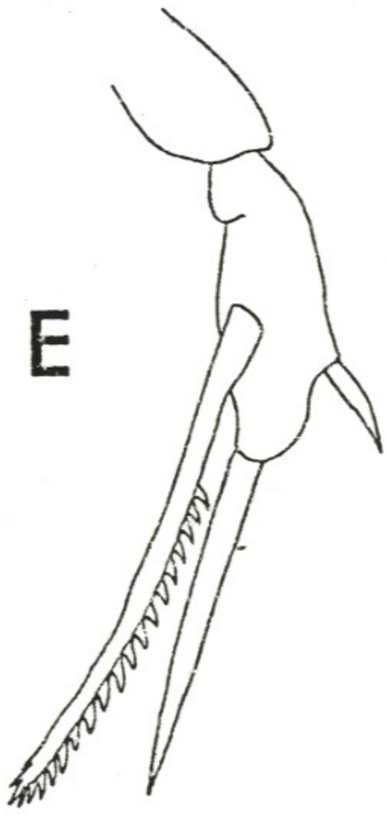


E



Description of male

Head fused with second thoracic segment. Rostrum much as in female. Fifth and sixth thoracic segments incompletely fused, sixth segment reduced and difficult to distinguish. Last thoracic segment rounded. Abdomen five-segmented, the anal segment reduced. The metasome about twice as long as the urosome. In many specimens the metasome is peculiarily humped above the third thoracic segment dorsally. A "suture" runs from the mid-cephalothorax to the fourth thoracic segment when viewed dorsally on the same specimens. Small spinules present on the lateral aspect of the third and fourth thoracic segments, on some specimens. First antennae nineteen-segmented and provided with aesthetes beyond segment eight. First antennae held ridgidly at right angles to body in most preserved specimens. They are bent posteriorly at segment three and fourteen, and extend approximately to the third thoracic segment. Mouth parts reduced. Swimming legs much as in female, but spines on third segment of endopod of fourth legs are absent. The fifth legs are assymetrical and biramous.

Total length: 2.58-2.90 mm.

Occurrance: Strait of Georgia, Bute and Jervis Inlets, more numerous in the inlets.

FIGURE 11.

Scaphocalanus brevicornis, male

A.

A. Dorsal view x 50

B. Side view x 50

C. First antenna x 80

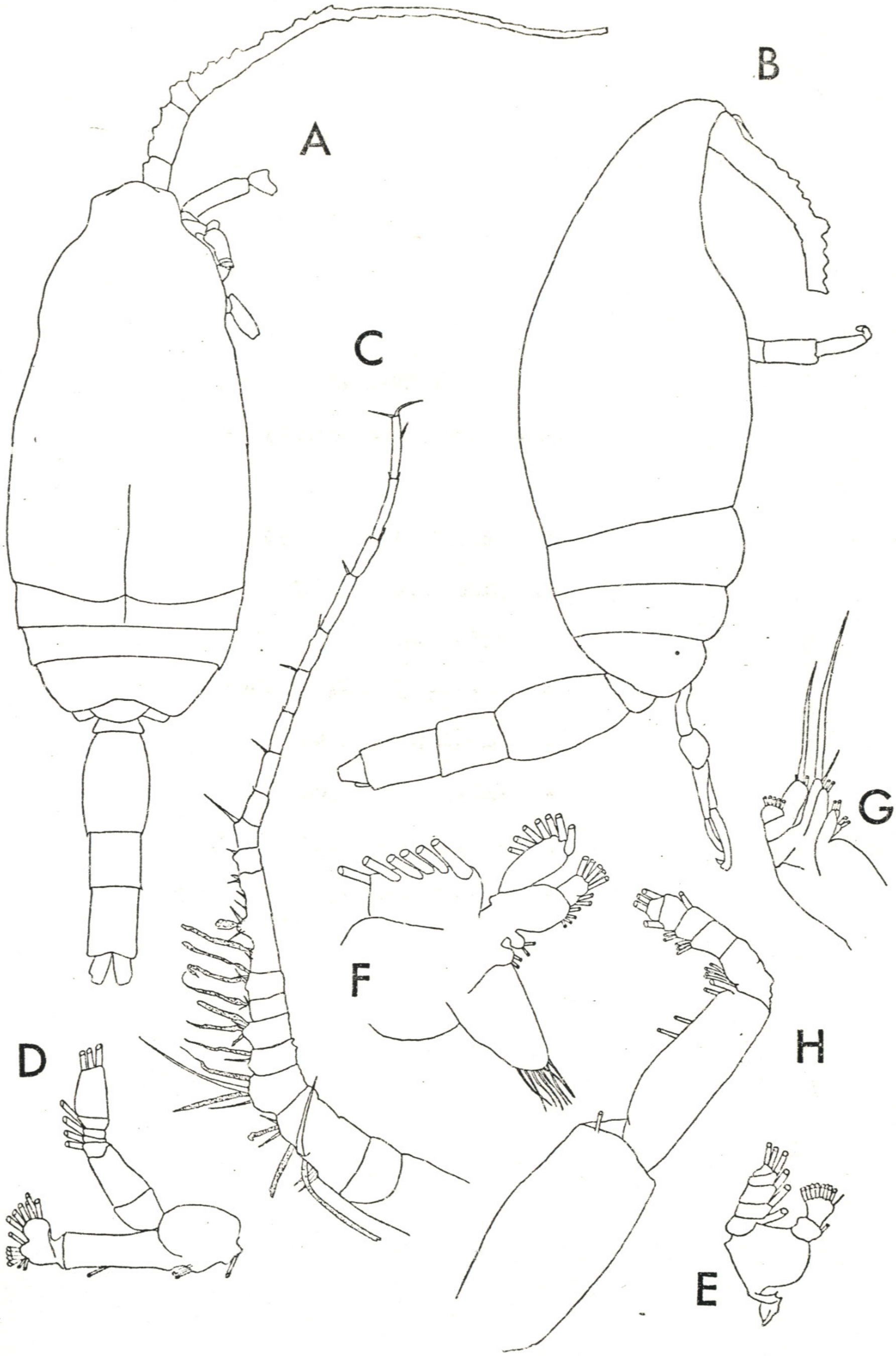
D. Second antenna x 80

E. Mandible x 80

F. Maxilla x 200

G. First maxilliped x 80

H. Second maxilliped x 200


A
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G
H

FIGURE 12.

Scaphocalanus brevicornis, male

A. First leg x 200

B. Second leg x 100

C. Third leg x 100

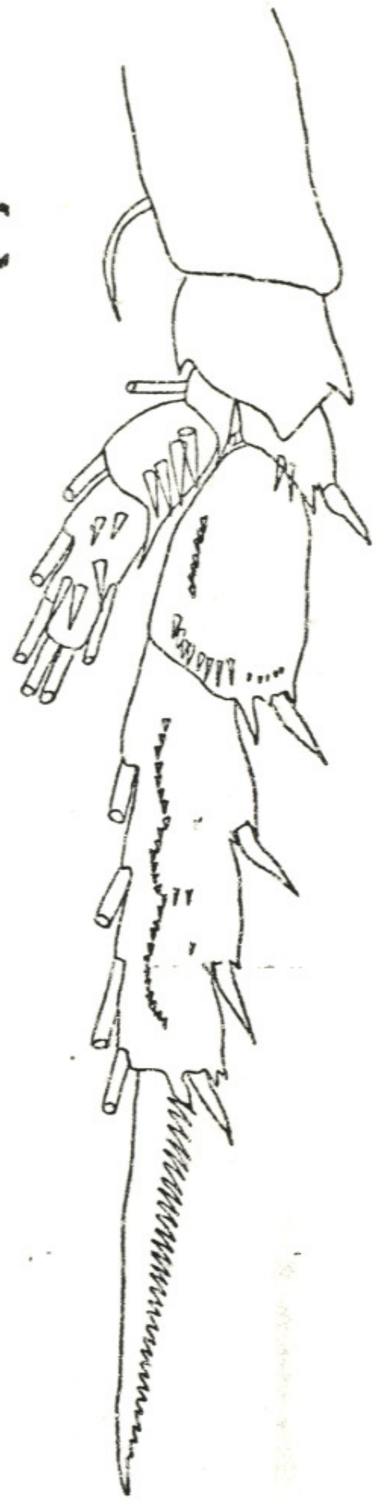
D. Fourth leg x 100

E. Fifth legs x 100

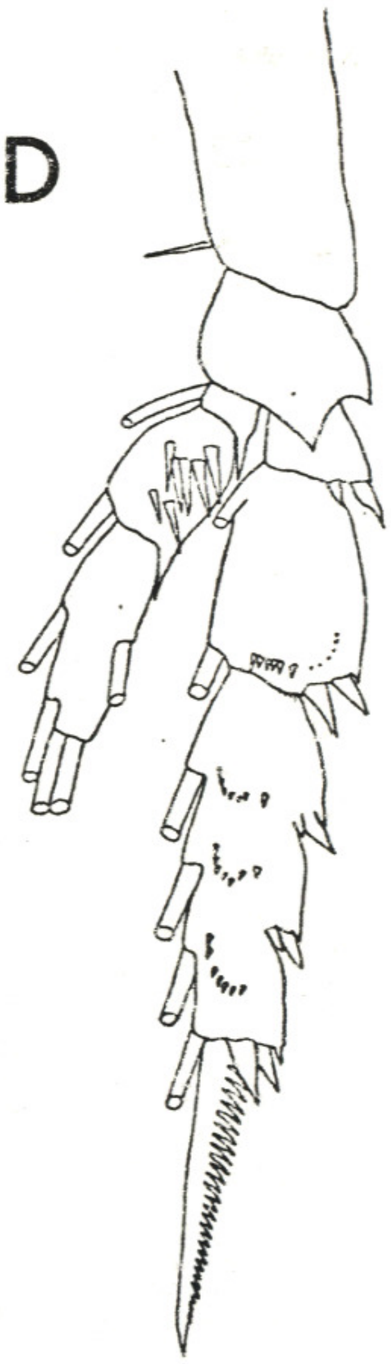
A

B

C



D



E

DISCUSSION

Both *Scaphocalanus brevicornis* and *S. echinatus* have been reported from the Strait of Georgia (Fulton, 1968, 1972). The former was listed as "rare" and the latter as "common" in that body of water. Only one species of *Scaphocalanus* was found in the present collection, and it best fits the descriptions of *S. brevicornis*.

The females of the two species are distinguishable by their size and by the form of the fifth legs. *S. echinatus* is the smaller of the two being generally less than 2 mm. long (Farran, 1905; Mori, 1964; Fulton, 1968, 1969). The fifth feet are very similar in all species of *Scaphocalanus* but they may be distinguished by the proportional lengths of the terminal and inner setae and by the form and number of teeth on the inner setae. In *S. brevicornis* the inner setae reach beyond the distal end of the terminal setae and are equipped with 17-20 teeth (Sars, 1900; Farran, 1903, 1929; Vervoort, 1951; Tanaka, 1961). In *S. echinatus* the inner setae do not reach beyond the terminal setae and are equipped with only 7-10 teeth (Farran, 1905, 1908, 1910; Mori, 1964; Tanaka, 1961).

The male of the present species appears to be identical with a single male specimen described by Tanaka (1937) as *S. minuta*. Vervoort (1951) consequently identified *S. minuta* as the male of *S. brevicornis*. Tanaka (1961) agreed with Vervoort's identification and described the males of both *S. brevicornis* and *S. echinatus*. They differ most conspicuously in the proportional lengths of the urosomal segments, in the proportional lengths of the urosome and metasome, and in total length.

Heterorhabdus tanneri (Giesbrecht, 1895)

(Figs. 13-16)

Heterochaeta tanneri Giesbrecht, 1895, Bull. Mus. Comp. Zoology, Harvard Coll., vol.25, no.12, p.259, pl.4, figs.5-6.

Heterorhabdus tanneri (Giesbrecht). Brodskii, 1950, Calanoida of the Far Eastern Seas and Polar Basin of the USSR, p.356-357, fig.251.

Description of female

Head separate from the second thoracic segment. Fifth and sixth thoracic segments also separate. Abdomen slightly less than 1/3 length of metasome. First antennae reaching to caudal rami when held in natural position. Distal edge of first to fourth urosomal segments fringed with small teeth. Sternal process between second maxillipeds pointed towards head, tipped with small denticles. Inner spine on second joint of exopod of fifth feet marked with conspicuous spiral line of denticles. All rami of all swimming legs three-segmented.

Total length: 3.42-3.91 mm.

Occurrance: Jervis and Bute Inlet. Rare in the Strait of Georgia.

Description of male

Much the same as female in general appearance. Abdomen five-segmented. Genital segment reduced, larger when viewed laterally. Caudal

FIGURE 13.

Heterorhabdus tanneri, female

A. Side view x 27

B. Dorsal view x 27

C. First antenna x 45

D. Second antenna x 70

E. Mandible x 70

F. Maxilla x 70

G. Second maxilliped x 70

H. First maxilliped x 75

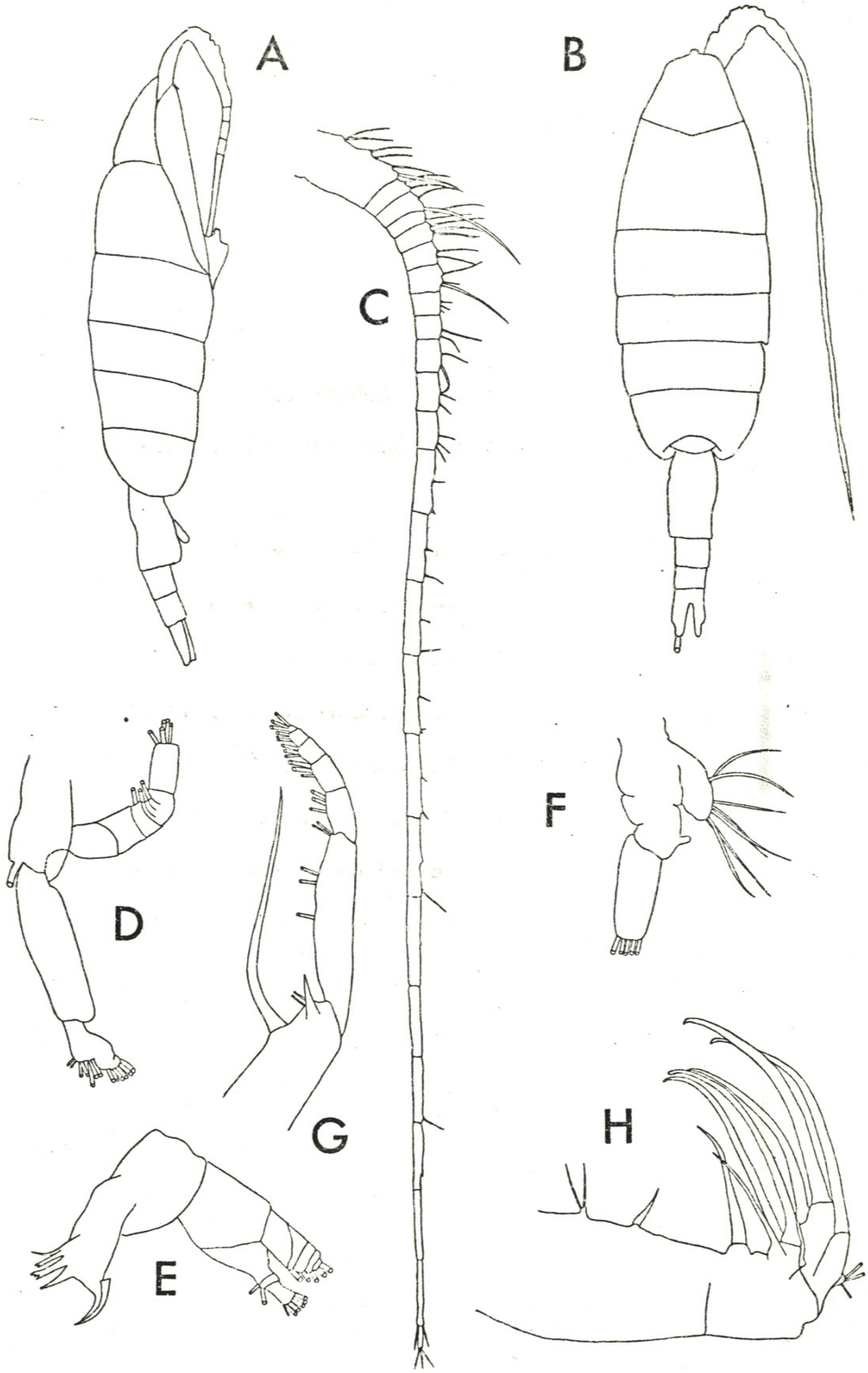

A
B
C
D
E
F
G
H

FIGURE 14.

Heterorhabdus tanneri, female

A. First leg x 70

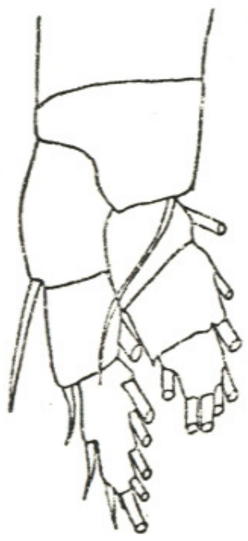
B. Second leg x 70

C. Third leg x 70

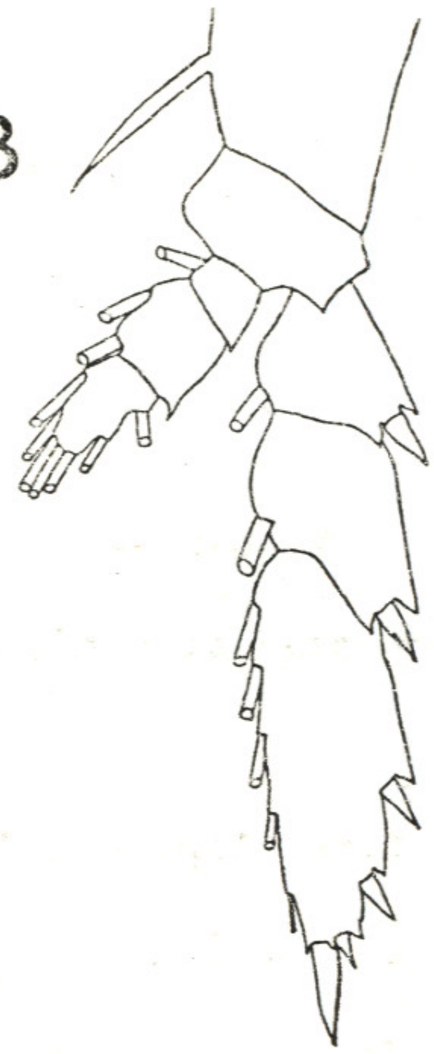
D. Fourth leg x 70

E. Fifth leg x 70

A



B



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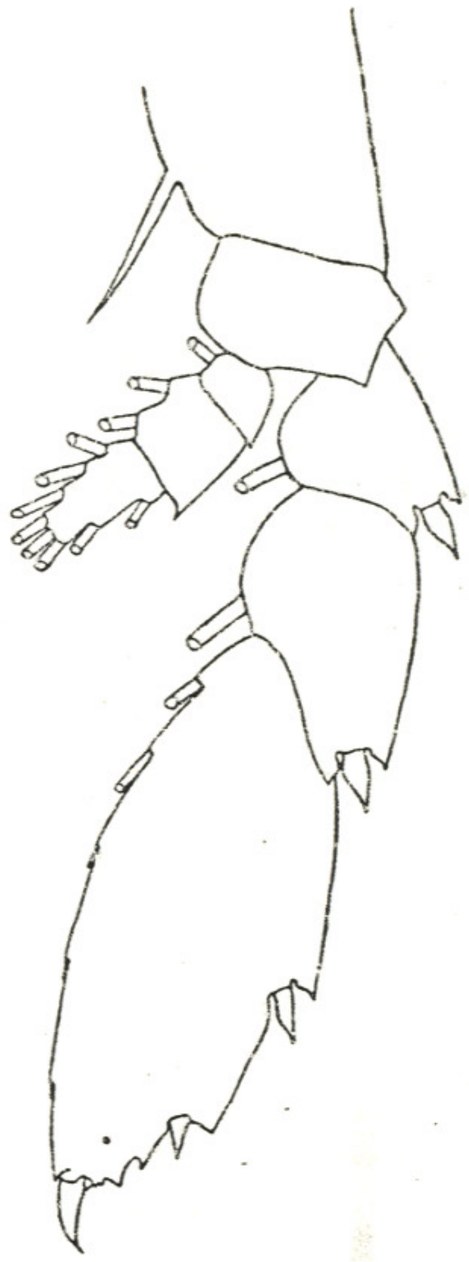

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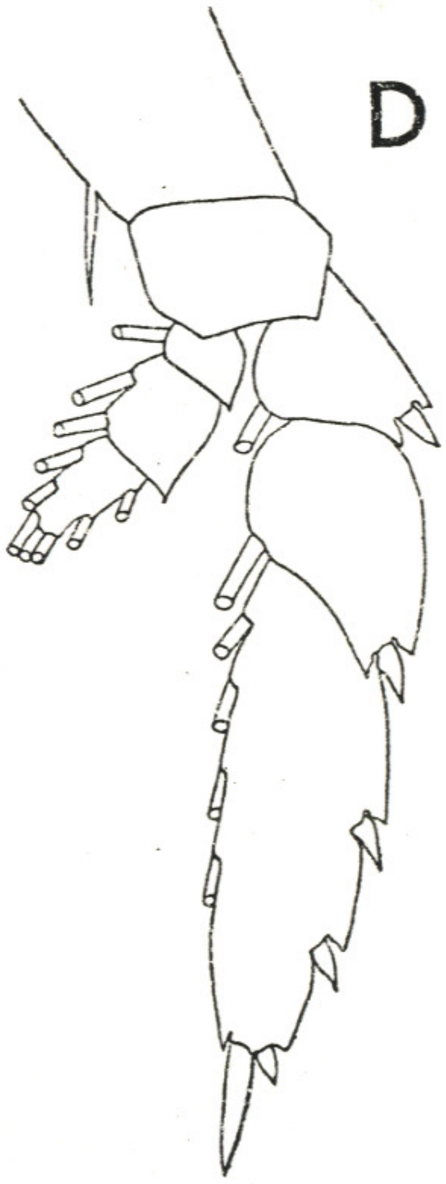

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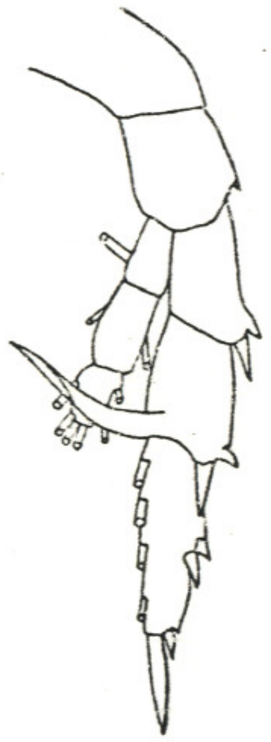


FIGURE 15.

Heterorhabdus tanneri, male

A. Side view x 27

B. First antenna x 46

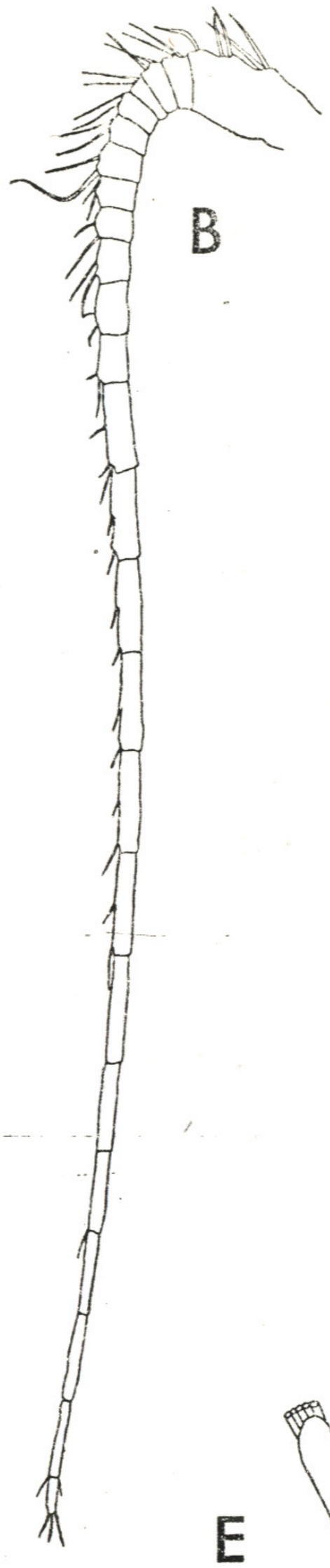
C. Second antenna x 70

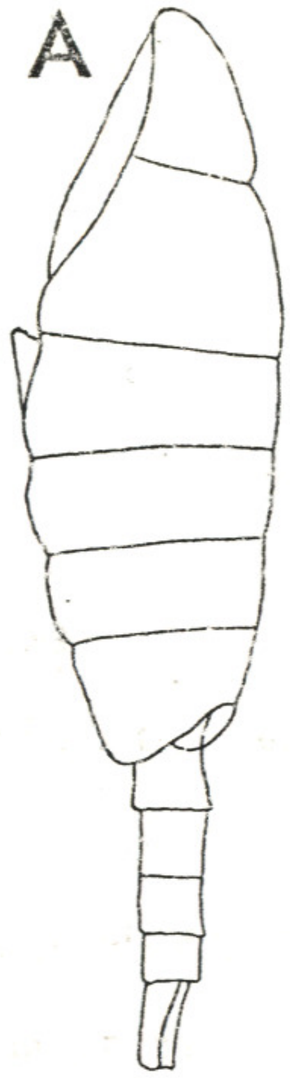
D. Mandible x 70

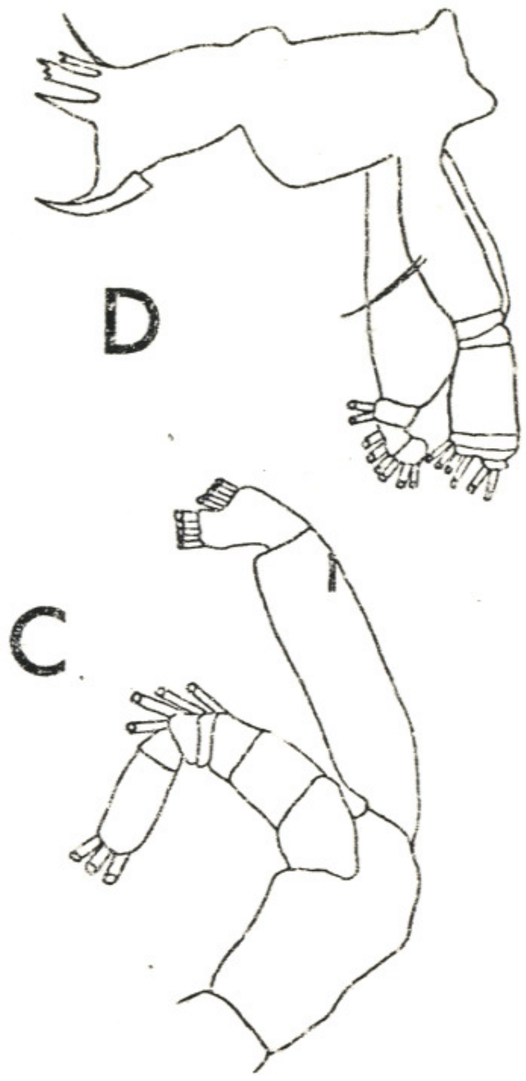
E. Maxilla x 70

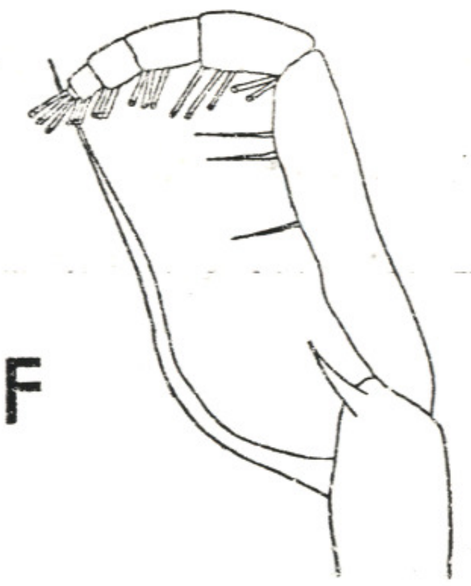
F. Second maxilliped x 70

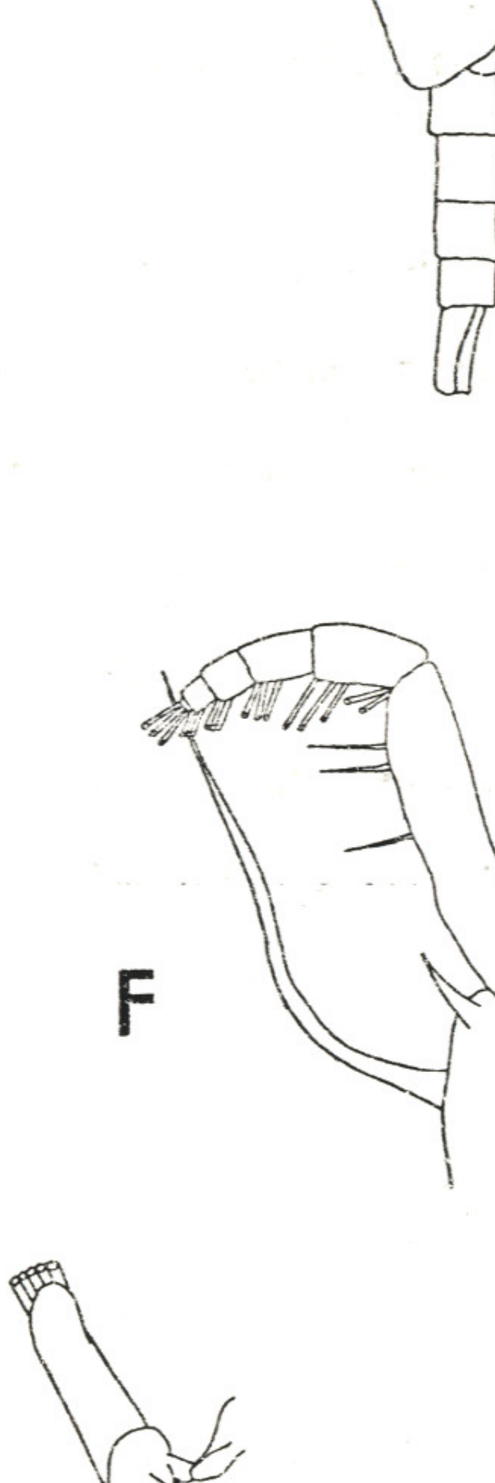
G. First maxilliped x 70











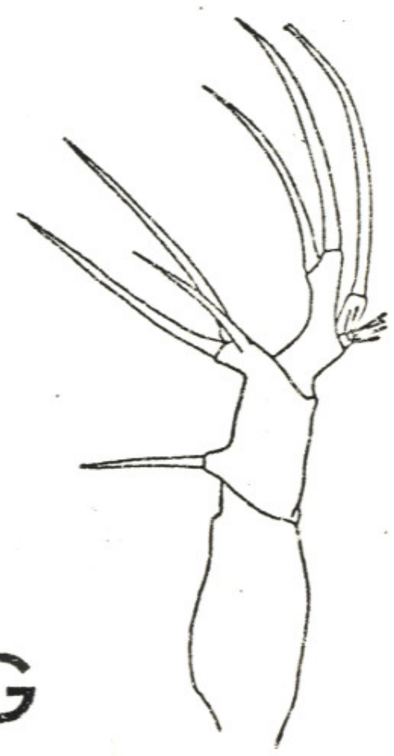


FIGURE 16.

Heterorhabdus tanneri, male

A. First leg x 70

B. Second leg x 70

C. Fourth leg x 70

D. Third leg x 70

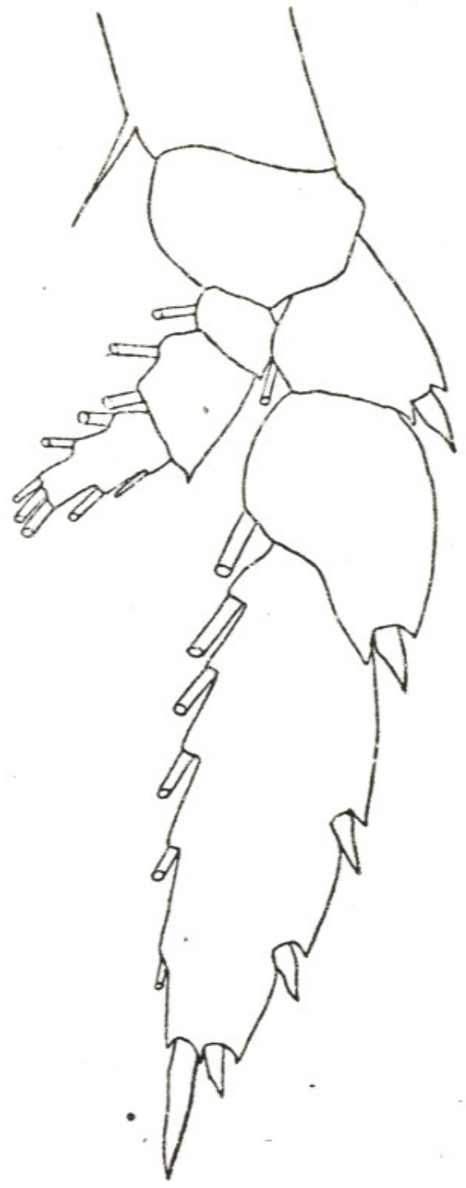
E. Right fifth leg x 70

F. Left fifth leg x 70

A

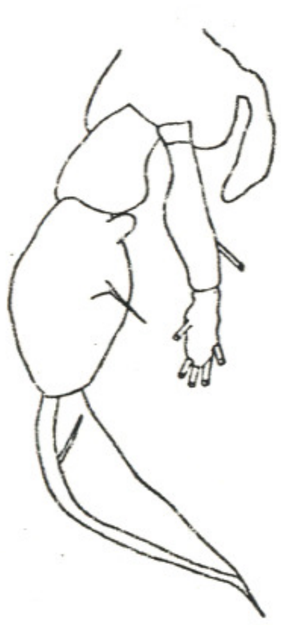
B

C



D

E



F

rami assymetrical as in female, left ramus provided with a long seta up to three times the body length. Right fifth leg provided with a small inner process on the proximal part of the first joint of the right exopod.

Total length: 3.10-3.42 mm.

Occurrance: Jervis and Bute Inlet. Rare in the Strait of Georgia.

DISCUSSION

The male of this species was first described by Giesbrecht (1895) from a single specimen found in the Pacific Ocean (35° N; 125° W). The female was first described by Brodskii (1950). The species is distinguished by the presence of a small process directed toward the basipodite, on the second joint of the right exopod of the fifth pair of legs of the male.

Davis (1949) reported a new species, *H. proximus*, from Puget Sound and off Cape Flattery, which may have been *H. tanneri*. Unfortunately the description of the male fifth foot is not detailed. Cameron (1957) included *H. proximus* in her list of copepods from the Queen Charlotte Islands. Her identification was uncertain, and she may also have been looking at *H. tanneri*. Fulton (1968, 1972) lists this species as "rare" in the Strait of Georgia.

APPENDIX 2. Statistics

From Figure 24 it is clear that *Calanus glacialis*, *C. plumchrus* and *Pseudocalanus minutus* migrated only slightly or not at all during a 24 hour period. For these species the three or four sampling times at each station in July can be used as replicates to estimate the uncertainty associated with a single observation. These estimates will most likely exceed the true confidence limits since some vertical movement is to be expected by these animals.

The basic data for *P. minutus* is shown in Table I. The dusk and 400-600 meter observations have been eliminated throughout because of missing data entries in these categories. All numbers represent numbers of animals/cubic meter transformed to logarithms for convenience in analysis of variance (anova). Table II represents a three-way anova of the *P. minutus* data. Note that the main effects of depth and station are highly significant, as expected. The depth-station interaction is highly significant. This is also to be expected, since animals will tend to hold approximately the same depth intervals along the inlet.

These results allow us to analyse the data in a two-way anova where time has been eliminated to give three replicates at each depth (Table III). With replication an error term can now be generated that can be used to estimate confidence limits for a single observation according to Winsor and Clarke (1940).

Within subgroup variance (Error) = .03216

Standard deviation = .17933

A deviation of .17933 in the logarithm of the catch means that the

catch has been multiplied or divided by 1.51123. Therefore one standard deviation in the logarithm corresponds to a percentage deviation, or coefficient of variation, of 51% in the catch.

Any vertical movement in *P. minutus* is likely to cause an overestimation of the coefficient of variation if the shallowest and deepest hauls are included. These depth intervals contain the fewest animals. A slight migration from the main population in mid-water may double or triple the population at the shallow and deep intervals but will affect the main population only slightly. Table IV shows the converted *P. minutus* data in which the shallowest and deepest hauls have been eliminated. The analysis is carried out as a single classification anova (Table IV-A). The coefficient of variation for a single observation is 36%. Since *P. minutus* appears to migrate slightly more than *C. glacialis* and *C. plumchrus* (Fig. 24) we can expect that the coefficient of variation for these two species will be even less. Actually, it is 20% for *C. glacialis* and 23% for *C. plumchrus* (Table V-B, V-C).

In order to test the significance of differences in total numbers between stations a one-way anova was carried out on the transformed totals (Table VI). These totals can be considered true replicates since they represent a series of samples from the entire water column. The coefficient of variation from this data is 12.5%. The 95% confidence limits for distribution diagrams in July can now be set at ± 25% of the catch. The analysis shows that the difference between stations is highly significant (Table VI). A student-Newman-Keuls test verifies that the means of the totals at each station differ significantly from each other (Table VII).

TABLE I. *P. minutus* data (transformed), dusk and 400-600 meters excluded.

Depth (m)	Times	Bute 2	Bute 4	Bute 6
0-50	MDNT	.72949	-	-
	DAWN	.97165	.27290	-
	NOON	.49638	.66140	.48359
50-100	MDNT	.60206	.42095	.18752
	DAWN	.16286	.23729	.37365
	NOON	.63528	.17609	.39794
100-200	MDNT	.93171	.30103	.89564
	DAWN	1.12888	.33885	.85071
	NOON	1.15452	.40569	.87245
200-300	MDNT	2.17739	2.05447	1.72278
	DAWN	2.27978	2.02419	1.88752
	NOON	2.20140	2.03561	1.79808
300-400	MDNT	2.31483	2.08894	1.04536
	DAWN	2.26460	2.22742	1.33457
	NOON	2.42916	2.11546	1.67066

TABLE II. Three-way analysis of variance table for *P. minutus* data from Bute Inlet.

Source of variation	df	SS	MS	Fs
Depths	4	24.4214	6.1054	167.64***
Stations	2	1.7340	.8670	23.81***
Time	2	.1426	.0713	
Depth x Station	8	1.5898	.1987	5.44**
Depth x Time	8	.1623	.0203	
Station x Time	4	.0773	.0193	
Depth x Station x Time	16	.5827	.0364	

TABLE III. Two-way analysis of variance table for *P. minutus* data from Bute Inlet

Source of variation	df	SS	MS	Fs
Subgroups	14	27.7453	1.9818	
Stations	2	1.7340	.8670	4.3628 ***
Depths	4	24.4214	6.1054	30.7219
Stations x Depths	8	1.5898	.1987	6.1794***
Within subgroups (Error)	30	.9649	.0322	

TABLE IV. Transformed data for *P. minutus*, shallow and deep hauls excluded.

2.13004	1.89311	.64885	1.80986
2.05063	2.08539	.83658	1.71448
2.02006	2.22484	.78469	1.88185
2.03159	2.11212	.80990	1.79111
.87766	2.17449	2.31272	1.22968
1.09534	2.27749	2.26224	1.00436
1.12297	2.19866	2.42754	1.31399
			1.66129

TABLE V. One-way analysis of variance for *P. minutus*, *C. plumchrus* and *C. glacialis* data from Bute Inlet.

Species	Source of variation	df	SS	MS
P. minutus	Among groups	7	8.55614	1.22231
	Within groups	21	.37876	.01804
	Total	28	8.93490	
C. glacialis	Among groups	7	10.00470	1.42924
	Within groups	21	.13271	.00632
	Total	28	10.13741	
C. plumchrus	Among groups	7	8.4640	1.20971
	Within groups	21	.16443	..00783
	Total	28	8.62843	

TABLE VI. Data and analysis of variance table of total counts from each staion in Bute Inlet. July, 1973.

Bute 2	Bute 4	Bute 6
2.90255	2.79239	2.39620
2.91908	2.70157	2.36173
2.03222	2.76790	2.43297
	2.68124	2.39620

Source of variation	df	SS	MS	Fs
Among groups	2	.55362	.27663	105.99***
Within groups	8	.02088	.00261	
Total	10	.57414		

TABLE VII. Student-Newman-Keuls comparison among means of station totals from Bute Inlet.

		Mean	2.39678	2.73578	2.95128
Rank		n_i	3	4	4
1	2.39678	3	-	-	-
2	2.73578	4	.339**	-	-
3	2.95128	4	.555**	.216**	-

APPENDIX 3. Data tables

TABLE I. Physical data

Date & Station	Depth (m)	Temperature (°C)	Oxygen (ml/l)	Salinity (°/oo)
	0	5.40	6.96	27.051
	10	6.25	6.67	27.956
	20	7.02	6.50	28.066
	30	7.72	4.0	29.839
	50	8.03	4.59	30.146
Jan. 17, 1973	100	8.52	3.99	30.550
	150	8.52	4.43	30.693
GS 1	200	8.60	3.44	30.897
	250	8.65	3.32	30.965
	300	8.74	3.21	31.048
	350	-	3.19	31.079
	0	4.90	6.82	24.117
	10	5.84	6.05	26.979
	20	5.79	6.04	27.379
	30	6.16	6.07	28.158
	50	7.44	4.73	29.595
Jan. 18, 1973	100	8.44	3.56	30.434
	150	8.58	3.18	30.640
Jervis 3	200	8.67	2.84	30.769
	300	8.65	2.48	30.968
	400	8.64	2.67	30.983
	500	8.63	2.73	30.993
	600	8.70	2.74	31.0
	0	6.95	6.81	28.822
	10	6.56	6.23	28.947
	20	6.78	6.12	29.171
	30	6.96	5.48	29.389
Feb. 20, 1973	50	7.10	5.29	29.555
	100	7.93	4.41	30.230
GN 1	150	7.83	4.96	30.454
	200	8.08	4.58	30.574
	300	8.27	4.11	30.704

TABLE I (cont'd.). Physical data

Date & Station	Depth (m)	Temperature (°C)	Oxygen (ml/l)	Salinity (°/oo)
	0	6.34	5.97	28.947
	10	6.44	5.72	29.083
	20	6.74	5.41	29.360
	30	7.06	5.05	29.621
	50	7.24	4.69	29.721
Feb. 21, 1973	100	7.47	4.53	29.914
	150	8.03	3.96	30.324
Bute 2	200	8.31	3.61	30.545
	300	8.41	3.55	30.622
	400	8.53	3.28	30.660
	500	8.58	3.33	30.668
	600	8.56	3.41	30.667
	0	5.10	7.49	24.321
	10	5.54	6.18	29.022
	20	5.60	5.83	29.20
Feb. 22, 1973	30	5.86	5.58	29.412
	50	5.92	5.51	29.504
Bute 6	100	6.91	4.53	29.875
	150	8.04	3.17	30.414
	200	8.42	2.90	30.602
	300	8.47	2.83	30.647
	0	13.83	6.16	26.981
	10	12.04	5.60	27.648
	20	10.18	4.83	28.726
July 16, 1973	30	9.88	4.87	29.029
	50	9.50	4.66	29.398
GN 1	100	8.17	4.17	30.244
	150	8.13	4.40	30.541
	200	8.17	4.32	30.643
	300	8.21	3.96	30.699
	0	15.26	7.30	13.591
July 17, 1973	10	10.21	5.34	27.472
	20	9.18	4.72	28.556
Bute 2	30	8.90	4.27	29.001
	50	8.49	3.99	29.632

TABLE I (cont'd.). Physical data

Date & Station	Depth (m)	Temperature (°C)	Oxygen (ml/l)	Salinity (°/oo)
	100	8.07	3.57	30.358
	150	8.18	3.50	30.518
July 17, 1973	200	8.22	3.68	30.536
	300	8.14	3.61	30.552
Bute 2	400	8.24	3.51	30.564
	500	8.23	3.49	30.575
	600	8.45	2.95	30.618
	0	14.73	7.61	6.705
	10	9.76	5.05	27.705
	20	8.98	4.47	28.702
	30	8.83	4.31	29.013
	50	7.54	4.48	29.339
July 18, 1973	100	7.98	3.42	30.325
	150	8.23	3.28	30.516
Bute 4	200	8.32	3.38	30.555
	300	8.33	3.30	30.581
	400	8.46	3.08	30.608
	500	8.48	3.02	30.632
	600	8.55	2.76	30.645
	0	12.08	7.93	2.1
	10	9.43	5.24	27.891
	20	8.79	5.12	28.625
July 19, 1973	30	8.37	4.83	29.009
	50	7.08	4.83	29.202
Bute 6	100	7.76	3.27	30.234
	150	8.29	2.88	30.488
	200	8.38	3.02	30.570
	300	8.45	2.84	30.604

TABLE II(1). Zooplankton Data from SCOR net hauls (numbers/cubic meter). GS 1, January, 1973.

Species name	0-50	50-100	100-200	200-300	300-400 meters
Calanus glacialis	-	1.0	9.0	190.0	195.84
Calanus plumchrus	-	-	1.36	30.32	31.04
Eucalanus bungii bungii	.08	-	-	.96	9.92
Pseudocalanus minutus	1.60	1.64	20.36	104.72	133.76
Spinocalanus brevicaudatus	-	-	.24	.16	1.08
Euchaeta japonica	.40	1.76	4.80	9.04	11.28
Scaphocalanus brevicornis	.04	-	.60	.08	.60
Scolecithricella minor	1.96	1.48	4.60	1.72	-
Gadius columbiae	-	-	6.92	36.72	6.92
Heterorhabdus tanneri	-	-	-	-	.08

TABLE II(2). Zoolplankton Data from SCOR net hauls (numbers/cubic meter). Jervis 3, January, 1973.

Species name	0-100	100-200	200-300	300-400	400-500	500-600 meters
Calanus glacialis	1.56	8.04	88.80	234.72	173.76	59.20
Calanus plumchrus	-	2.40	29.12	87.20	35.50	13.76
Eucalanus bungii bungii	-	-	1.12	4.64	20.48	2.88
Pseudocalanus minutus	3.08	24.60	62.08	110.88	129.92	73.92
Spinocalanus brevicaudatus	- -	- 20.04	- 8.76	- -	.88 21.76	.96 31.08
Euchaeta japonica	1.76	1.04	4.56	4.80	3.30	-
Scaphocalanus brevicornis	-	1.64	1.48	.92	-	1.28
Scolecithricella minor	2.0	2.32	-	-	-	-
Gadius columbiae	-	1.16	6.96	10.32	-	-
Heterorhabdus tanneri	.12	.96	1.04	.76	-	.72

TABLE II(3). Zooplankton Data from SCOR net hauls (numbers/cubic meter). Bute 2, February, 1973.

Species name	0-300	300-400	400-500	500-600 meters
Calanus glacialis	49.81	61.44	10.24	-
Calanus plumchrus	1.71	16.64	7.68	-
Eucalanus bungii bungii	.87	6.34	3.84	-
Pseudocalanus minutus	21.54	31.36	-	-
Spinocalanus brevicaudatus	.013 4.13	.16 2.0	.76 10.88	.24 9.92
Euchaeta japonica	4.26	8.96	7.04	-
Scaphocalanus brevicornis	.80	4.75	1.65	-
Metridia pacifica	25.60	-	1.76	17.60
Meteridia okhotensis	1.70	9.44	3.52	-
Gadius columbiae	21.58	70.96	68.76	-
Heterorhabdus tanneri	.96	1.08	.28	.80
Comanterna columbiae	-	-	.08	2.44

TABLE II(4). Zooplankton Data from SCOR net hauls (numbers/cubic meter). GN 1, 1973.

Species name	0-100	100-200	200-300 meters
Calanus glacialis	7.20	9.92	15.60
Calanus plumchrus	-	.56	3.04
Eucalanus bungii bungii	-	.04	.64
Pseudocalanus minutus	9.92	7.92	7.12
Spinocalanus brevicaudatus	-	.08	.52
Euchaeta japonica	.44	2.36	3.04
Scaphocalanus brevicornis	-	-	.30
Metridia pacifica	3.04	46.56	2.28
Metridia okhotensis	-	-	.16
Gadius columbiae	-	.12	1.0
Heterorhabdus tanneri	-	-	.04

APPENDIX 3

TABLE III(1-74)

TABLE 1 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION GN 1 TIME DAY DEPTH INTERVAL 50- 0 M.

DATE JULY 16.1973 AMT.FILTERED 22.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	0.136	0.136	0.000	0.273	23.1
CALANUS PLUMCHRUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
EUCALANUS BUNGII BUNGII	0.000	0.000	0.000	0.000	0.000	0.000	0.0
PSEUDOCALANUS MINUTUS	0.000	0.000	0.045	0.000	0.000	0.045	3.8
SPINOCALANUS BREVICAUDATUS	0.000	0.045	0.045	0.000	0.000	0.091	7.7
ACARTIOPSIS ACUATUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
GADIUS COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
EUCHAETA JAPONICA	0.000	0.000	0.000	0.000	0.227	0.227	19.2
SCAPHOCALANUS SP.	0.000	0.000	0.000	0.000	0.000	0.000	0.0
SCOLECITHRICELLA MINOR	0.091	0.409	0.045	0.000	0.000	0.545	46.2
THARYCIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA OKHOTENSIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
HETEROHABDUS TANNERI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CANDACIA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
				TOTAL		1.182	

TABLE 2 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION GN 1 TIME DAY DEPTH INTERVAL 100- 50 M.

DATE JULY 16.1973 AMT.FILTERED 22.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	1.364	0.000	0.000	1.364	17.6
CALANUS PLUMCHRUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
EUCALANUS BUNGII BUNGII	0.000	0.000	0.000	0.000	0.000	0.000	0.0
PSEUDOCALANUS MINUTUS	0.000	0.000	0.091	0.000	0.000	0.091	1.2
SPINOCALANUS BREVICAUDATUS	0.000	0.000	0.045	0.000	0.000	0.045	0.6
ACARTIOPSIS ACUATUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
GADIUS COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
EUCHAETA JAPONICA	0.000	0.000	0.000	0.000	1.364	1.364	17.6
SCAPHOCALANUS SP.	0.000	0.000	0.000	0.000	0.000	0.000	0.0
SCOLECITHRICELLA MINOR	0.364	3.864	0.409	0.000	0.000	4.636	60.0
THARYCIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.000	0.000	0.000	0.000	0.227	0.227	2.9
METRIDIA OKHOTENSIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
HETEROHABDUS TANNERI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CANDACIA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
				TOTAL		7.727	

TABLE 3 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION GN 1 TIME DAY DEPTH INTERVAL 200-100 M.

DATE JULY 16,1973 AMT.FILTERED 44.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	5.818	0.000	0.000	5.818	1.3
CALANUS PLUMCHRUS	0.000	0.000	0.364	0.000	0.000	0.364	0.1
EUCALANUS BUNGII BUNGII	0.000	0.000	1.091	0.000	0.000	1.091	0.2
PSEUDOCALANUS MINUTUS	0.000	0.000	3.273	0.000	0.000	3.273	0.7
SPINOCALANUS BREVICAUDATUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
ACTIDEUS ARMATUS	0.000	0.000	0.182	0.000	0.000	0.182	0.0
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.545	0.909	1.091	0.727	3.273	0.7
GADIUS COLUMBIAE	0.000	0.182	0.727	3.636	0.182	4.727	1.0
EUCHAETA JAPONICA	0.364	0.727	2.182	1.455	1.455	6.182	1.4
SCAPHOCALANUS SP.	0.000	0.000	0.000	0.000	0.000	0.000	0.0
SCOLECITHRICELLA MINOR	0.909	4.182	0.727	0.000	0.000	5.818	1.3
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	21.818	401.454	1.455	0.000	0.000	424.727	93.2
METRIDIA OKHOTENSIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
HETEROHABDUS TANNERI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CANDACIA COLUMBIAE	0.182	0.000	0.182	0.000	0.000	0.364	0.1

TOTAL 455.817

TABLE 4 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION GN 1 TIME DAY DEPTH INTERVAL 300-200 M.

DATE JULY 16,1973 AMT.FILTERED 44.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	93.455	0.000	0.000	93.455	42.1
CALANUS PLUMCHRUS	0.000	0.000	1.818	0.000	0.000	1.818	0.8
EUCALANUS BUNGII BUNGII	0.000	0.000	4.182	0.000	0.000	4.182	1.9
PSEUDOCALANUS MINUTUS	0.000	0.000	65.818	0.000	0.000	65.818	29.7
SPINOCALANUS BREVICAUDATUS	0.000	0.273	0.091	0.000	0.000	0.364	0.2
ACTIDEUS ARMATUS	0.000	0.091	0.045	0.000	0.000	0.136	0.1
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.273	0.318	0.045	0.500	1.636	0.7
GADIUS COLUMBIAE	0.000	1.273	1.091	4.364	1.818	8.545	3.9
EUCHAETA JAPONICA	0.318	1.045	0.727	0.364	4.000	6.455	2.9
SCAPHOCALANUS SP.	0.091	0.182	0.364	0.045	0.000	0.682	0.3
SCOLECITHRICELLA MINOR	0.273	2.182	0.318	0.000	0.000	2.773	1.2
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	24.000	7.455	1.818	0.182	0.000	33.455	15.1
METRIDIA OKHOTENSIS	0.000	0.091	1.500	0.000	0.000	1.591	0.7
HETEROHABDUS TANNERI	0.045	0.000	0.000	0.000	0.000	0.045	0.0
CANDACIA COLUMBIAE	0.091	0.227	0.273	0.000	0.273	0.864	0.4

TOTAL 221.818

TABLE 5 ZOOPLANKTON COUNTS, ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 2 TIME MDNT DEPTH INTERVAL 50- 0 M.

DATE JULY 16,1973 AMT.FILTERED 22.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	2.364	0.000	0.000	2.364	5.3
CALANUS PLUMCHRUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
EUCALANUS BUNGII BUNGII	0.000	0.000	0.000	0.000	0.000	0.000	0.0
PSEUDOCALANUS MINUTUS	0.000	3.636	0.727	0.000	0.000	4.364	9.7
SPINOCALANUS BREVICAUDATUS	0.000	0.136	0.182	0.000	0.000	0.318	0.7
AETIDEUS ARMATUS	0.000	0.455	0.000	0.045	0.000	0.500	1.1
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.273	0.091	0.000	0.091	0.455	1.0
GADIUS COLUMBIAE	0.000	0.909	2.364	9.273	1.273	13.818	30.7
EUCHAETA JAPONICA	0.000	0.136	4.000	2.727	2.727	9.591	21.3
SCAPHOCALANUS SP.	0.000	0.000	0.045	0.136	0.000	0.182	0.4
SCOLECITHRICELLA MINOR	0.182	1.182	0.273	0.000	0.000	1.636	3.6
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	4.955	4.364	1.455	0.000	0.545	11.273	25.1
METRIDIA OKHOTENSIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
HETERORHABDUS TANNERI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CANDACIA COLUMBIAE	0.000	0.136	0.000	0.000	0.318	0.455	1.0

TOTAL 44.954

TABLE 6 ZOOPLANKTON COUNTS, ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 2 TIME MDNT DEPTH INTERVAL 100- 50 M.

DATE JULY 17,1973 AMT.FILTERED 22.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.227	0.000	0.000	0.000	0.227	0.6
CALANUS PLUMCHRUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
EUCALANUS BUNGII BUNGII	0.000	0.000	0.318	0.000	0.000	0.318	0.8
PSEUDOCALANUS MINUTUS	0.000	0.000	3.000	0.000	0.000	3.000	7.3
SPINOCALANUS BREVICAUDATUS	0.000	10.909	1.545	0.000	0.000	12.455	30.2
AETIDEUS ARMATUS	0.045	0.318	0.000	0.000	0.000	0.364	0.9
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.045	0.182	0.182	0.227	0.091	0.727	1.8
GADIUS COLUMBIAE	0.000	0.091	0.545	5.818	7.864	14.318	34.8
EUCHAETA JAPONICA	0.000	0.091	0.591	0.136	3.545	4.364	10.6
SCAPHOCALANUS SP.	0.045	0.273	0.955	0.318	0.000	1.591	3.9
SCOLECITHRICELLA MINOR	0.000	0.591	0.000	0.000	0.000	0.591	1.4
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	1.364	0.182	0.409	0.182	0.000	2.136	5.2
METRIDIA OKHOTENSIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
HETERORHABDUS TANNERI	0.136	0.318	0.455	0.000	0.000	0.909	2.2
CANDACIA COLUMBIAE	0.000	0.000	0.000	0.000	0.182	0.182	0.4

TOTAL 41.182

TABLE 7 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 2 TIME MDNT DEPTH INTERVAL 200-100 M.

DATE JULY 17,1973 AMT.FILTERED 44.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	0.182	0.000	0.000	0.182	0.3
CALANUS PLUMCHRUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
EUCALANUS BUNGII BUNGII	0.000	0.000	0.068	0.000	0.000	0.068	0.1
PSEUDOCALANUS MINUTUS	0.000	0.000	7.545	0.000	0.000	7.545	13.7
SPINOCALANUS BREVICAUDATUS	0.023	17.909	11.727	0.545	0.000	30.205	54.8
ARTIOPUS ARMATUS	0.000	0.023	0.045	0.000	0.000	0.068	0.1
CORNATIPNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.023	0.000	0.068	0.023	0.114	0.2
GADIUS COLUMBIAE	0.000	0.000	0.227	0.000	5.273	5.500	10.0
EUCHAETA JAPONICA	0.023	0.182	0.000	0.182	2.273	2.659	4.8
SCAPHOCALANUS SP.	0.045	0.250	1.227	0.295	0.000	1.818	3.3
SCOLECITHRICELLA MINOR	0.000	0.023	0.000	0.000	0.000	0.023	0.0
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	5.182	0.091	0.409	0.023	0.000	5.705	10.3
METRIDIA OKHOTENSIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
HETEROPHAEDUS TANNERI	0.341	0.386	0.386	0.091	0.000	1.205	2.2
CANDACIA COLUMBIAE	0.023	0.000	0.000	0.000	0.045	0.068	0.1
				TOTAL		55.159	

TABLE 8 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 2 TIME MDNT DEPTH INTERVAL 300-200 M.

DATE JULY 17,1973 AMT.FILTERED 44.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	11.182	0.000	0.000	11.182	4.8
CALANUS PLUMCHRUS	0.000	0.000	0.636	0.000	0.000	0.636	0.3
EUCALANUS BUNGII BUNGII	0.000	0.000	0.409	0.000	0.000	0.409	0.2
PSEUDOCALANUS MINUTUS	0.000	0.000	149.455	0.000	0.000	149.455	64.5
SPINOCALANUS BREVICAUDATUS	0.182	11.091	17.545	2.182	0.000	31.000	13.4
ARTIOPUS ARMATUS	0.045	0.000	0.000	0.000	0.000	0.045	0.0
CORNATIPNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.068	0.045	0.023	0.000	0.136	0.1
GADIUS COLUMBIAE	0.000	0.068	0.273	0.886	8.545	9.773	4.2
EUCHAETA JAPONICA	0.114	0.205	0.182	0.091	3.364	3.955	1.7
SCAPHOCALANUS SP.	0.091	0.364	1.773	1.500	0.045	3.773	1.6
SCOLECITHRICELLA MINOR	0.000	0.000	0.000	0.000	0.000	0.000	0.0
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	16.909	0.250	0.114	0.091	0.000	17.364	7.5
METRIDIA OKHOTENSIS	0.000	0.523	1.568	0.000	0.000	2.091	0.9
HETEROPHAEDUS TANNERI	0.750	0.909	0.295	0.023	0.000	1.977	0.9
CANDACIA COLUMBIAE	0.045	0.023	0.000	0.000	0.023	0.091	0.0
				TOTAL		231.886	

TABLE 9 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 2 TIME MDNT DEPTH INTERVAL 400-300 M.

DATE JULY 17,1973 AMT.FILTERED 44.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	54.000	0.000	0.000	54.000	15.3
CALANUS PLUMCHRUS	0.000	0.000	31.273	0.000	0.000	31.273	8.8
EUCALANUS BUNGII BUNGII	0.000	0.000	2.523	0.000	0.000	2.523	0.7
PSEUDOCALANUS MINUTUS	0.000	0.000	205.455	0.000	0.000	205.455	58.0
SPINOCALANUS BREVICAUDATUS	0.841	8.273	13.636	1.364	0.000	24.114	6.8
ALTIUS ARMATUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CLMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.023	0.045	0.023	0.000	0.000	0.091	0.0
GADIUS COLUMBIAE	0.000	0.000	0.182	0.682	6.545	7.409	2.1
EUCHAETA JAPONICA	0.114	0.386	0.000	0.000	1.818	2.318	0.7
SCAPHOCALANUS SP.	0.114	0.682	1.886	0.864	0.045	3.591	1.0
SCOLECITHRICELLA MINOR	0.000	0.000	0.000	0.000	0.000	0.000	0.0
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	10.636	0.341	0.068	0.000	0.000	17.045	4.8
METRIDIA OKHOTENSIS	0.000	0.545	1.886	0.000	0.000	2.432	0.7
HETERORHABDUS TANNERI	1.705	1.568	0.250	0.023	0.000	3.545	1.0
CANDACIA COLUMBIAE	0.068	0.045	0.000	0.000	0.068	0.182	0.1
				TOTAL		353.976	

TABLE 10 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 2 TIME DAWN DEPTH INTERVAL 50- 0 M.

DATE JULY 17,1973 AMT.FILTERED 22.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	2.727	0.636	0.000	0.000	3.364	9.0
CALANUS PLUMCHRUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
EUCALANUS BUNGII BUNGII	0.000	0.000	2.727	0.000	0.000	2.727	7.3
PSEUDOCALANUS MINUTUS	0.000	8.182	0.182	0.000	0.000	8.364	22.4
SPINOCALANUS BREVICAUDATUS	0.000	0.000	0.045	0.000	0.000	0.045	0.1
ALTIUS ARMATUS	0.000	0.091	0.000	0.000	0.000	0.091	0.2
CLMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
GADIUS COLUMBIAE	0.000	0.091	0.000	0.000	0.000	0.091	0.2
EUCHAETA JAPONICA	0.000	0.682	7.455	6.545	0.364	15.045	40.3
SCAPHOCALANUS SP.	0.000	0.000	0.000	0.000	0.000	0.000	0.0
SCOLECITHRICELLA MINOR	0.000	0.364	0.000	0.000	0.000	0.364	1.0
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.136	3.227	1.818	0.636	0.091	5.773	15.5
METRIDIA OKHOTENSIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
HETERORHABDUS TANNERI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CANDACIA COLUMBIAE	0.045	0.045	0.227	0.545	0.591	1.455	3.9
				TOTAL		37.318	

TABLE 11 ZOOPLANKTON COUNTS, ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 2 TIME DAWN DEPTH INTERVAL 100- 50 M.

DATE JULY 17,1973 AMT.FILTERED 22.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	0.091	0.000	0.000	0.091	2.0
CALANUS PLUMCHRUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
EUCALANUS BUNGII BUNGII	0.000	0.000	0.000	0.000	0.000	0.000	0.0
PSEUDOCALANUS MINUTUS	0.000	0.000	0.455	0.000	0.000	0.455	10.1
SPINOCALANUS BREVICAUDATUS	0.000	0.773	0.045	0.000	0.000	0.818	18.2
ACARTIUS ACUTUS	0.000	0.045	0.000	0.000	0.000	0.045	1.0
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.091	0.000	0.182	0.000	0.273	6.1
GADIUS COLUMBIAE	0.000	0.000	0.000	0.000	0.909	0.909	20.2
EUCHAETA JAPONICA	0.000	0.000	0.136	0.045	0.045	0.227	5.1
SCAPHOCALANUS SP.	0.000	0.000	0.000	0.000	0.000	0.000	0.0
SCOLECITHRICELLA MINOR	0.000	0.773	0.136	0.000	0.000	0.909	20.2
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.000	0.227	0.455	0.000	0.000	0.682	15.2
METRIDIA OKHOTENSIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
HETERORHABDUS TANNERI	0.045	0.000	0.045	0.000	0.000	0.091	2.0
CANDACIA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
				TOTAL		4.500	

TABLE 12 ZOOPLANKTON COUNTS, ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 2 TIME DAWN DEPTH INTERVAL 200-100 M.

DATE JULY 17,1973 AMT.FILTERED 44.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.023	0.091	0.182	0.000	0.000	0.295	0.3
CALANUS PLUMCHRUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
EUCALANUS BUNGII BUNGII	0.000	0.000	1.000	0.000	0.000	1.000	1.0
PSEUDOCALANUS MINUTUS	0.000	0.000	12.455	0.000	0.000	12.455	12.6
SPINOCALANUS BREVICAUDATUS	0.045	17.909	7.909	0.545	0.000	26.409	26.6
ACARTIUS ACUTUS	0.000	0.091	0.045	0.023	0.000	0.159	0.2
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.045	0.227	0.159	0.068	0.136	0.636	0.6
GADIUS COLUMBIAE	0.000	0.215	2.114	13.818	14.909	31.045	31.3
EUCHAETA JAPONICA	0.182	0.409	3.000	1.000	2.909	7.500	7.6
SCAPHOCALANUS SP.	0.091	0.614	2.341	0.477	0.000	3.523	3.6
SCOLECITHRICELLA MINOR	0.023	0.205	0.045	0.000	0.000	0.273	0.3
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	12.000	1.455	0.409	0.045	0.000	13.909	14.0
METRIDIA OKHOTENSIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
HETERORHABDUS TANNERI	0.705	0.750	0.409	0.000	0.000	1.864	1.9
CANDACIA COLUMBIAE	0.000	0.023	0.023	0.023	0.023	0.091	0.1
				TOTAL		99.159	

TABLE 13 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE. 2 TIME DAWN DEPTH INTERVAL 300-200 M.

DATE JULY 17,1973 AMT.FILTERED 44.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.091	11.455	0.000	0.000	11.545	3.9
CALANUS PLUMCHRUS	0.000	0.000	1.091	0.000	0.000	1.091	0.4
EUCALANUS BUNGII BUNGII	0.000	0.000	0.727	0.000	0.000	0.727	0.2
PSEUDOCALANUS MINUTUS	0.000	0.000	189.455	0.000	0.000	189.455	63.5
SPINOCALANUS BREVICAUDATUS	0.045	14.909	20.364	1.273	0.000	36.591	12.3
ATTIDEUS ARMATUS	0.045	0.045	0.000	0.000	0.000	0.091	0.0
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.068	0.023	0.068	0.045	0.205	0.1
GADIUS COLUMBIAE	0.000	0.068	1.409	2.818	13.455	17.750	6.0
EUCHAETA JAPONICA	0.159	0.795	0.182	0.545	2.000	3.682	1.2
SCAPHOCALANUS SP.	0.045	0.432	2.341	1.432	0.023	4.273	1.4
SCOLECITHRICELLA MINOR	0.000	0.000	0.091	0.000	0.000	0.091	0.0
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	28.364	0.591	0.159	0.000	0.000	29.114	9.8
METRIDIA OKHOTENSIS	0.000	0.386	1.250	0.045	0.000	1.682	0.6
HETEROPHABDUS TANNERI	0.591	0.818	0.500	0.045	0.000	1.955	0.7
CANDACIA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0

TOTAL 298.249

TABLE 14 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 2 TIME DAWN DEPTH INTERVAL 400-300 M.

DATE JULY 17,1973 AMT.FILTERED 44.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	43.091	0.000	0.000	43.091	14.6
CALANUS PLUMCHRUS	0.000	0.000	23.182	0.000	0.000	23.182	7.8
EUCALANUS BUNGII BUNGII	0.000	0.000	0.273	0.000	0.000	0.273	0.1
PSEUDOCALANUS MINUTUS	0.000	0.000	182.909	0.000	0.000	182.909	61.8
SPINOCALANUS BREVICAUDATUS	0.318	5.023	11.432	2.659	0.000	19.432	6.6
ATTIDEUS ARMATUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.068	0.023	0.000	0.000	0.091	0.0
GADIUS COLUMBIAE	0.023	0.023	0.114	0.909	4.773	5.841	2.0
EUCHAETA JAPONICA	0.136	0.159	0.000	0.000	2.727	3.023	1.0
SCAPHOCALANUS SP.	0.000	0.295	0.864	0.977	0.182	2.318	0.8
SCOLECITHRICELLA MINOR	0.000	0.000	0.000	0.000	0.000	0.000	0.0
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	11.864	0.159	0.368	0.000	0.000	12.091	4.1
METRIDIA OKHOTENSIS	0.000	0.364	1.273	0.000	0.000	1.636	0.6
HETEROPHABDUS TANNERI	0.886	0.955	0.091	0.000	0.000	1.932	0.7
CANDACIA COLUMBIAE	0.000	0.000	0.023	0.023	0.114	0.159	0.1

TOTAL 295.976

TABLE 15 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 2 TIME DAWN DEPTH INTERVAL 600-400 M.

DATE JULY 17,1973 AMT.FILTERED 88.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	21.909	0.000	0.000	21.909	22.4
CALANUS PLUMCHRUS	0.000	0.000	8.909	0.000	0.000	8.909	9.1
EUCALANUS BUNGII BUNGII	0.000	0.000	10.455	0.000	0.000	10.455	10.7
PSEUDOCALANUS MINUTUS	0.000	0.000	20.455	0.000	0.000	20.455	20.9
SPINOCALANUS BREVICAUDATUS	0.409	7.591	9.500	1.409	0.000	18.909	19.3
ACTIDEUS ARMATUS	0.000	0.011	0.000	0.000	0.000	0.011	0.0
CLEANTENNA COLUMBIAE	0.057	0.023	0.034	0.000	0.000	0.114	0.1
CHIRIDIUS GRACILIS	0.023	0.011	0.023	0.011	0.000	0.068	0.1
GAPIUS COLUMBIAE	0.000	0.011	0.091	0.148	0.920	1.170	1.2
EUCHAETA JAPONICA	0.057	0.386	0.000	0.000	1.727	2.170	2.2
SCAPHOCALANUS SP.	0.057	0.307	0.511	0.250	0.011	1.136	1.2
SCOLECITHRICELLA MINOR	0.000	0.000	0.000	0.000	0.000	0.000	0.0
THARYEIS FULTONI	0.000	0.011	0.000	0.000	0.000	0.011	0.0
METRIDIA PACIFICA	11.091	0.170	0.011	0.000	0.000	11.273	11.5
METRIDIA OKHOTENSIS	0.000	0.000	0.102	0.000	0.000	0.102	0.1
HETERORHABDUS TANNERI	0.318	0.511	0.193	0.011	0.000	1.034	1.1
CANDACIA COLUMBIAE	0.011	0.011	0.011	0.023	0.011	0.068	0.1

TOTAL 97.795

TABLE 16 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 2 TIME NOON DEPTH INTERVAL 50- 0 M.

DATE JULY 17,1973 AMT.FILTERED 22.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	0.409	0.000	0.000	0.409	8.0
CALANUS PLUMCHRUS	0.000	0.000	0.045	0.000	0.000	0.045	0.9
EUCALANUS BUNGII BUNGII	0.000	0.000	0.045	0.000	0.000	0.045	0.9
PSEUDOCALANUS MINUTUS	0.000	0.000	2.136	0.000	0.000	2.136	42.0
SPINOCALANUS BREVICAUDATUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
ACTIDEUS ARMATUS	0.045	0.045	0.000	0.000	0.000	0.091	1.8
CLEANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
GAPIUS COLUMBIAE	0.000	0.000	0.000	0.000	0.182	0.182	3.6
EUCHAETA JAPONICA	0.000	0.000	0.000	0.000	0.818	0.818	16.1
SCAPHOCALANUS SP.	0.000	0.000	0.000	0.000	0.000	0.000	0.0
SCOLECITHRICELLA MINOR	0.045	0.318	0.045	0.000	0.000	0.409	8.0
THARYEIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.045	0.045	0.000	0.000	0.955	0.955	18.8
METRIDIA OKHOTENSIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
HETERORHABDUS TANNERI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CANDACIA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0

TOTAL 5.091

TABLE 17 ZOOPLANKTON COUNTS, ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 2 TIME NOON DEPTH INTERVAL 100- 50 M.

DATE JULY 17,1973 AMT.FILTERED 22.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CALANUS PLUMCHRUS	0.000	0.000	0.318	0.000	0.000	0.318	1.7
EUCALANUS BUNGII BUNGII	0.000	0.000	0.818	0.000	0.000	0.818	4.5
PSEUDOCALANUS MINUTUS	0.000	0.000	3.318	0.000	0.000	3.318	18.1
SPINOCALANUS BREVICAUDATUS	0.000	0.000	0.409	0.000	0.000	0.409	2.2
ACTIDEUS ARMATUS	0.000	0.091	0.045	0.000	0.000	0.136	0.7
CEMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.045	0.000	0.000	0.000	0.045	0.2
GAETUS COLUMBIAE	0.000	0.000	0.091	0.318	1.773	2.182	11.9
EUCHAETA JAPONICA	0.000	0.000	0.000	0.000	8.409	8.409	45.9
SCAPHOCALANUS SP.	0.000	0.000	0.000	0.000	0.000	0.000	0.0
SCOLECITHRICELLA MINOR	0.000	0.909	0.364	0.000	0.000	1.273	6.9
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.000	0.000	0.455	0.909	0.000	1.364	7.4
METRIDIA OKHOTENSIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
HETERORHABDUS TANNERI	0.000	0.000	0.000	0.045	0.000	0.045	0.2
CANDACIA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0

TOTAL 18.318

TABLE 18 ZOOPLANKTON COUNTS, ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 2 TIME NOON DEPTH INTERVAL 200-100 M.

DATE JULY 17,1973 AMT.FILTERED 44.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.068	0.273	0.114	0.000	0.000	0.455	0.3
CALANUS PLUMCHRUS	0.000	0.000	0.182	0.000	0.000	0.182	0.1
EUCALANUS BUNGII BUNGII	0.000	0.000	0.182	0.000	0.000	0.182	0.1
PSEUDOCALANUS MINUTUS	0.000	0.000	13.273	0.000	0.000	13.273	8.2
SPINOCALANUS BREVICAUDATUS	0.000	38.364	20.909	0.727	0.000	60.000	37.3
ACTIDEUS ARMATUS	0.000	0.432	0.023	0.000	0.000	0.455	0.3
CEMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.286	0.727	0.955	0.159	2.227	1.4
GAETUS COLUMBIAE	0.000	0.227	1.250	14.000	33.091	48.568	30.2
EUCHAETA JAPONICA	0.159	0.364	4.000	2.727	3.273	10.523	6.5
SCAPHOCALANUS SP.	0.136	0.568	2.864	1.523	0.000	5.091	3.2
SCOLECITHRICELLA MINOR	0.114	0.341	0.182	0.000	0.000	0.636	0.4
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	11.273	5.023	0.568	0.000	0.000	16.864	11.5
METRIDIA OKHOTENSIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
HETERORHABDUS TANNERI	0.773	0.977	0.500	0.000	0.000	2.250	1.4
CANDACIA COLUMBIAE	0.000	0.000	0.000	0.091	0.227	0.318	0.2

TOTAL 161.023

TABLE 19 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 2 TIME NOON DEPTH INTERVAL 300-200 M.

DATE JULY 17,1973 AMT.FILTERED 44.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	17.364	0.000	0.000	17.364	7.7
CALANUS PLUMCHRUS	0.000	0.000	1.364	0.000	0.000	1.364	0.6
EUCALANUS BUNGII FUNGII	0.000	0.000	0.455	0.000	0.000	0.455	0.2
PSEUDOCALANUS MINUTUS	0.000	0.000	158.000	0.000	0.000	158.000	69.7
SPINOCALANUS BREVICAUDATUS	0.159	7.091	10.182	0.909	0.000	18.341	8.1
AETIDEUS ARMATUS	0.000	0.000	0.182	0.000	0.000	0.182	0.1
CEMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.023	0.114	0.023	0.000	0.000	0.159	0.1
GAETIUS COLUMBIAE	0.000	0.000	0.409	1.750	6.727	8.886	3.9
EUCHAETA JAPONICA	0.182	0.636	0.000	0.000	2.273	3.091	1.4
SCAPHOCALANUS SP.	0.000	0.295	2.182	1.432	0.114	4.023	1.8
SCOLECITHRICELLA MINOR	0.000	0.000	0.091	0.000	0.000	0.091	0.0
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	6.416	1.227	0.000	0.000	0.000	9.636	4.3
METRIDIA OKHOTENSIS	0.000	0.864	2.091	0.000	0.000	2.955	1.3
HETERORHABDUS TANNERI	0.864	0.773	0.159	0.045	0.000	1.841	0.8
CANDACIA COLUMBIAE	0.045	0.068	0.000	0.091	0.068	0.273	0.1

TOTAL 226.659

TABLE 20 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 2 TIME NOON DEPTH INTERVAL 400-300 M.

DATE JULY 17,1973 AMT.FILTERED 44.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	59.636	0.000	0.000	59.636	14.3
CALANUS PLUMCHRUS	0.000	0.000	13.273	0.000	0.000	13.273	3.2
EUCALANUS BUNGII BUNGII	0.000	0.000	1.273	0.000	0.000	1.273	0.3
PSEUDOCALANUS MINUTUS	0.000	0.000	267.636	0.000	0.000	267.636	64.0
SPINOCALANUS BREVICAUDATUS	0.159	9.455	10.000	1.273	0.000	20.886	5.0
AETIDEUS ARMATUS	0.000	0.023	0.000	0.000	0.000	0.023	0.0
CEMANTENNA COLUMBIAE	0.023	0.000	0.000	0.000	0.000	0.023	0.0
CHIRIDIUS GRACILIS	0.023	0.136	0.000	0.000	0.000	0.159	0.0
GAETIUS COLUMBIAE	0.000	0.023	0.295	1.864	9.273	11.455	2.7
EUCHAETA JAPONICA	0.455	0.773	0.000	0.000	4.000	5.227	1.3
SCAPHOCALANUS SP.	0.023	0.386	3.364	2.114	0.068	5.955	1.4
SCOLECITHRICELLA MINOR	0.045	0.000	0.000	0.000	0.000	0.045	0.0
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	24.364	0.205	0.045	0.000	0.000	24.614	5.9
METRIDIA OKHOTENSIS	0.000	1.159	4.341	0.000	0.000	5.500	1.3
HETERORHABDUS TANNERI	0.977	0.886	0.227	0.000	0.000	2.091	0.5
CANDACIA COLUMBIAE	0.000	0.023	0.000	0.023	0.023	0.068	0.0

TOTAL 417.862

TABLE 21 ZOOPLANKTON COUNTS, ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 2 TIME NOON DEPTH INTERVAL 600-400 M.

DATE JULY 17,1973 AMT.FILTERED 88.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	61.455	0.000	0.000	61.455	24.5
CALANUS PLUMCHRUS	0.000	0.000	24.909	0.000	0.000	24.909	9.9
EUCALANUS BUNGII BUNGII	0.000	0.000	17.091	0.000	0.000	17.091	6.8
PSEUDOCALANUS MINUTUS	0.000	0.000	83.818	0.000	0.000	83.818	33.4
SPINOCALANUS PREVICAUDATUS	0.386	10.455	15.727	2.364	0.000	28.932	11.5
ALTIPEUS ARMATUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
COMANTENNA COLUMBIAE	0.000	0.023	0.045	0.000	0.000	0.068	0.0
CHIRIDIUS GRACILIS	0.023	0.023	0.000	0.023	0.023	0.091	0.0
GADIUS COLUMBIAE	0.000	0.045	0.136	0.841	5.705	6.727	2.7
EUCHAETA JAPONICA	0.068	0.318	0.000	0.000	4.545	4.932	2.0
SCAPHOCALANUS SP.	0.068	0.614	1.045	0.250	0.023	2.000	0.8
SCOLECITHRICELLA MINOR	1.000	0.057	0.034	0.000	0.000	0.091	0.0
THARYBIS FULTONI	0.000	0.068	0.000	0.000	0.000	0.068	0.0
METRIDIA PACIFICA	11.182	0.250	0.000	0.000	0.000	18.432	7.3
METRIDIA OKHOTENSIS	0.000	0.000	0.455	0.000	0.000	0.455	0.2
HETERORHABDUS TANNERI	0.568	0.705	0.500	0.011	0.000	1.784	0.7
CANDACIA COLUMBIAE	0.023	0.000	0.000	0.023	0.068	0.114	0.0

TOTAL 250.966

TABLE 22 ZOOPLANKTON COUNTS, ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 4 TIME DUSK DEPTH INTERVAL 50- 0 M.

DATE JULY 17,1973 AMT.FILTERED 22.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	0.136	0.000	0.000	0.136	4.3
CALANUS PLUMCHRUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
EUCALANUS BUNGII BUNGII	0.000	0.000	0.000	0.000	0.000	0.000	0.0
PSEUDOCALANUS MINUTUS	0.000	0.000	1.045	0.000	0.000	1.045	32.9
SPINOCALANUS PREVICAUDATUS	0.000	0.455	0.318	0.000	0.000	0.773	24.3
ALTIPEUS ARMATUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
GADIUS COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
EUCHAETA JAPONICA	0.000	0.000	0.000	0.000	0.000	0.000	0.0
SCAPHOCALANUS SP.	0.000	0.000	0.000	0.000	0.773	0.773	24.3
SCOLECITHRICELLA MINOR	0.000	0.318	0.136	0.000	0.000	0.455	14.3
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA OKHOTENSIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
HETERORHABDUS TANNERI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CANDACIA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0

TOTAL 3.182

TABLE 23 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 4 TIME DUSK DEPTH INTERVAL 100- 50 M.

DATE JULY 17.1973 AMT.FILTERED 22.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	2.273	1.000	0.000	0.000	3.273	2.3
CALANUS PLUMCHRUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
EUCALANUS BUNGII BUNGII	0.000	0.000	0.000	0.000	0.000	0.000	0.0
PSEUDOCALANUS MINUTUS	0.000	0.000	9.091	0.000	0.000	9.091	6.4
SPINOCALANUS BREVICAUDATUS	0.000	0.227	0.364	0.000	0.000	0.591	0.4
ACTIDEUS ARMATUS	0.045	1.318	1.545	0.545	0.000	3.455	2.4
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.000	0.045	0.000	0.000	0.045	0.0
GADIUS COLUMBIAE	0.000	0.136	0.136	1.955	19.273	21.500	15.1
EUCHAETA JAPONICA	3.909	2.955	12.364	5.091	44.364	68.682	48.2
SCAPHOCALANUS SP.	0.000	0.000	0.182	0.182	0.000	0.364	0.3
SCOLECITHRICELLA MINOR	3.409	12.636	3.682	0.000	0.000	19.727	13.8
THARYCIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.000	2.091	4.864	3.682	1.227	11.864	8.3
METRIDIA OKHOTENSIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
HETERORHABDUS TANNERI	0.773	1.227	0.727	0.182	0.000	2.909	2.0
CANDACIA COLUMBIAE	0.409	0.091	0.000	0.091	0.409	1.000	0.7

TOTAL 142.500

TABLE 24 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 4 TIME DUSK DEPTH INTERVAL 200-100 M.

DATE JULY 17.1973 AMT.FILTERED 44.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	0.364	0.000	0.000	0.364	0.9
CALANUS PLUMCHRUS	0.000	0.000	0.091	0.000	0.000	0.091	0.2
EUCALANUS BUNGII BUNGII	0.000	0.000	0.273	0.000	0.000	0.273	0.7
PSEUDOCALANUS MINUTUS	0.000	0.000	2.000	0.000	0.000	2.000	5.0
SPINOCALANUS BREVICAUDATUS	0.000	15.455	7.455	0.091	0.000	23.000	57.7
ACTIDEUS ARMATUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.045	0.023	0.000	0.000	0.068	0.2
GADIUS COLUMBIAE	0.000	0.068	0.068	0.318	4.432	4.886	12.3
EUCHAETA JAPONICA	0.068	0.045	0.023	0.114	3.045	3.295	8.3
SCAPHOCALANUS SP.	0.114	0.591	1.182	0.545	0.000	2.432	6.1
SCOLECITHRICELLA MINOR	0.091	0.227	0.091	0.000	0.000	0.409	1.0
THARYCIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.136	0.432	0.273	0.114	0.182	1.136	2.9
METRIDIA OKHOTENSIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
HETERORHABDUS TANNERI	0.727	0.727	0.341	0.068	0.000	1.864	4.7
CANDACIA COLUMBIAE	0.000	0.000	0.000	0.000	0.023	0.023	0.1

TOTAL 39.841

TABLE 25 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE

STATION BUTE 4 NET TYPE BOGO

DATE JULY 17.1973 TIME DUSK DEPTH INTERVAL 300-200 M.

AMT.FILTERED 44.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACILIS	0.000	0.000	11.545	0.000	0.000	11.545	6.2
CALANUS P_UMCHRUS	0.000	0.000	0.455	0.000	0.000	0.455	0.2
EUCALANUS BUNGII BUNGII	0.000	0.000	0.432	0.000	0.000	0.432	0.2
PSEUDOCALANUS MINUTUS	0.000	0.000	134.909	0.000	0.000	134.909	72.2
SPINOCALANUS BREVICAUDATUS	0.114	10.818	9.364	2.091	0.000	22.386	12.0
ACTIDIUS ARMATUS	0.000	0.000	0.023	0.000	0.000	0.023	0.0
CENTROPAGES COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.136	0.000	0.000	0.000	0.136	0.1
GAIDIUS COLUMBIAE	0.000	0.023	0.045	0.000	5.818	5.886	3.2
EUCHAETA JAPONICA	0.341	0.432	0.227	0.045	1.364	2.409	1.3
SCAPHOCALANUS SP.	0.068	0.614	1.295	0.682	0.000	2.659	1.4
SCOLECITHRICELLA MINOR	0.000	0.159	0.000	0.000	0.000	0.159	0.1
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	1.773	0.205	0.182	0.205	0.000	2.364	1.3
METRIDIA OKHOTENSIS	0.000	0.455	0.591	0.000	0.000	1.045	0.6
HETEROCHAETUS TANNERI	1.045	1.250	0.114	0.000	0.000	2.409	1.3
CANDACIA COLUMBIAE	0.000	0.000	0.000	0.000	0.023	0.023	0.0

TOTAL 186.841

TABLE 26 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE

STATION BUTE 4 NET TYPE BOGO

DATE JULY 17.1973 TIME DUSK DEPTH INTERVAL 400-300 M.

AMT.FILTERED 44.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACILIS	0.000	0.000	36.545	0.000	0.000	36.545	22.5
CALANUS P_UMCHRUS	0.000	0.000	32.182	0.000	0.000	32.182	19.8
EUCALANUS BUNGII BUNGII	0.000	0.000	4.568	0.000	0.000	4.568	2.8
PSEUDOCALANUS MINUTUS	0.000	0.000	78.182	0.000	0.000	78.182	48.1
SPINOCALANUS BREVICAUDATUS	0.159	2.659	2.091	0.591	0.000	5.500	3.4
ACTIDIUS ARMATUS	0.000	0.000	0.023	0.000	0.000	0.023	0.0
CENTROPAGES COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.045	0.000	0.000	0.000	0.045	0.0
GAIDIUS COLUMBIAE	0.023	0.023	0.023	0.045	0.523	0.636	0.4
EUCHAETA JAPONICA	0.000	0.045	0.000	0.000	0.773	0.818	0.5
SCAPHOCALANUS SP.	0.000	0.705	0.205	0.068	0.000	0.977	0.6
SCOLECITHRICELLA MINOR	0.000	0.023	0.000	0.000	0.000	0.023	0.0
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.773	0.227	0.023	0.068	0.000	1.023	0.6
METRIDIA OKHOTENSIS	0.000	0.341	0.386	0.000	0.000	0.727	0.4
HETEROCHAETUS TANNERI	0.636	0.636	0.068	0.000	0.000	1.341	0.8
CANDACIA COLUMBIAE	0.000	0.023	0.023	0.000	0.023	0.068	0.0

TOTAL 162.659

TABLE 27 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 4 TIME DUSK DEPTH INTERVAL 600-400 M.

DATE JULY 17.1973 AMT.FILTERED 88.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	18.045	0.000	0.000	18.045	20.2
CALANUS PLUMCHRUS	0.000	0.000	11.227	0.000	0.000	11.227	12.6
EUCALANUS BUNGII BUNGII	0.000	0.000	12.909	0.000	0.000	12.909	14.4
PSEUDOCALANUS MINUTUS	0.000	0.000	37.636	0.000	0.000	37.636	42.1
SPINOCALANUS BREVICAUDATUS	0.591	1.955	2.500	0.750	0.000	5.795	6.5
ACHAETUS ARMATUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CONANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.011	0.023	0.023	0.011	0.011	0.080	0.1
GADIUS COLUMBIAE	0.000	0.011	0.000	0.011	0.216	0.239	0.3
EUCHAETA JAPONICA	0.011	0.057	0.011	0.000	0.625	0.705	0.8
SCAPHOCALANUS SP.	0.068	0.330	0.182	0.023	0.000	0.602	0.7
SCOLECITHRICELLA MINOR	0.000	0.011	0.000	0.000	0.000	0.011	0.0
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.636	0.307	0.023	0.000	0.000	0.966	1.1
METRIDIA OKHOTENSIS	0.011	0.011	0.000	0.000	0.000	0.023	0.0
HETEROCHAETUS TANNERI	0.002	0.398	0.068	0.023	0.000	1.091	1.2
CANDACIA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0

TOTAL 89.375

TABLE 28 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 4 TIME MDNT DEPTH INTERVAL 50- 0 M.

DATE JULY 18.1973 AMT.FILTERED 22.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	20.364	0.000	0.000	20.364	6.9
CALANUS PLUMCHRUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
EUCALANUS BUNGII BUNGII	0.000	0.000	4.364	0.000	0.000	4.364	1.5
PSEUDOCALANUS MINUTUS	0.000	0.000	4.545	0.000	0.000	4.545	1.5
SPINOCALANUS BREVICAUDATUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
ACHAETUS ARMATUS	0.000	0.045	0.000	0.000	0.000	0.045	0.0
CONANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	1.455	0.000	0.000	0.000	1.455	0.5
GADIUS COLUMBIAE	0.000	5.091	21.818	26.909	0.000	53.818	18.2
EUCHAETA JAPONICA	8.000	12.364	85.818	36.364	0.000	142.545	48.1
SCAPHOCALANUS SP.	0.000	0.000	0.000	0.000	0.000	0.000	0.0
SCOLECITHRICELLA MINOR	2.364	27.273	4.545	0.000	0.000	34.182	11.5
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.000	23.273	8.636	0.000	0.000	31.873	10.8
METRIDIA OKHOTENSIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
HETEROCHAETUS TANNERI	0.727	1.455	0.000	0.000	0.000	2.182	0.7
CANDACIA COLUMBIAE	0.727	0.727	0.000	0.000	0.000	1.455	0.5

TOTAL 296.227

TABLE 29 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 4 TIME MDNT DEPTH INTERVAL 100- 50 M.

DATE JULY 18.1973 AMT.FILTERED 22.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	0.909	0.000	0.000	0.909	1.4
CALANUS PLUMCHRUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
EUCALANUS BUNGII BUNGII	0.000	0.000	0.182	0.000	0.000	0.182	0.3
PSEUDOCALANUS MINUTUS	0.000	0.000	1.636	0.000	0.000	1.636	2.5
SPINOCALANUS BREVICAUDATUS	0.000	1.955	0.000	0.045	0.000	2.000	3.0
ACTIDIUS ARMATUS	0.000	0.455	0.227	0.000	0.000	0.682	1.0
CORANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.227	0.000	0.000	0.000	0.227	0.3
GADIUS COLUMBIAE	0.000	0.227	0.818	2.818	12.500	16.364	24.9
EUCHAETA JAPONICA	0.636	0.536	0.455	0.136	20.909	22.773	34.6
SCAPHOCALANUS SP.	0.045	0.727	3.409	1.364	0.000	5.545	8.4
SCOLECITHRICELLA MINOR	1.091	3.409	1.727	0.000	0.000	6.227	9.5
THARYPIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.000	3.364	2.955	0.000	0.000	6.318	9.6
METRIDIA OKHOTENSIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
HETERORHABDUS TANNERI	0.773	1.500	0.273	0.000	0.000	2.545	3.9
CANDACIA COLUMBIAE	0.045	0.182	0.000	0.136	0.045	0.409	0.6
				TOTAL		65.773	

TABLE 30 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 4 TIME MDNT DEPTH INTERVAL 200-100 M.

DATE JULY 18.1973 AMT.FILTERED 44.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CALANUS PLUMCHRUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
EUCALANUS BUNGII BUNGII	0.000	0.000	0.000	0.000	0.000	0.000	0.0
PSEUDOCALANUS MINUTUS	0.000	0.000	1.000	0.000	0.000	1.000	2.4
SPINOCALANUS BREVICAUDATUS	0.000	12.273	3.000	0.000	0.000	15.273	36.1
ACTIDIUS ARMATUS	0.000	0.159	0.091	0.000	0.000	0.250	0.6
CORANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.023	0.023	0.000	0.023	0.045	0.114	0.3
GADIUS COLUMBIAE	0.000	0.023	0.000	0.091	3.182	3.295	7.8
EUCHAETA JAPONICA	0.045	0.091	0.000	0.000	10.136	10.273	24.3
SCAPHOCALANUS SP.	0.136	0.750	1.864	0.909	0.000	3.659	8.7
SCOLECITHRICELLA MINOR	0.636	2.114	0.432	0.000	0.000	3.182	7.5
THARYPIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.136	0.159	0.182	1.136	0.227	1.841	4.4
METRIDIA OKHOTENSIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
HETERORHABDUS TANNERI	1.227	1.591	0.341	0.068	0.000	3.227	7.6
CANDACIA COLUMBIAE	0.045	0.091	0.000	0.000	0.023	0.159	0.4
				TOTAL		42.273	

TABLE 31 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 4 TIME MDNT DEPTH INTERVAL 300-200 M.

DATE JULY 18,1973 AMT.FILTERED 44.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	15.364	0.000	0.000	15.364	10.1
CALANUS P_UMCHRUS	0.000	0.000	1.273	0.000	0.000	1.273	0.8
EUCALANUS BUNGII BUNGII	0.000	0.000	0.000	0.000	0.000	0.000	0.0
PSEUDOCALANUS MINUTUS	0.000	0.000	112.364	0.000	0.000	112.364	73.6
SPINOCALANUS BREVICAUDATUS	0.159	6.273	5.455	1.091	0.000	12.977	8.5
~~METRIDIUS ARMATUS~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.0~~
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACI_IS	0.000	0.023	0.000	0.000	0.000	0.023	0.0
GADIUS COLUMBIAE	0.000	0.023	0.114	0.432	2.750	3.318	2.2
EUCHAETA JAPONICA	0.068	0.159	0.000	0.000	1.273	1.500	1.0
SCAPHOCALANUS SP.	0.023	0.523	0.727	0.341	0.023	1.636	1.1
SCOLECITHRICELLA MINOR	0.000	0.068	0.000	0.000	0.000	0.068	0.0
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
~~METRIDIA PACIFICA~~	~~1.568~~	~~6.182~~	~~0.250~~	~~0.000~~	~~0.000~~	~~2.000~~	~~1.3~~
METRIDIA OKHOTENSIS	0.000	0.364	0.659	0.000	0.000	1.023	0.7
HETERORHABDUS TANNERI	0.545	0.523	0.045	0.000	0.000	1.114	0.7
CANDACIA COLUMBIAE	0.023	0.023	0.000	0.000	0.000	0.045	0.0

TOTAL 152.704

TABLE 32 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 4 TIME MDNT DEPTH INTERVAL 400-300 M.

DATE JULY 18,1973 AMT.FILTERED 44.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	33.091	0.000	0.000	33.091	17.6
CALANUS PLUMCHRUS	0.000	0.000	18.727	0.000	0.000	18.727	9.9
EUCALANUS BUNGII BUNGII	0.000	0.000	0.000	0.000	0.000	0.000	0.0
PSEUDOCALANUS MINUTUS	0.000	0.000	121.727	0.000	0.000	121.727	64.6
SPINOCALANUS BREVICAUDATUS	0.364	2.000	2.659	1.500	0.023	6.545	3.5
~~METRIDIUS ARMATUS~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.0~~
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACI_IS	0.000	0.068	0.023	0.023	0.000	0.114	0.1
GADIUS COLUMBIAE	0.000	0.000	0.045	0.114	1.955	2.114	1.1
EUCHAETA JAPONICA	0.091	0.091	0.000	0.000	0.909	1.091	0.6
SCAPHOCALANUS SP.	0.023	0.682	0.318	0.250	0.045	1.318	0.7
SCOLECITHRICELLA MINOR	0.000	0.000	0.000	0.000	0.000	0.000	0.0
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
~~METRIDIA PACIFICA~~	~~1.227~~	~~0.136~~	~~0.045~~	~~0.000~~	~~0.000~~	~~1.408~~	~~0.7~~
METRIDIA OKHOTENSIS	0.000	0.432	0.818	0.000	0.000	1.250	0.7
HETERORHABDUS TANNERI	0.386	0.523	0.045	0.000	0.000	0.955	0.5
CANDACIA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0

TOTAL 188.341

TABLE 33 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 4 TIME MDNT DEPTH INTERVAL 600-400 M.

DATE JULY 18,1973 AMT.FILTERED 88.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	7.545	0.000	0.000	7.545	17.6
CALANUS PLUMCHRUS	0.000	0.000	3.591	0.000	0.000	3.591	8.4
EUCALANUS BUNGII BUNGII	0.000	0.000	10.909	0.000	0.000	10.909	25.4
PSEUDOCALANUS MINUTUS	0.000	0.000	13.636	0.000	0.000	13.636	31.8
SPINOCALANUS BREVICAUDATUS	0.298	1.909	1.966	0.489	0.000	4.761	11.1
METRIDIA ARMATA	0.000	0.011	0.000	0.000	0.000	0.011	0.0
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.023	0.091	0.034	0.045	0.000	0.193	0.4
GADIUS COLUMBIAE	0.011	0.011	0.011	0.011	0.114	0.159	0.4
EUCHAETA JAPONICA	0.000	0.034	0.000	0.000	0.318	0.352	0.8
SCAPHOCALANUS SP.	0.045	0.352	0.000	0.034	0.000	0.511	1.2
SCOLECITHRICELLA MINOR	0.000	0.000	0.000	0.000	0.000	0.000	0.0
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.466	0.136	0.057	0.000	0.000	0.662	1.4
METRIDIA OKHOTENSIS	0.000	0.011	0.023	0.000	0.000	0.034	0.1
HETERORHABDUS TANNERI	0.307	0.284	0.011	0.011	0.000	0.614	1.4
CANDACIA COLUMBIAE	0.011	0.000	0.000	0.000	0.000	0.011	0.0
				TOTAL		42.932	

TABLE 34 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 4 TIME DAWN DEPTH INTERVAL 50- 0 M.

DATE JULY 18,1973 AMT.FILTERED 22.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	0.727	0.000	0.000	0.727	2.8
CALANUS PLUMCHRUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
EUCALANUS BUNGII BUNGII	0.000	0.000	0.000	0.000	0.000	0.000	0.0
PSEUDOCALANUS MINUTUS	0.000	0.000	0.727	0.000	0.000	0.727	2.8
SPINOCALANUS BREVICAUDATUS	0.000	0.045	0.091	0.000	0.000	0.136	0.5
METRIDIA ARMATA	0.000	0.000	0.000	0.000	0.000	0.000	0.0
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.182	0.045	0.000	0.000	0.227	0.9
GADIUS COLUMBIAE	0.000	0.227	0.136	1.727	2.773	4.864	18.9
EUCHAETA JAPONICA	0.182	0.273	2.545	1.455	6.000	10.455	40.6
SCAPHOCALANUS SP.	0.000	0.000	0.000	0.045	0.000	0.045	0.2
SCOLECITHRICELLA MINOR	0.682	1.591	0.364	0.000	0.000	2.636	10.2
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	1.045	2.182	1.591	1.409	0.000	5.182	20.1
METRIDIA OKHOTENSIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
HETERORHABDUS TANNERI	0.045	0.227	0.000	0.000	0.000	0.273	1.1
CANDACIA COLUMBIAE	0.273	0.136	0.000	0.045	0.045	0.500	1.9
				TOTAL		25.773	

TABLE 35 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 4 TIME DAWN DEPTH INTERVAL 100- 50 M.

DATE JULY 18.1973 AMT.FILTERED 22.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.045	0.409	0.500	0.000	0.000	0.955	1.3
CALANUS PLUMCHRUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
EUCALANUS BUNGII BUNGII	0.000	0.000	0.000	0.000	0.000	0.000	0.0
PSEUDOCALANUS MINUTUS	0.000	0.000	2.000	0.000	0.000	2.000	2.7
SPINOCALANUS BREVICAUDATUS	0.000	3.591	0.227	0.000	0.000	3.818	5.1
ACHIXIS ARMATUS	0.000	0.500	0.136	0.000	0.045	0.682	0.9
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.045	0.364	0.136	0.091	0.000	0.636	0.8
GADIUS COLUMBIAE	0.000	0.591	2.545	6.727	14.727	24.591	32.6
EUCHAETA JAPONICA	0.364	0.591	6.364	4.182	14.182	25.682	34.0
SCAPHOCALANUS SP.	0.000	0.318	1.455	0.591	0.000	2.364	3.1
SCOLECITHRICELLA MINOR	1.409	4.273	1.136	0.000	0.000	6.818	9.0
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.591	3.227	1.727	0.500	0.000	5.545	7.3
METRIDIA OKHOTENSIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
HETERORHABDUS TANNERI	0.727	1.227	0.227	0.000	0.000	2.182	2.9
CANDACIA COLUMBIAE	0.000	0.091	0.000	0.000	0.091	0.182	0.2
					TOTAL	75.454	

TABLE 35 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 4 TIME DAWN DEPTH INTERVAL 200-100 M.

DATE JULY 18.1973 AMT.FILTERED 44.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	0.182	0.000	0.000	0.182	0.4
CALANUS PLUMCHRUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
EUCALANUS BUNGII BUNGII	0.000	0.000	0.227	0.000	0.000	0.227	0.5
PSEUDOCALANUS MINUTUS	0.000	0.000	1.182	0.000	0.000	1.182	2.6
SPINOCALANUS BREVICAUDATUS	0.000	18.273	10.818	0.909	0.000	30.000	66.6
ACHIXIS ARMATUS	0.000	0.023	0.000	0.000	0.000	0.023	0.1
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.023	0.000	0.000	0.000	0.023	0.1
GADIUS COLUMBIAE	0.000	0.023	0.205	0.045	4.182	4.455	9.9
EUCHAETA JAPONICA	0.068	0.023	0.000	0.000	2.364	2.455	5.4
SCAPHOCALANUS SP.	0.273	0.409	1.409	0.886	0.000	2.977	6.6
SCOLECITHRICELLA MINOR	0.114	0.227	0.068	0.000	0.000	0.409	0.9
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.068	0.114	0.295	0.273	0.000	0.750	1.7
METRIDIA OKHOTENSIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
HETERORHABDUS TANNERI	0.750	1.386	0.227	0.000	0.000	2.364	5.2
CANDACIA COLUMBIAE	0.023	0.000	0.000	0.000	0.000	0.023	0.1
					TOTAL	45.068	

TABLE 37 ZOOPLANKTON COUNTS, ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 4 TIME DAWN DEPTH INTERVAL 300-200 M.

DATE JULY 18,1973 AMT.FILTERED 44.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	14.000	0.000	0.000	14.000	9.5
CALANUS PACIFICUS	0.000	0.000	0.727	0.000	0.000	0.727	0.5
EUCALANUS BUNGII BUNGII	0.000	0.000	0.364	0.000	0.000	0.364	0.2
PSEUDOCALANUS MINUTUS	0.000	0.000	104.727	0.000	0.000	104.727	71.0
SPINOCALANUS BREVICAUDATUS	0.159	6.818	5.500	2.545	0.000	15.023	10.2
ACHIRUS ARMATUS	0.000	0.000	0.045	0.000	0.000	0.045	0.0
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.045	0.000	0.000	0.023	0.068	0.0
GADIUS COLUMBIAE	0.000	0.000	0.091	0.341	3.955	4.386	3.0
EUCHAETA JAPONICA	0.227	0.273	0.045	0.023	1.386	1.955	1.3
SCAPHOCALANUS SP.	0.023	0.568	0.886	0.568	0.114	2.159	1.5
SCOLECITHRICELLA MINOR	0.000	0.159	0.000	0.000	0.000	0.159	0.1
THARYDIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	1.205	0.191	0.000	0.159	0.909	1.455	1.0
METRIDIA OKHOTENSIS	0.000	0.295	0.568	0.000	0.000	0.864	0.6
HETERORHABDUS TANNERI	0.705	0.886	0.000	0.000	0.000	1.591	1.1
CANDACIA COLUMBIAE	0.023	0.023	0.000	0.000	0.023	0.068	0.0
				TOTAL		147.591	

TABLE 38 ZOOPLANKTON COUNTS, ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 4 TIME DAWN DEPTH INTERVAL 400-300 M.

DATE JULY 18,1973 AMT.FILTERED 44.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	45.318	0.000	0.000	45.318	17.6
CALANUS PACIFICUS	0.000	0.000	27.000	0.000	0.000	27.000	10.5
EUCALANUS BUNGII BUNGII	0.000	0.000	2.841	0.000	0.000	2.841	1.1
PSEUDOCALANUS MINUTUS	0.000	0.000	167.818	0.000	0.000	167.818	65.2
SPINOCALANUS BREVICAUDATUS	0.477	2.955	2.727	0.977	0.000	7.136	2.8
ACHIRUS ARMATUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.023	0.023	0.000	0.000	0.000	0.045	0.0
GADIUS COLUMBIAE	0.000	0.000	0.045	0.136	1.636	1.818	0.7
EUCHAETA JAPONICA	0.045	0.045	0.000	0.000	0.182	0.273	0.1
SCAPHOCALANUS SP.	0.068	0.523	0.295	0.136	0.023	1.045	0.4
SCOLECITHRICELLA MINOR	0.000	0.068	0.000	0.000	0.000	0.068	0.0
THARYDIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	1.341	0.205	0.045	0.000	0.000	1.591	0.6
METRIDIA OKHOTENSIS	0.000	0.409	0.659	0.000	0.000	1.068	0.4
HETERORHABDUS TANNERI	0.650	0.559	0.045	0.000	0.045	1.409	0.5
CANDACIA COLUMBIAE	0.023	0.000	0.000	0.000	0.000	0.023	0.0
				TOTAL		257.454	

TABLE 39 ZOOPLANKTON COUNTS, ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 4 TIME DAWN DEPTH INTERVAL 600-400 M.

DATE JULY 18,1973 AMT.FILTERED 88.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	5.091	0.000	0.000	5.091	13.6
CALANUS PLUMCHRUS	0.000	0.000	2.182	0.000	0.000	2.182	5.8
EUCALANUS BUNGII BUNGII	0.000	0.000	10.591	0.000	0.000	10.591	28.3
PSEUDOCALANUS MINUTUS	0.000	0.000	11.727	0.000	0.000	11.727	31.3
SPINOCALANUS PREVICAUDATUS	0.375	2.398	1.943	0.648	0.000	5.364	14.3
ACTIDEUS ARMATUS	0.011	0.011	0.023	0.000	0.000	0.045	0.1
CORANTENNA COLUMBIAE	0.011	0.011	0.011	0.000	0.000	0.034	0.1
CHIRIDIUS GRACILIS	0.011	0.034	0.091	0.023	0.000	0.159	0.4
GADIUS COLUMBIAE	0.000	0.000	0.000	0.000	0.136	0.136	0.4
EUCHAETA JAPONICA	0.011	0.045	0.000	0.000	0.273	0.330	0.9
SCAPHOCALANUS SP.	0.011	0.295	0.114	0.000	0.000	0.420	1.1
SCOLECITHRICELLA MINOR	0.000	0.000	0.000	0.000	0.000	0.000	0.0
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.250	0.886	0.034	0.000	0.000	0.364	1.0
METRIDIA OKHOTENSIS	0.000	0.000	0.023	0.000	0.000	0.023	0.1
HETERORHABDUS TANNERI	0.432	0.386	0.045	0.045	0.000	0.909	2.4
CANDACIA COLUMBIAE	0.023	0.000	0.011	0.000	0.023	0.057	0.2
					TOTAL	37.432	

TABLE 40 ZOOPLANKTON COUNTS, ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 4 TIME NOON DEPTH INTERVAL 50- 0 M.

DATE JULY 18,1973 AMT.FILTERED 22.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	0.045	0.000	0.000	0.045	0.3
CALANUS PLUMCHRUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
EUCALANUS BUNGII BUNGII	0.000	0.000	0.591	0.000	0.000	0.591	4.0
PSEUDOCALANUS MINUTUS	0.000	0.000	3.636	0.000	0.000	3.636	24.8
SPINOCALANUS PREVICAUDATUS	0.000	0.091	0.000	0.000	0.000	0.091	0.6
ACTIDEUS ARMATUS	0.000	0.091	0.045	0.000	0.000	0.136	0.9
CORANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
GADIUS COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
EUCHAETA JAPONICA	0.000	0.000	0.000	0.000	5.682	5.682	38.8
SCAPHOCALANUS SP.	0.000	0.000	0.000	0.000	0.000	0.000	0.0
SCOLECITHRICELLA MINOR	0.455	3.455	0.227	0.000	0.000	4.136	28.3
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.000	0.000	0.000	0.000	0.318	0.318	2.2
METRIDIA OKHOTENSIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
HETERORHABDUS TANNERI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CANDACIA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
					TOTAL	14.636	

TABLE 41 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 4 TIME NOON DEPTH INTERVAL 100- 50 M.

DATE JULY 19,1973 AMT.FILTERED 22.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACILIS	0.000	0.000	0.273	0.000	0.000	0.273	3.3
CALANUS PLUMCHRUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
EUCALANUS BUNCII BUNGII	0.000	0.000	0.273	0.000	0.000	0.273	3.3
PSEUDOCALANUS MINUTUS	0.000	0.000	0.500	0.000	0.000	0.500	6.1
SPINOCALANUS BREVICAUDATUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
ACTIDIUS ARMATUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
GADIUS COLUMBIAE	0.000	0.000	0.000	0.000	1.682	1.682	20.4
EUCHAETA JAPONICA	0.000	0.000	0.000	0.000	3.773	3.773	45.9
SCAPHOCALANUS SP.	0.000	0.000	0.000	0.000	0.000	0.000	0.0
SCOLECITHRICELLA MINOR	0.136	1.136	0.227	0.000	0.000	1.500	18.2
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA OKHOTENSIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
HETERORHABDUS TANNERI	0.000	0.045	0.182	0.000	0.000	0.227	2.8
CANDACIA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0

TOTAL 8.227

TABLE 42 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 4 TIME NOON DEPTH INTERVAL 200-100 M.

DATE JULY 18,1973 AMT.FILTERED 44.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACILIS	0.000	0.000	1.455	0.000	0.000	1.455	1.9
CALANUS PLUMCHRUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
EUCALANUS BUNGII BUNGII	0.000	0.000	0.091	0.000	0.000	0.091	0.1
PSEUDOCALANUS MINUTUS	0.000	0.000	1.545	0.000	0.000	1.545	2.0
SPINOCALANUS BREVICAUDATUS	0.000	27.000	11.364	0.273	0.000	38.636	50.2
ACTIDIUS ARMATUS	0.000	0.068	0.023	0.000	0.000	0.091	0.1
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.023	0.045	0.045	0.000	0.023	0.136	0.2
GADIUS COLUMBIAE	0.000	0.364	1.000	4.182	12.091	17.636	22.9
EUCHAETA JAPONICA	0.295	0.364	0.182	0.045	5.864	6.750	8.8
SCAPHOCALANUS SP.	0.068	0.477	1.205	1.295	0.023	3.068	4.0
SCOLECITHRICELLA MINOR	0.023	0.114	0.114	0.000	0.000	0.250	0.3
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.250	2.977	0.955	0.000	0.000	4.182	5.4
METRIDIA OKHOTENSIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
HETERORHABDUS TANNERI	1.227	1.455	0.341	0.000	0.000	3.023	3.9
CANDACIA COLUMBIAE	0.000	0.000	0.000	0.023	0.023	0.045	0.1

TOTAL 76.909

TABLE 43 ZOOPLANKTON COUNTS, ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 4 TIME NOON DEPTH INTERVAL 300-200 M.

DATE JULY 18,1973 AMT.FILTERED 44.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	11.000	0.000	0.000	11.000	7.7
CALANUS PLUMCHRUS	0.000	0.000	1.091	0.000	0.000	1.091	0.8
EUCALANUS BUNGII BUNGII	0.000	0.000	0.000	0.000	0.000	0.000	0.0
PSEUDOCALANUS MINUTUS	0.000	0.000	107.545	0.000	0.000	107.545	75.0
SPINOCALANUS BREVICAUDATUS	0.136	5.705	4.250	1.523	0.000	11.614	8.1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CENANTENNA COLUMBIAE	0.000	0.000	0.023	0.000	0.000	0.023	0.0
CHIRIDIUS GRACILIS	0.000	0.091	0.000	0.000	0.000	0.091	0.1
GADIUS COLUMBIAE	0.068	0.091	0.364	0.227	3.273	4.023	2.8
EUCHAETA JAPONICA	0.205	0.295	0.000	0.000	1.000	1.500	1.0
SCAPHOCALANUS SP.	0.045	0.591	0.000	0.568	0.023	2.136	1.5
SCOLECITHRICELLA MINOR	0.000	0.227	0.000	0.000	0.000	0.227	0.2
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
METRIDIA OKHOTENSIS	0.000	0.614	0.432	0.000	0.000	1.045	0.7
HETEROHABDUS TANNERI	0.932	0.909	0.023	0.000	0.000	1.864	1.3
CANDACIA COLUMBIAE	0.023	0.045	0.000	0.000	0.023	0.091	0.1

TOTAL 143.477

TABLE 44 ZOOPLANKTON COUNTS, ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 4 TIME NOON DEPTH INTERVAL 400-300 M.

DATE JULY 18,1973 AMT.FILTERED 44.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	35.273	0.000	0.000	35.273	17.5
CALANUS PLUMCHRUS	0.000	0.000	22.364	0.000	0.000	22.364	11.1
EUCALANUS BUNGII BUNGII	0.000	0.000	2.273	0.000	0.000	2.273	1.1
PSEUDOCALANUS MINUTUS	0.000	0.000	129.455	0.000	0.000	129.455	64.2
SPINOCALANUS BREVICAUDATUS	0.386	2.614	1.795	0.273	0.000	5.068	2.5
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CENANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.045	0.091	0.000	0.023	0.000	0.159	0.1
GADIUS COLUMBIAE	0.000	0.000	0.023	0.068	0.568	0.659	0.3
EUCHAETA JAPONICA	0.000	0.045	0.000	0.000	1.273	1.318	0.7
SCAPHOCALANUS SP.	0.091	0.636	0.614	0.159	0.000	1.500	0.7
SCOLECITHRICELLA MINOR	0.000	0.023	0.000	0.000	0.000	0.023	0.0
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
METRIDIA OKHOTENSIS	0.000	0.409	0.409	0.000	0.000	0.818	0.4
HETEROHABDUS TANNERI	1.000	0.536	0.045	0.000	0.000	1.582	0.8
CANDACIA COLUMBIAE	0.000	0.023	0.000	0.000	0.000	0.023	0.0

TOTAL 201.773

TABLE 45 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 4 TIME NOON DEPTH INTERVAL 600-400 M.

DATE JULY 18,1973 AMT.FILTERED 88.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	6.591	0.000	0.000	6.591	17.0
CALANUS PLUMCHRUS	0.000	0.000	2.864	0.000	0.000	2.864	7.4
EUCALANUS BUNGII BUNGII	0.000	0.000	10.682	0.000	0.000	10.682	27.6
PSEUDOCALANUS MINUTUS	0.000	0.000	11.773	0.000	0.000	11.773	30.4
SPINOCALANUS BREVICAUDATUS	0.375	2.239	1.795	0.307	0.000	4.716	12.2
AETIDEUS ARMATUS	0.000	0.000	0.011	0.045	0.000	0.057	0.1
COMANTENNA COLUMBIAE	0.034	0.000	0.000	0.000	0.000	0.034	0.1
CHIRIDIUS GRACILIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
GAIUS COLUMBIAE	0.000	0.023	0.000	0.011	0.125	0.159	0.4
EUCHAETA JAPONICA	0.000	0.000	0.000	0.000	0.000	0.000	0.0
SCAPHOCALANUS SP.	0.057	0.375	0.114	0.045	0.000	0.591	1.5
SCOLECITHRICELLA MINOR	0.000	0.000	0.000	0.000	0.000	0.000	0.0
THARYBIS FULTONI	0.000	0.011	0.000	0.000	0.000	0.011	0.0
METRIDIA PACIFICA	0.205	0.045	0.000	0.000	0.000	0.250	0.6
METRIDIA OKHOTENSIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
HETERORHABDUS TANNERI	0.477	0.455	0.034	0.000	0.000	0.966	2.5
CANDACIA COLUMBIAE	0.000	0.011	0.000	0.000	0.000	0.011	0.0
					TOTAL	38.704	

TABLE 46 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 5 TIME DUSK DEPTH INTERVAL 50- 0 M.

DATE JULY 18,1973 AMT.FILTERED 22.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.455	0.500	0.000	0.000	0.955	2.4
CALANUS PLUMCHRUS	0.000	0.000	0.273	0.000	0.000	0.273	0.7
EUCALANUS BUNGII BUNGII	0.000	0.000	0.000	0.000	0.000	0.000	0.0
PSEUDOCALANUS MINUTUS	0.000	0.000	2.136	0.000	0.000	2.136	5.3
SPINOCALANUS BREVICAUDATUS	0.000	2.727	0.136	0.000	0.000	2.864	7.1
AETIDEUS ARMATUS	0.000	0.045	0.000	0.000	0.000	0.045	0.1
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.091	0.000	0.000	0.000	0.091	0.2
GAIUS COLUMBIAE	0.000	0.318	0.364	1.818	1.045	3.545	8.8
EUCHAETA JAPONICA	0.727	0.773	2.273	2.727	6.455	12.955	32.0
SCAPHOCALANUS SP.	0.000	0.000	0.000	0.000	0.000	0.000	0.0
SCOLECITHRICELLA MINOR	0.591	1.818	2.136	0.000	0.000	4.545	11.2
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.000	3.136	6.591	3.545	0.045	11.318	28.0
METRIDIA OKHOTENSIS	0.000	0.000	0.045	0.000	0.000	0.045	0.1
HETERORHABDUS TANNERI	0.727	0.682	0.000	0.000	0.000	1.409	3.5
CANDACIA COLUMBIAE	0.136	0.091	0.000	0.045	0.000	0.273	0.7
					TOTAL	40.454	

TABLE 47 ZOOPLANKTON COUNTS, ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE .5 TIME DUSK DEPTH INTERVAL 100- 50 M.

DATE JULY 18,1973 AMT.FILTERED 22.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACILIS	0.000	0.091	1.273	0.000	0.000	1.364	3.3
CALANUS PLUMCHRUS	0.000	0.000	0.091	0.000	0.000	0.091	0.2
EUCALANUS BUNGII BUNGII	0.000	0.000	1.500	0.000	0.000	1.500	3.7
PSEUDOCALANUS MINUTUS	0.000	0.000	1.909	0.000	0.000	1.909	4.7
SPINOCALANUS BREVICAUDATUS	0.000	19.500	1.955	0.091	0.000	21.545	52.7
ACTIDIUS APYATUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.182	0.000	0.000	0.000	0.182	0.4
GADIUS COLUMBIAE	0.000	0.000	0.000	0.045	0.273	0.318	0.8
EUCHAETA JAPONICA	0.000	0.182	0.091	0.227	3.318	3.818	9.3
SCAPHOCALANUS SP.	0.045	0.136	0.500	0.091	0.000	0.773	1.9
SCOLECITHRICELLA MINOR	0.000	0.818	0.182	0.000	0.000	1.000	2.4
THARYBIS EULONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.045	1.409	4.954	0.227	0.000	6.545	16.0
METRIDIA OKHOTENSIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
HETEROHABDUS TANNERI	1.182	0.455	0.136	0.000	0.000	1.773	4.3
CANDACIA COLUMBIAE	0.000	0.000	0.045	0.000	0.000	0.045	0.1
				TOTAL		40.864	

TABLE 48 ZOOPLANKTON COUNTS, ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 5 TIME DUSK DEPTH INTERVAL 200-100 M.

DATE JULY 18,1973 AMT.FILTERED 44.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACILIS	0.000	0.000	1.227	0.000	0.000	1.227	4.6
CALANUS PLUMCHRUS	0.000	0.000	0.023	0.000	0.000	0.023	0.1
EUCALANUS BUNGII BUNGII	0.000	0.000	3.477	0.000	0.000	3.477	13.1
PSEUDOCALANUS MINUTUS	0.000	0.000	4.455	0.000	0.000	4.455	16.8
SPINOCALANUS BREVICAUDATUS	0.023	5.432	1.386	0.227	0.000	7.068	26.7
ACTIDIUS APYATUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.023	0.000	0.000	0.000	0.023	0.1
GADIUS COLUMBIAE	0.023	0.000	0.114	0.023	0.523	0.682	2.6
EUCHAETA JAPONICA	0.045	0.136	0.114	0.045	1.114	1.455	5.5
SCAPHOCALANUS SP.	0.136	0.705	0.523	0.341	0.045	1.750	6.6
SCOLECITHRICELLA MINOR	0.000	0.068	0.068	0.000	0.000	0.136	0.5
THARYBIS EULONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	1.773	1.568	1.864	0.591	0.000	4.795	17.8
METRIDIA OKHOTENSIS	0.000	0.023	0.000	0.000	0.000	0.023	0.1
HETEROHABDUS TANNERI	0.841	0.477	0.000	0.000	0.000	1.318	5.0
CANDACIA COLUMBIAE	0.045	0.000	0.023	0.045	0.000	0.114	0.4
				TOTAL		26.454	

TABLE 49 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 5 TIME DUSK DEPTH INTERVAL 300-200 M.

DATE JULY 15.1973 AMT.FILTERED 44.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	7.182	0.000	0.000	7.182	8.2
CALANUS PLUMCHRUS	0.000	0.000	0.545	0.000	0.000	0.545	0.6
EUCALANUS BUNGII BUNGII	0.000	0.000	3.545	0.000	0.000	3.545	4.0
PSEUDOCALANUS MINUTUS	0.000	0.000	64.545	0.000	0.000	64.545	73.5
SPINOCALANUS BREVICAUDATUS	0.114	2.032	0.795	0.227	0.000	4.068	4.6
ACHIDEUS ARMATUS	0.000	0.000	0.023	0.000	0.000	0.023	0.0
CORANTENNA COLUMBIAE	0.023	0.045	0.000	0.000	0.000	0.068	0.1
CHIRIDIUS GRACILIS	0.000	0.045	0.068	0.000	0.000	0.114	0.1
GADIUS COLUMBIAE	0.023	0.000	0.045	0.045	0.136	0.250	0.3
EUCHAETA JAPONICA	0.000	0.227	0.091	0.000	0.636	0.955	1.1
SCAPHOCALANUS SP.	0.023	0.955	0.295	0.023	0.000	1.295	1.5
SCOLECITHRICELLA MINOR	0.000	0.000	0.000	0.000	0.000	0.000	0.0
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	1.568	0.273	0.182	0.000	0.000	2.023	2.3
METRIDIA OKHOTENSIS	0.000	0.818	0.955	0.000	0.000	1.773	2.0
HETEROCHAETUS TANNERI	0.932	0.455	0.000	0.000	0.000	1.386	1.6
CANDACIA COLUMBIAE	0.000	0.000	0.023	0.023	0.000	0.045	0.1
					TOTAL	87.818	

TABLE 50 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 5 TIME DUSK DEPTH INTERVAL 390-300 M.

DATE JULY 19.1973 AMT.FILTERED 39.6 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	2.727	0.000	0.000	2.727	4.8
CALANUS PLUMCHRUS	0.000	0.000	3.737	0.000	0.000	3.737	6.6
EUCALANUS BUNGII BUNGII	0.000	0.000	22.828	0.000	0.000	22.828	40.6
PSEUDOCALANUS MINUTUS	0.000	0.000	16.970	0.000	0.000	16.970	30.1
SPINOCALANUS BREVICAUDATUS	0.227	3.359	0.101	0.177	0.000	3.864	6.9
ACHIDEUS ARMATUS	0.025	0.000	0.025	0.051	0.000	0.051	0.1
CORANTENNA COLUMBIAE	0.025	0.025	0.000	0.051	0.025	0.126	0.2
CHIRIDIUS GRACILIS	0.000	0.076	0.076	0.051	0.025	0.227	0.4
GADIUS COLUMBIAE	0.025	0.025	0.025	0.101	0.000	0.177	0.3
EUCHAETA JAPONICA	0.000	0.328	0.303	0.000	0.707	1.338	2.4
SCAPHOCALANUS SP.	0.076	1.212	0.177	0.000	0.000	1.465	2.6
SCOLECITHRICELLA MINOR	0.000	0.025	0.000	0.000	0.000	0.025	0.0
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.354	0.202	0.025	0.000	0.000	0.581	1.0
METRIDIA OKHOTENSIS	0.000	0.278	0.631	0.000	0.000	0.909	1.6
HETEROCHAETUS TANNERI	0.732	0.455	0.000	0.000	0.000	1.187	2.1
CANDACIA COLUMBIAE	0.025	0.025	0.025	0.000	0.000	0.076	0.1
					TOTAL	56.288	

TABLE 51 ZOOPLANKTON COUNTS, ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 5 TIME MDNT DEPTH INTERVAL 50- 0 M.

DATE JULY 19,1973 AMT.FILTERED 22.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.364	0.864	0.045	0.000	1.273	4.7
CALANUS PLUMCHRUS	0.000	0.000	0.091	0.000	0.000	0.091	0.3
EUCALANUS BUNGII BUNGII	0.000	0.000	0.000	0.000	0.000	0.000	0.0
PSEUDOCALANUS MINUTUS	0.000	0.000	0.545	0.000	0.000	0.545	2.0
SPINOCALANUS BREVICAUDATUS	0.000	1.818	0.000	0.000	0.000	1.818	6.6
METRIDIA PACIFICA	0.000	0.045	0.045	0.000	0.000	0.091	0.3
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.045	0.000	0.000	0.000	0.045	0.2
GADIUS COLUMBIAE	0.000	0.136	0.409	1.091	1.091	2.727	10.0
EUCHAETA JAPONICA	0.273	0.409	0.818	0.500	4.818	6.818	24.9
SCAPHOCALANUS SP.	0.000	0.045	0.091	0.000	0.000	0.136	0.5
SCOLECITHRICELLA MINOR	0.364	1.591	1.318	0.000	0.000	3.273	12.0
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.000	3.045	5.182	1.000	0.045	9.273	33.9
METRIDIA OKHOTENSIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
HETERORHABDUS TANNERI	0.364	0.854	0.091	0.000	0.000	1.227	4.5
CANDACIA COLUMBIAE	0.000	0.000	0.000	0.045	0.000	0.045	0.2

TOTAL 27.364

TABLE 52 ZOOPLANKTON COUNTS, ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 5 TIME MDNT DEPTH INTERVAL 100- 50 M.

DATE JULY 19,1973 AMT.FILTERED 22.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	0.864	0.000	0.000	0.864	2.7
CALANUS PLUMCHRUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
EUCALANUS BUNGII BUNGII	0.000	0.000	0.818	0.000	0.000	0.818	2.5
PSEUDOCALANUS MINUTUS	0.000	0.000	0.591	0.000	0.000	0.591	1.8
SPINOCALANUS BREVICAUDATUS	0.000	14.818	1.364	0.000	0.000	16.182	50.2
METRIDIA PACIFICA	0.000	0.045	0.000	0.000	0.000	0.045	0.1
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.045	0.000	0.000	0.000	0.045	0.1
GADIUS COLUMBIAE	0.000	0.000	0.000	0.000	0.045	0.045	0.1
EUCHAETA JAPONICA	0.045	0.000	0.045	0.273	2.818	3.182	9.9
SCAPHOCALANUS SP.	0.000	0.136	0.227	0.182	0.000	0.545	1.7
SCOLECITHRICELLA MINOR	0.000	0.536	0.000	0.000	0.000	0.636	2.0
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.045	1.182	5.182	0.545	0.000	7.955	24.7
METRIDIA OKHOTENSIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
HETERORHABDUS TANNERI	0.727	0.545	0.045	0.000	0.000	1.318	4.1
CANDACIA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0

TOTAL 32.227

TABLE 53 ZOOPLANKTON COUNTS, ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 5 TIME MDNT DEPTH INTERVAL 200-100 M.

DATE JULY 19,1973 AMT.FILTERED 44.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	1.045	0.000	0.000	1.045	3.5
CALANUS P_UMCHRJS	0.000	0.000	0.045	0.000	0.000	0.045	0.2
EUCALANUS BUNGII BUNGII	0.000	0.045	3.182	0.000	0.000	3.227	10.8
PSEJDOCALANUS MINUTUS	0.000	0.000	6.864	0.000	0.000	6.864	22.9
SPINOCALANUS BREVICAUDATUS	0.023	6.682	1.636	0.318	0.000	6.659	28.9
ARTIOEUS ARMATUS	0.000	0.045	0.023	0.023	0.000	0.091	0.3
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACI_IS	0.023	0.114	0.000	0.000	0.000	0.136	0.5
GADIUS CO_UMBIAE	0.023	0.023	0.114	0.114	0.682	0.955	3.2
EUCHAETA JAPONICA	0.091	0.114	0.136	0.045	0.636	1.023	3.4
SCAPHOCALANUS SP.	0.136	0.750	0.591	0.136	0.023	1.636	5.5
SCO_ECITHRICELLA MINOR	0.000	0.023	0.000	0.000	0.000	0.023	0.1
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.818	1.818	1.682	0.477	0.023	4.818	16.1
METRIDIA OKHOTENSIS	0.000	0.023	0.045	0.000	0.000	0.068	0.2
HETEROHABDUS TANNERI	0.864	0.477	0.000	0.000	0.000	1.341	4.5
CANDACIA COLUMBIAE	0.000	0.000	0.000	0.023	0.000	0.023	0.1
					TOTAL	29.954	

TABLE 54 ZOOPLANKTON COUNTS, ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 5 TIME MDNT DEPTH INTERVAL 300-200 M.

DATE JULY 19,1973 AMT.FILTERED 44.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	8.545	0.000	0.000	8.545	10.5
CALANUS P_UMCHRJS	0.000	0.000	1.636	0.000	0.000	1.636	2.0
EUCALANUS BUNGII BUNGII	0.000	0.000	5.000	0.000	0.000	5.000	6.1
PSEJDOCALANUS MINUTUS	0.000	0.000	51.818	0.000	0.000	51.818	63.6
SPINOCALANUS BREVICAUDATUS	0.091	3.750	1.045	0.159	0.000	5.045	6.2
ARTIOEUS ARMATUS	0.000	0.000	0.045	0.000	0.000	0.045	0.1
COMANTENNA COLUMBIAE	0.000	0.023	0.000	0.000	0.000	0.023	0.0
CHIRIDIUS GRACI_IS	0.000	0.068	0.023	0.000	0.000	0.091	0.1
CADIUS CO_UMBIAE	0.045	0.000	0.114	0.136	0.455	0.750	0.9
EUCHAETA JAPONICA	0.023	0.250	0.091	0.000	1.182	1.545	1.9
SCAPHOCALANUS SP.	0.045	1.318	0.295	0.114	0.000	1.773	2.2
SCO_ECITHRICELLA MINOR	0.000	0.000	0.000	0.000	0.000	0.000	0.0
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.841	0.477	0.409	0.000	0.000	1.727	2.1
METRIDIA OKHOTENSIS	0.000	0.841	1.114	0.000	0.000	1.955	2.4
HETEROHABDUS TANNERI	0.727	0.727	0.000	0.000	0.000	1.455	1.8
CANDACIA COLUMBIAE	0.000	0.000	0.000	0.023	0.000	0.023	0.0
					TOTAL	81.432	

TABLE 55 ZOOPLANKTON COUNTS, ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 6 TIME MONT DEPTH INTERVAL 390-300 M.

DATE JULY 19,1973 AMT.FILTERED 39.6 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	3.333	0.000	0.000	3.333	5.4
CALANUS PLUMCHRUS	0.000	0.000	4.747	0.000	0.000	4.747	7.7
EUCALANUS BUNGII BUNGII	0.000	0.707	32.323	0.000	0.000	33.030	53.7
PSEUDOCALANUS MINUTUS	0.000	0.000	10.101	0.000	0.000	10.101	16.4
SPINOCALANUS BREVICAUDATUS	0.227	4.192	0.783	0.101	0.000	5.303	8.6
ALTIDEUS ARMATUS	0.000	0.025	0.051	0.000	0.000	0.076	0.1
COMANTENNA COLUMBIAE	0.025	0.000	0.025	0.000	0.025	0.076	0.1
CHIRIDIUS GRACILIS	0.051	0.076	0.076	0.000	0.025	0.227	0.4
GADIUS COLUMBIAE	0.025	0.000	0.025	0.025	0.000	0.076	0.1
EUCHAETA JAPONICA	0.025	0.101	0.000	0.000	0.505	0.631	1.0
SCAPHOCALANUS SP.	0.025	0.783	0.177	0.000	0.000	0.985	1.6
SCOLECITHRICELLA MINOR	0.000	0.000	0.000	0.000	0.000	0.000	0.0
THARYBIS EULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.278	0.051	0.101	0.000	0.000	0.429	0.7
METRIDIA OKHOTENSIS	0.000	0.657	0.505	0.000	0.000	1.162	1.9
HETERORHABDUS TANNERI	0.631	0.556	0.000	0.000	0.000	1.187	1.9
CANDACIA COLUMBIAE	0.051	0.000	0.025	0.025	0.025	0.126	0.2
				TOTAL		61.490	

TABLE 56 ZOOPLANKTON COUNTS, ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 6 TIME DAWN DEPTH INTERVAL 50- 0 M.

DATE JULY 19,1973 AMT.FILTERED 22.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.045	0.364	1.091	0.182	0.045	1.727	5.4
CALANUS PLUMCHRUS	0.000	0.000	0.182	0.000	0.000	0.182	0.6
EUCALANUS BUNGII BUNGII	0.000	0.000	0.000	0.000	0.000	0.000	0.0
PSEUDOCALANUS MINUTUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
SPINOCALANUS BREVICAUDATUS	0.000	1.182	0.091	0.000	0.000	1.273	4.0
ALTIDEUS ARMATUS	0.000	0.000	0.000	0.000	0.045	0.045	0.1
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.000	0.000	0.000	0.045	0.045	0.1
GADIUS COLUMBIAE	0.000	0.273	0.591	1.000	1.864	3.727	11.6
EUCHAETA JAPONICA	0.409	0.545	1.318	0.591	3.409	6.273	19.6
SCAPHOCALANUS SP.	0.045	0.000	0.000	0.000	0.000	0.045	0.1
SCOLECITHRICELLA MINOR	0.682	2.500	3.273	0.182	0.000	6.636	20.7
THARYBIS EULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.000	0.455	7.409	3.182	0.045	11.091	34.6
METRIDIA OKHOTENSIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
HETERORHABDUS TANNERI	0.455	0.500	0.000	0.000	0.000	0.955	3.0
CANDACIA COLUMBIAE	0.045	0.000	0.000	0.000	0.000	0.045	0.1
				TOTAL		32.045	

TABLE 57 ZOOPLANKTON COUNTS, ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 5 TIME DAWN DEPTH INTERVAL 100- 50 M.

DATE JULY 19,1973 AMT.FILTERED 22.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.273	0.818	0.091	0.000	1.182	2.8
CALANUS PLUMCHRUS	0.000	0.000	0.045	0.000	0.000	0.045	0.1
EUCALANUS BUNGII BUNGII	0.000	0.000	0.773	0.000	0.000	0.773	1.8
PSEUDOCALANUS MINUTUS	0.000	0.000	1.364	0.000	0.000	1.364	3.2
SPINOCALANUS PREVICAUDATUS	0.000	17.273	2.773	0.500	0.000	20.545	48.3
AETIDEUS ARMATUS	0.000	0.000	0.000	0.045	0.000	0.045	0.1
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
GAUIUS COLUMBIAE	0.000	0.045	0.091	0.091	0.500	0.727	1.7
EUCHAETA JAPONICA	0.136	0.045	0.273	0.136	4.545	5.136	12.1
SCAPHOCALANUS SP.	0.091	0.091	0.182	0.000	0.000	0.364	0.9
SCOLECITHRICELLA MINOR	0.091	1.045	0.909	0.000	0.000	2.045	4.8
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.000	1.727	6.227	1.000	0.045	9.000	21.2
METRIDIA OKHOTENSIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
HETERORHABDUS TANNERI	0.864	0.409	0.000	0.000	0.045	1.318	3.1
CANDACIA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0

TOTAL 42.545

TABLE 58 ZOOPLANKTON COUNTS, ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 5 TIME DAWN DEPTH INTERVAL 200-100 M.

DATE JULY 19,1973 AMT.FILTERED 44.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	0.818	0.000	0.000	0.818	2.8
CALANUS PLUMCHRUS	0.000	0.000	0.091	0.000	0.000	0.091	0.3
EUCALANUS BUNGII BUNGII	0.000	0.000	3.409	0.318	0.000	3.727	12.8
PSEUDOCALANUS MINUTUS	0.000	0.000	6.091	0.000	0.000	6.091	20.9
SPINOCALANUS PREVICAUDATUS	0.000	5.341	1.909	0.523	0.000	7.773	26.7
AETIDEUS ARMATUS	0.000	0.000	0.000	0.023	0.000	0.023	0.1
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.068	0.000	0.023	0.000	0.091	0.3
GAUIUS COLUMBIAE	0.000	0.068	0.068	0.136	0.523	0.795	2.7
EUCHAETA JAPONICA	0.114	0.136	0.000	0.091	1.000	1.341	4.6
SCAPHOCALANUS SP.	0.159	1.386	0.659	0.227	0.000	2.432	8.4
SCOLECITHRICELLA MINOR	0.000	0.068	0.114	0.000	0.000	0.182	0.6
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.682	1.568	2.000	0.091	0.000	4.341	14.9
METRIDIA OKHOTENSIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
HETERORHABDUS TANNERI	0.864	0.455	0.000	0.000	0.000	1.318	4.5
CANDACIA COLUMBIAE	0.000	0.023	0.000	0.023	0.023	0.068	0.2

TOTAL 29.091

TABLE 59 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 6 TIME DAWN DEPTH INTERVAL 300-200 M.

DATE JULY 19,1973 AMT.FILTERED 44.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	8.455	0.000	0.000	8.455	8.3
CALANUS PLUMCHRUS	0.000	0.000	1.000	0.000	0.000	1.000	1.0
EUCALANUS BUNGII BUNGII	0.000	0.000	3.182	0.000	0.000	3.182	3.1
PSEUDOCALANUS MINUTUS	0.000	0.000	76.182	0.000	0.000	76.182	74.4
SPINOCALANUS LONGICAUDATUS	0.182	3.386	1.136	0.182	0.000	5.386	5.3
AETIDEUS ARMATUS	0.000	0.000	0.023	0.000	0.000	0.023	0.0
CORNANTENNA COLUMBIAE	0.023	0.000	0.023	0.000	0.023	0.068	0.1
CHIRIDIUS GRACILIS	0.000	0.023	0.000	0.000	0.000	0.023	0.0
GAIDIUS COLUMBIAE	0.000	0.045	0.114	0.045	0.591	0.795	0.8
EUCHAETA JAPONICA	0.000	0.364	0.273	0.000	0.318	0.955	0.9
SCAPHOCALANUS SP.	0.068	1.273	0.227	0.000	0.000	1.568	1.5
SCOLECITHRICELLA MINOR	0.000	0.000	0.000	0.000	0.000	0.000	0.0
THARYBIS EULONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	1.159	0.364	0.364	0.045	0.023	1.955	1.9
METRIDIA OKHOTENSIS	0.000	0.614	0.727	0.000	0.000	1.341	1.3
HETERORHABDUS TANNERI	0.773	0.545	0.000	0.000	0.000	1.318	1.3
CANDACIA COLUMBIAE	0.000	0.000	0.000	0.068	0.068	0.136	0.1

TOTAL 102.385

TABLE 60 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 5 TIME DAWN DEPTH INTERVAL 390-300 M.

DATE JULY 19,1973 AMT.FILTERED 39.6 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	3.939	0.000	0.000	3.939	6.0
CALANUS PLUMCHRUS	0.000	0.000	4.141	0.000	0.000	4.141	6.3
EUCALANUS BUNGII BUNGII	0.000	0.000	25.556	0.000	0.000	25.556	38.6
PSEUDOCALANUS MINUTUS	0.000	0.000	20.606	0.000	0.000	20.606	31.2
SPINOCALANUS LONGICAUDATUS	0.328	3.817	1.364	0.278	0.000	5.783	8.7
AETIDEUS ARMATUS	0.000	0.025	0.051	0.025	0.000	0.101	0.2
CORNANTENNA COLUMBIAE	0.051	0.000	0.051	0.025	0.025	0.152	0.2
CHIRIDIUS GRACILIS	0.025	0.177	0.051	0.025	0.025	0.303	0.5
GAIDIUS COLUMBIAE	0.025	0.025	0.025	0.051	0.051	0.177	0.3
EUCHAETA JAPONICA	0.000	0.202	0.101	0.000	1.010	1.313	2.0
SCAPHOCALANUS SP.	0.025	0.808	0.152	0.152	0.000	1.136	1.7
SCOLECITHRICELLA MINOR	0.000	0.000	0.000	0.000	0.000	0.000	0.0
THARYBIS EULONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.076	0.076	0.126	0.000	0.000	0.278	0.4
METRIDIA OKHOTENSIS	0.000	0.557	0.732	0.000	0.000	1.389	2.1
HETERORHABDUS TANNERI	0.581	0.530	0.000	0.000	0.000	1.111	1.7
CANDACIA COLUMBIAE	0.051	0.000	0.000	0.076	0.025	0.152	0.2

TOTAL 66.136

TABLE 61 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 5 TIME NOON DEPTH INTERVAL 50- 0 M.

DATE JULY 19,1973 AMT.FILTERED 22.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.273	0.909	0.000	0.000	1.182	5.8
CALANUS PLUMCHRUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
EUCALANUS BUNGII BUNGII	0.000	0.000	0.000	0.000	0.000	0.000	0.0
PSEUDOCALANUS MINUTUS	0.000	0.000	2.045	0.000	0.000	2.045	10.0
SPINOCALANUS BREVICAUDATUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
AETIDEUS ARMATUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
GADIUS COLUMBIAE	0.000	0.000	0.000	0.000	0.182	0.182	0.9
EUCHAETA JAPONICA	0.000	0.000	0.000	0.045	3.364	3.409	16.7
SCAPHOCALANUS SP.	0.000	0.000	0.000	0.000	0.000	0.000	0.0
SCOLECITHRICELLA MINOR	0.727	1.273	3.545	0.000	0.000	5.545	27.2
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.000	0.000	4.773	3.091	0.182	8.045	39.4
METRIDIA OKHOTENSIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
HETERORHABDUS TANNERI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CANDACIA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0

TOTAL 20.409

TABLE 62 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 5 TIME NOON DEPTH INTERVAL 100- 50 M.

DATE JULY 19,1973 AMT.FILTERED 22.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.045	0.136	1.364	0.091	0.000	1.636	3.8
CALANUS PLUMCHRUS	0.000	0.000	0.136	0.000	0.000	0.136	0.3
EUCALANUS BUNGII BUNGII	0.000	0.000	0.591	0.182	0.000	0.773	1.8
PSEUDOCALANUS MINUTUS	0.000	0.000	1.500	0.000	0.000	1.500	3.5
SPINOCALANUS BREVICAUDATUS	0.000	17.955	2.136	0.182	0.000	20.273	47.2
AETIDEUS ARMATUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.000	0.000	0.045	0.000	0.045	0.1
GADIUS COLUMBIAE	0.000	0.000	0.091	0.273	1.091	1.455	3.4
EUCHAETA JAPONICA	0.045	0.045	0.000	0.182	3.636	3.909	9.1
SCAPHOCALANUS SP.	0.000	0.045	0.136	0.136	0.000	0.318	0.7
SCOLECITHRICELLA MINOR	0.136	1.955	0.727	0.000	0.000	2.818	6.6
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.227	1.955	5.455	0.682	0.000	8.318	19.4
METRIDIA OKHOTENSIS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
HETERORHABDUS TANNERI	0.500	1.273	0.000	0.000	0.000	1.773	4.1
CANDACIA COLUMBIAE	0.100	0.000	0.000	0.000	0.000	0.000	0.0

TOTAL 42.954

TABLE 63 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 5 TIME NOON DEPTH INTERVAL 200-100 M.

DATE JULY 10,1973 AMT.FILTERED 44.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	0.500	0.000	0.000	0.500	1.5
CALANUS PLUMCHRUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
EUCALANUS BUNGII BUNGII	0.000	0.000	2.545	0.000	0.000	2.545	7.8
PSEUDOCALANUS MINUTUS	0.000	0.000	6.455	0.000	0.000	6.455	19.7
SPINOCALANUS BREVICAUDATUS	0.000	7.864	1.409	0.182	0.000	9.455	28.9
ARTIDEUS ARCATUS	0.000	0.000	0.045	0.023	0.000	0.068	0.2
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.114	0.023	0.000	0.000	0.136	0.4
GADIUS COLUMBIAE	0.000	0.068	0.341	0.477	0.636	1.523	4.7
EUCHAETA JAPONICA	0.364	0.364	0.955	0.364	1.045	3.091	9.4
SCAPHOCALANUS SP.	0.091	0.841	0.318	0.182	0.000	1.432	4.4
SCOLECITHRICELLA MINOR	0.023	0.273	0.318	0.000	0.000	0.614	1.9
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.750	2.341	1.591	0.386	0.000	5.068	15.5
METRIDIA OKHOTENSIS	0.000	0.000	0.023	0.000	0.000	0.023	0.1
HETEROHABDUS TANNERI	1.068	0.614	0.000	0.000	0.000	1.682	5.1
CANDACIA COLUMBIAE	0.000	0.023	0.000	0.091	0.023	0.136	0.4
				TOTAL		32.727	

TABLE 64 ZOOPLANKTON COUNTS. ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION BUTE 5 TIME NOON DEPTH INTERVAL 300-200 M.

DATE JULY 10,1973 AMT.FILTERED 44.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	7.455	0.000	0.000	7.455	8.5
CALANUS PLUMCHRUS	0.000	0.000	0.727	0.000	0.000	0.727	0.8
EUCALANUS BUNGII BUNGII	0.000	0.114	2.795	0.000	0.000	2.909	3.3
PSEUDOCALANUS MINUTUS	0.000	0.000	61.818	0.000	0.000	61.818	70.9
SPINOCALANUS BREVICAUDATUS	0.182	3.091	0.727	0.068	0.000	4.068	4.7
ARTIDEUS ARCATUS	0.000	0.000	0.000	0.023	0.000	0.023	0.0
COMANTENNA COLUMBIAE	0.023	0.023	0.068	0.000	0.000	0.114	0.1
CHIRIDIUS GRACILIS	0.023	0.045	0.068	0.000	0.000	0.136	0.2
GADIUS COLUMBIAE	0.068	0.000	0.023	0.205	0.227	0.523	0.6
EUCHAETA JAPONICA	0.023	0.341	0.091	0.000	1.000	1.455	1.7
SCAPHOCALANUS SP.	0.045	0.977	0.295	0.045	0.000	1.364	1.6
SCOLECITHRICELLA MINOR	0.045	0.023	0.000	0.000	0.000	0.068	0.1
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	1.795	0.682	0.705	0.023	0.000	3.205	3.7
METRIDIA OKHOTENSIS	0.000	0.955	0.773	0.000	0.000	1.727	2.0
HETEROHABDUS TANNERI	0.955	0.568	0.000	0.000	0.000	1.523	1.7
CANDACIA COLUMBIAE	0.023	0.000	0.000	0.068	0.000	0.091	0.1
				TOTAL		87.204	

TABLE 65 ZOOPLANKTON COUNTS, ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE BOGO

STATION *BUTE 5 TIME NOON DEPTH INTERVAL 390-300 M.

DATE JULY 15,1973 AMT.FILTERED 39.6 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	6.970	0.000	0.000	6.970	10.2
CALANUS PLUMCHRUS	0.000	0.000	0.808	0.000	0.000	0.808	1.2
EUCALANUS BUNGII BUNGII	0.000	0.000	2.121	0.000	0.000	2.121	3.1
PSEUDOCALANUS MINUTUS	0.000	0.000	45.859	0.000	0.000	45.859	67.2
SPINOCALANUS BREVICAUDATUS	0.177	3.535	0.556	0.051	0.000	4.318	6.3
AETIDEUS ARMATUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
COMANTENNA COLUMBIAE	0.000	0.000	0.025	0.025	0.000	0.051	0.1
CHIRIDIUS GRACILIS	0.000	0.025	0.000	0.000	0.000	0.025	0.0
GAIDIUS COLUMBIAE	0.000	0.051	0.152	0.126	0.278	0.606	0.9
EUCHAETA JAPONICA	0.076	0.227	0.202	0.101	0.505	1.111	1.6
SCAPHOCALANUS SP.	0.025	1.136	0.202	0.076	0.000	1.439	2.1
SCOLECITHRICELLA MINOR	0.000	0.025	0.000	0.000	0.000	0.025	0.0
THARYBIS EULONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	1.237	0.505	0.480	0.025	0.000	2.348	3.4
METRIDIA OKHOTENSIS	0.000	0.455	0.581	0.000	0.000	1.035	1.5
HETEROHABDUS TANNERI	0.859	0.530	0.000	0.000	0.000	1.389	2.0
CANDACIA COLUMBIAE	0.000	0.025	0.000	0.051	0.025	0.101	0.1

TOTAL 68.207

TABLE 66 ZOOPLANKTON COUNTS, ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE PARIZEAU NET TYPE SCOR

STATION GS 1 TIME DAY DEPTH INTERVAL 400- 0 M.

DATE JAN. 17,1973 AMT.FILTERED 100.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	1.550	2.320	95.090	0.000	0.000	98.960	33.5
CALANUS PLUMCHRUS	3.840	0.000	11.840	0.000	0.000	15.680	5.3
EUCALANUS BUNGII BUNGII	0.000	0.000	2.720	0.000	0.000	2.720	0.9
PSEUDOCALANUS MINUTUS	0.000	0.000	65.520	0.000	0.000	65.520	22.2
SPINOCALANUS BREVICAUDATUS	0.010	0.100	0.150	0.020	0.000	0.370	0.1
AETIDEUS ARMATUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.140	0.070	0.040	0.150	0.300	0.1
GAIDIUS COLUMBIAE	0.350	0.290	11.820	0.100	0.270	12.630	4.3
EUCHAETA JAPONICA	0.500	1.330	1.000	0.130	1.330	4.290	1.5
SCAPHOCALANUS SP.	0.020	0.100	0.160	0.040	0.000	0.320	0.1
SCOLECITHRICELLA MINOR	0.150	1.040	0.180	0.000	0.000	1.770	0.6
THARYBIS EULONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.200	88.000	1.000	0.000	0.000	89.200	30.2
METRIDIA OKHOTENSIS	0.370	0.200	2.750	0.000	0.000	3.320	1.1
HETEROHABDUS TANNERI	0.010	0.010	0.000	0.000	0.000	0.020	0.0
CANDACIA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0

TOTAL 295.099

TABLE 67 ZOOPLANKTON COUNTS, ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE PARIZEAU NET TYPE SCOR

STATION JERV 3 TIME DAY DEPTH INTERVAL 600- 0 M.

DATE JAN. 18,1973 AMT.FILTERED 150.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACILIS	1.133	0.000	93.267	0.000	0.000	94.400	33.5
CALANUS PLUMCHRUS	5.493	1.827	20.673	0.000	0.000	27.993	11.7
EUCALANUS BUNGII BUNGII	0.000	0.000	4.853	0.000	0.000	4.853	2.0
PSEUDOCALANUS MINUTUS	0.000	0.000	67.413	0.000	0.000	67.413	28.3
SPINOCALANUS BREVICAUDATUS	0.307	8.433	5.000	0.393	0.000	14.133	5.9
ALTIDEUS ARMATUS	0.000	0.000	0.000	0.000	0.000	0.000	0.0
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.007	0.000	0.007	0.000	0.013	0.0
GAETUS COLUMBIAE	0.547	0.327	1.707	0.020	0.013	2.613	1.1
EUCHAETA JAPONICA	0.607	0.327	1.013	0.000	0.000	2.507	1.1
SCAPHOCALANUS SP.	0.053	0.380	0.240	0.053	0.000	0.727	0.3
SCOLECITHRICELLA MINOR	0.053	0.393	0.033	0.000	0.000	0.480	0.2
THARYBIS EUTONI	0.000	0.000	0.000	0.020	0.000	0.020	0.0
METRIDIA PACIFICA	0.447	21.333	0.673	0.000	0.000	22.453	9.4
METRIDIA OKHOTENSIS	0.100	0.167	0.000	0.000	0.000	0.267	0.1
HETERORHABDUS TANNERI	0.293	0.207	0.000	0.000	0.000	0.500	0.2
CANDACIA COLUMBIAE	0.013	0.033	0.027	0.013	0.007	0.093	0.0

TOTAL 238.447

TABLE 68 ZOOPLANKTON COUNTS, ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE SCOR

STATION GN 1 TIME DAY DEPTH INTERVAL 300- 0 M.

DATE FEB. 25,1973 AMT.FILTERED 75.2 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACILIS	3.333	4.707	4.333	0.000	0.200	12.373	25.7
CALANUS PLUMCHRUS	0.400	0.800	0.000	0.000	0.000	1.200	2.5
EUCALANUS BUNGII BUNGII	0.000	0.000	0.173	0.000	0.000	0.173	0.4
PSEUDOCALANUS MINUTUS	0.080	8.000	0.080	0.000	0.000	8.160	17.0
SPINOCALANUS BREVICAUDATUS	0.000	0.200	0.013	0.013	0.000	0.227	0.5
ALTIDEUS ARMATUS	0.000	0.040	0.027	0.013	0.000	0.080	0.2
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.013	0.173	0.040	0.040	0.067	0.333	0.7
GAETUS COLUMBIAE	0.013	0.120	0.240	0.000	0.000	0.373	0.8
EUCHAETA JAPONICA	0.333	0.440	1.173	0.000	0.000	1.947	4.0
SCAPHOCALANUS SP.	0.000	0.013	0.027	0.000	0.000	0.040	0.1
SCOLECITHRICELLA MINOR	0.280	2.800	0.520	0.000	0.000	3.600	7.5
THARYBIS EUTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.200	17.627	0.200	0.000	1.333	19.360	40.3
METRIDIA OKHOTENSIS	0.013	0.013	0.000	0.000	0.000	0.027	0.1
HETERORHABDUS TANNERI	0.000	0.013	0.000	0.000	0.000	0.013	0.0
CANDACIA COLUMBIAE	0.053	0.053	0.053	0.013	0.013	0.187	0.4

TOTAL 48.093

TAB_E 69 ZOOPLANKTON COUNTS, ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE SCOR

STATION BUTE 2 TIME DAY DEPTH INTERVAL 600- 0 M.

DATE FEB. 21,1973 AMT.FILTERED 150.2 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	7.127	9.660	14.253	0.000	0.000	31.040	29.8
CALANUS PLUMCHRUS	1.227	3.893	0.000	0.000	0.000	5.120	4.9
EUCALANUS BUNGII BUNGII	0.000	0.000	1.760	0.000	0.000	1.760	1.7
PSEUDOCALANUS MINUTUS	2.083	9.767	3.133	0.000	0.000	14.983	14.3
SPINOCALANUS BREVICAUDATUS	0.200	3.573	1.680	0.000	0.000	5.453	5.2
AETIDEUS ARMATUS	0.047	0.180	0.213	0.000	0.000	0.440	0.4
COMANTENNA COLUMBIAE	0.027	0.073	0.207	0.073	0.007	0.387	0.4
CHIRIDIUS GRACILIS	0.000	0.007	0.027	0.067	0.147	0.247	0.2
GADIUS COLUMBIAE	2.447	8.773	11.660	0.000	0.000	22.880	21.9
EUCHAETA JAPONICA	0.373	0.907	2.560	0.000	0.000	3.840	3.7
SCAPHOCALANUS SP.	0.033	0.540	0.453	0.220	0.013	1.260	1.2
SCOLECITHRICELLA MINOR	0.020	0.027	0.000	0.000	0.000	0.047	0.0
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.560	13.093	0.280	0.000	0.140	14.073	13.5
METRIDIA OKHOTENSIS	0.820	1.187	0.220	0.000	0.000	2.227	2.1
HETEROPHARDUS TANNERI	0.207	0.267	0.013	0.000	0.000	0.487	0.5
CANDACIA COLUMBIAE	0.000	0.033	0.040	0.027	0.007	0.107	0.1

TOTAL 104.300

TAB_E 70 ZOOPLANKTON COUNTS, ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE SCOR

STATION BUTE 4 TIME DAY DEPTH INTERVAL 600- 0 M.

DATE FEB. 23,1973 AMT.FILTERED 150.2 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	12.060	24.467	18.087	0.000	0.000	54.613	32.0
CALANUS PLUMCHRUS	0.487	3.133	0.980	0.000	0.000	4.600	2.7
EUCALANUS BUNGII BUNGII	0.000	0.000	2.960	0.000	0.000	2.960	1.7
PSEUDOCALANUS MINUTUS	1.240	21.827	1.733	0.000	0.000	24.800	14.5
SPINOCALANUS BREVICAUDATUS	2.060	23.647	10.087	0.213	0.000	35.007	21.1
AETIDEUS ARMATUS	0.000	0.067	0.147	0.000	0.000	0.213	0.1
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.027	0.053	0.133	0.000	0.213	0.1
GADIUS COLUMBIAE	1.027	0.280	0.187	0.000	0.000	1.493	0.9
EUCHAETA JAPONICA	0.100	0.620	5.513	0.000	0.000	5.533	3.3
SCAPHOCALANUS SP.	0.047	0.373	0.547	0.327	0.020	1.313	0.8
SCOLECITHRICELLA MINOR	0.000	0.013	0.000	0.000	0.000	0.013	0.0
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.000	35.673	0.727	0.000	0.000	36.400	21.3
METRIDIA OKHOTENSIS	0.307	0.653	0.093	0.000	0.000	1.053	0.5
HETEROPHARDUS TANNERI	0.147	0.227	0.060	0.140	0.000	0.573	0.3
CANDACIA COLUMBIAE	0.013	0.020	0.007	0.013	0.000	0.053	0.0

TOTAL 170.840

TABLE 71 ZOOPLANKTON COUNTS, ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE LAYMORE NET TYPE SCOR

STATION BUTE 5 TIME DAY DEPTH INTERVAL 300- 0 M.

DATE FEB. 22,1973 AMT.FILTERED 75.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	1.760	6.227	5.560	0.000	0.000	13.547	18.0
CALANUS PLUMCHRUS	0.747	2.503	0.613	0.000	0.000	4.053	5.4
EUCALANUS BUNGII BUNGII	0.000	0.000	5.973	0.000	0.000	5.973	7.9
PSEUDOCALANUS MINUTUS	0.000	16.293	1.413	0.000	0.000	17.707	23.5
SPINOCALANUS BREVICAUDATUS	0.107	5.173	5.067	0.000	0.000	10.347	13.7
AETIDEUS ARMATUS	0.000	0.013	0.013	0.000	0.000	0.027	0.0
COMANTENNA COLUMBIAE	0.000	0.013	0.000	0.000	0.000	0.013	0.0
CHIRIDIUS GRACILIS	0.000	0.027	0.013	0.000	0.000	0.053	0.1
GAETIUS COLUMBIAE	0.147	0.107	0.027	0.013	0.107	0.400	0.5
EUCHAETA JAPONICA	1.053	0.653	3.307	0.000	0.000	3.413	4.5
SCAPHOCALANUS SP.	0.000	0.067	0.107	0.147	0.000	0.320	0.4
SCOLECITHRICELLA MINOR	0.267	1.120	0.213	0.000	0.000	1.600	2.1
THARYBIS FULTONI	0.013	0.013	0.000	0.000	0.000	0.013	0.0
METRIDIA PACIFICA	0.480	15.200	0.320	0.000	0.000	16.000	21.2
METRIDIA OKHOTENSIS	0.133	0.387	0.067	0.000	0.000	0.587	0.8
HETERORHABDUS TANNERI	0.053	0.133	0.240	0.853	0.000	1.280	1.7
CANDACIA COLUMBIAE	0.000	0.000	0.013	0.027	0.040	0.080	0.1

TOTAL 75.413

TABLE 72 ZOOPLANKTON COUNTS, ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE VECTOR NET TYPE SCOR

STATION BUTE 2 TIME DAY DEPTH INTERVAL 500- 0 M.

DATE JUNE 14,1973 AMT.FILTERED 150.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	5.520	0.000	0.000	5.520	3.3
CALANUS PLUMCHRUS	0.000	0.000	2.320	0.000	0.000	2.320	1.4
EUCALANUS BUNGII BUNGII	0.000	0.000	4.427	0.000	0.000	4.427	2.6
PSEUDOCALANUS MINUTUS	0.000	0.000	84.453	0.000	0.000	84.453	50.4
SPINOCALANUS BREVICAUDATUS	0.640	8.240	12.053	3.967	0.000	25.540	15.3
AETIDEUS ARMATUS	0.160	0.107	0.053	0.000	0.000	0.320	0.2
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.107	0.160	0.533	0.107	0.053	0.960	0.5
GAETIUS COLUMBIAE	0.000	0.267	0.000	3.413	21.873	25.553	15.3
EUCHAETA JAPONICA	0.107	0.107	3.520	0.000	0.000	3.733	2.2
SCAPHOCALANUS SP.	0.100	0.300	0.600	0.400	0.033	1.433	0.9
SCOLECITHRICELLA MINOR	0.267	0.533	0.267	0.000	0.000	1.067	0.6
THARYBIS FULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	4.660	5.000	0.200	0.000	0.000	9.520	5.6
METRIDIA OKHOTENSIS	0.000	0.320	0.107	0.000	0.000	0.427	0.3
HETERORHABDUS TANNERI	0.267	0.320	0.747	0.213	0.000	1.547	0.9
CANDACIA COLUMBIAE	0.160	0.000	0.053	0.053	0.000	0.267	0.2

TOTAL 167.687

TABLE 73 ZOOPLANKTON COUNTS, ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE VECTOR NET TYPE SCOR

STATION BUTE 4 TIME DAY DEPTH INTERVAL 600- 0 M.

DATE JUNE 14,1973 AMT.FILTERED 180.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	3.840	0.000	0.000	3.840	7.4
CALANUS PLUMCHRUS	0.000	0.000	1.973	0.000	0.000	1.973	1.7
EUCALANUS BUNGII BUNGII	0.000	0.000	7.413	0.000	0.000	7.413	6.5
PSEUDOCALANUS MINUTUS	0.000	0.000	46.080	0.000	0.000	46.080	40.5
SPINOCALANUS BREVICAUDATUS	0.427	13.120	6.203	4.053	0.000	23.803	21.0
ALTIDEUS ARMATUS	0.000	0.107	0.053	0.000	0.000	0.160	0.1
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.053	0.160	0.267	0.053	0.000	0.533	0.5
GADIUS COLUMBIAE	0.000	0.960	0.107	1.707	11.300	14.073	12.4
EUCHAETA JAPONICA	0.373	0.160	5.547	0.000	0.000	6.080	5.3
SCAPHOCALANUS SP.	0.107	0.907	1.333	0.907	0.000	3.253	2.9
SCOLECITHRICELLA MINOR	0.280	0.553	0.287	0.000	0.000	1.120	1.0
THARYBIS EULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	0.747	1.227	0.053	0.000	0.000	2.027	1.8
METRIDIA OKHOTENSIS	0.000	0.533	0.267	0.000	0.000	0.800	0.7
HETEROPHABDUS TANNERI	0.907	0.800	0.640	0.000	0.000	2.347	2.1
CANDACIA COLUMBIAE	0.107	0.000	0.000	0.000	0.000	0.107	0.1

TOTAL 113.700

TABLE 74 ZOOPLANKTON COUNTS, ADULT AND COPEPODITE STAGES OF CALANOID COPEPODS IN NUMBERS PER CUBIC METER

CRUISE VECTOR NET TYPE SCOR

STATION BUTE 5 TIME DAY DEPTH INTERVAL 380- 0 M.

DATE JUNE 14,1973 AMT.FILTERED 95.0 CU.M.

SPECIES NAME	MALES	FEMALES	ST.V	ST.IV	ST.I-III	TOTAL	PCT TOTAL
CALANUS GRACIALIS	0.000	0.000	11.453	0.000	0.000	11.453	5.6
CALANUS PLUMCHRUS	0.000	0.000	0.758	0.000	0.000	0.758	0.4
EUCALANUS BUNGII BUNGII	0.000	0.000	25.263	0.000	0.000	25.263	12.3
PSEUDOCALANUS MINUTUS	0.000	0.000	112.505	0.000	0.000	112.505	54.6
SPINOCALANUS BREVICAUDATUS	0.337	14.716	7.411	0.000	0.000	22.063	10.7
ALTIDEUS ARMATUS	0.000	0.084	0.000	0.000	0.000	0.084	0.0
COMANTENNA COLUMBIAE	0.000	0.000	0.000	0.000	0.000	0.000	0.0
CHIRIDIUS GRACILIS	0.000	0.169	0.105	0.084	0.063	0.421	0.2
GADIUS COLUMBIAE	0.000	1.432	0.337	2.526	4.547	8.842	4.3
EUCHAETA JAPONICA	0.084	1.095	5.558	0.000	0.000	6.737	3.3
SCAPHOCALANUS SP.	0.484	1.768	1.095	0.674	0.421	4.442	2.2
SCOLECITHRICELLA MINOR	0.432	1.474	0.621	0.000	0.000	2.525	1.2
THARYBIS EULTONI	0.000	0.000	0.000	0.000	0.000	0.000	0.0
METRIDIA PACIFICA	1.589	3.832	1.589	0.474	0.000	7.484	3.6
METRIDIA OKHOTENSIS	0.000	0.505	0.589	0.000	0.000	1.095	0.5
HETEROPHABDUS TANNERI	1.095	1.179	0.084	0.000	0.000	2.358	1.1
CANDACIA COLUMBIAE	0.084	0.000	0.000	0.000	0.000	0.084	0.0

TOTAL 206.116

APPENDIX 4. FORTRAN PROGRAM

```
      SWATFIV (ROSELLTR,P,A,7JF4J4,7ESD,KCELL_FF)
      1       REAL FILT,DATA(17,7),TOTAL
      2       INTEGER NET,MO,DATE,YR,TIME,A,B,C,D,TABLE
      3       DOUBLE PRECISION CRU
      4    95 READ4,CRU,NET,MO,DATE,YR,TIME,A,B,C,D,TABLE,FILT
      5     4 FORMAT(A8,A4,A4,I2,I4,A4,A4,I2,I3,I3,I3,F4.1)
      6       TOTAL=0
      7       Y=FILT
      8       IF(Y.EQ.0)60 TO 100
      9       PRINT1,TABLE
     10     1 FORMAT('1',16X,'TABLE',1X,I3,5X,'ZOOPLANKTON COUNTS, ADULT AND
     1COPEPODITE STAGES OF')
     11       PRINT2
     12     2 FORMAT(' ',30X,'CALANOID COPEPODS IN NUMBERS PER CUBIC METER')
     13       PRINT3,CRU,NET
     14     3 FORMAT('0',35X,'CRUISE',1X,A8,18X,'NET TYPE',2X,A4)
     15       PRINT41,A,B,TIME,C,D
     16    41 FORMAT('0',16X,'STATION',2X,A4,1X,I2,19X,'TIME',2X,A4,14X,
     1'DEPTH INTERVAL',1X,I3,'-',I3,1X,'M.')
     17       PRINT5,MO,DATE,YR,FILT
     18     5 FORMAT('0',16X,'DATE',1X,A4,1X,I2,',',I4,42X,'AMT.FILTERED',
     111X,F4.1,1X,'CU.M.')
     19       PRINT6
     20     6 FORMAT('0',23X,'SPECIES NAME',11X,'MALES',2X,'FEMALES',2X,'ST.V',
     14X,'ST.IV',2X,'ST.I-III',1X,'TOTAL',2X,'PCT TOTA_')
     21       READ,((DATA(I,J),J=1,7),I=1,17)
     22       DO 22 I=1,17
     23       DO 22 J=1,7
     24    22 DATA(I,J)=DATA(I,J)/FILT
     25       DO 33 I=1,17
     26    33 DATA(I,6)=DATA(I,1)+DATA(I,2)+DATA(I,3)+DATA(I,4)+DATA(I,5)
     27       DO 44 I=1,17
     28    44 TOTAL=TOTAL+DATA(I,6)
     29       DO 55 I=1,17
     30    55 DATA(I,7)=DATA(I,6)/TOTAL*100
     31       PRINT61,(DATA(1,J),J=1,7)
     32    61 FORMAT('0',16X,'CALANUS GRACIALIS',10X,6F8.3,4X,F4.1)
     33       PRINT62,(DATA(2,J),J=1,7)
     34    62 FORMAT(' ',16X,'CALANUS PLUMCHRUS',10X,6F8.3,4X,F4.1)
     35       PRINT63,(DATA(3,J),J=1,7)
```

```
      63    FORMAT(' ',16X,'EUCALANUS BUNGII BUNGII',4X,6F8.3,4X,F4.1)
            PRINT64,(DATA(4,J),J=1,7)
      64    FORMAT(' ',16X,'PSEUDOCALANUS MINUTUS',6X,6F8.3,4X,F4.1)
            PRINT65,(DATA(5,J),J=1,7)
      65    FORMAT(' ',16X,'SPINOCALANUS BREVICAUDATUS',1X,6F8.3,4X,F4.1)
            PRINT66,(DATA(6,J),J=1,7)
      66    FORMAT(' ',16X,'AETIDEUS ARMATUS',11X,6F8.3,4X,F4.1)
            PRINT67,(DATA(7,J),J=1,7)
      67    FORMAT(' ',16X,'EUCHIRELLA COLUMBIAE',7X,6F8.3,4X,F4.1)
            PRINT68,(DATA(8,J),J=1,7)
      68    FORMAT(' ',16X,'CHIRIDIUS GRACILIS',9X,6F8.3,4X,F4.1)
            PRINT69,(DATA(9,J),J=1,7)
      69    FORMAT(' ',16X,'GADIUS COLUMBIAE',11X,6F8.3,4X,F4.1)
            PRINT70,(DATA(10,J),J=1,7)
      70    FORMAT(' ',16X,'EUCHAETA JAPONICA',10X,6F8.3,4X,F4.1)
            PRINT71,(DATA(11,J),J=1,7)
      71    FORMAT(' ',16X,'SCAPHOCALANUS SP.',12X,6F8.3,4X,F4.1)
            PRINT72,(DATA(12,J),J=1,7)
      72    FORMAT(' ',16X,'SCOLECITHRICELLA MINOR',5X,6F8.3,4X,F4.1)
            PRINT73,(DATA(13,J),J=1,7)
      73    FORMAT(' ',16X,'THARYBIS FULTONI',11X,6F8.3,4X,F4.1)
            PRINT74,(DATA(14,J),J=1,7)
      74    FORMAT(' ',16X,'METRIDIA PACIFICA',10X,6F8.3,4X,F4.1)
            PRINT75,(DATA(15,J),J=1,7)
      75    FORMAT(' ',16X,'METRIDIA OKHOTENSIS',8X,6F8.3,4X,F4.1)
            PRINT76,(DATA(16,J),J=1,7)
      76    FORMAT(' ',16X,'HETERORHABDUS TANNERI',6X,6F8.3,4X,F4.1)
            PRINT77,(DATA(17,J),J=1,7)
      77    FORMAT(' ',16X,'CANDACIA COLUMBIAE',9X,6F8.3,4X,F4.1)
            PRINT80,TOTAL
      80    FORMAT('0',73X,'TOTAL',3X,F10.3)
            GO TO 95
     100    CONTINUE
            STOP
            END

$ENTRY
```

VITA

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Publications:

The replication of biological events in enclosed water columns. M. Takahashi, W.H. Thomas, D.L.R. Seibert, J. Beers, P. Koeller and T.R. Parsons. Arch. Hydrobiol. (in press)

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