

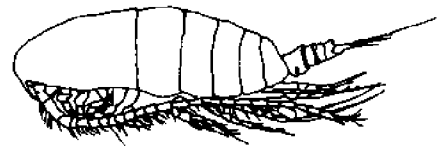
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**ZOOPLANKTON
ALONG THE
CONTINENTAL
SHELF OFF
NEWPORT,
OREGON,
1969-1972:**

**distribution,
abundance, seasonal
cycle and year-to-year
variations**

**William Peterson
Charles Miller**



**OREGON STATE UNIVERSITY
SEA GRANT COLLEGE PROGRAM**

Publication no. ORESU-T-76-002

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SCHOOL OF OCEANOGRAPHY**

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acknowledgment



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related publications

OREGON'S ESTUARIES: DESCRIPTIONS AND INFORMATION SOURCES, by K.L. Percy, C. Sutterlin, D.A. Bella and P.C. Klingeman. Publication No. H-74-001. 294 pp. Price: \$2.50.

Summarizes much of the known information about Oregon's 13 major estuaries, excluding only the Columbia River estuary. Numerous citations of literature and agencies from which further information can be obtained make this an excellent starting point for assembling physical, chemical and biological data about Oregon's estuaries.

THE FUTURE MANAGEMENT OF THE OREGON COAST: PROCEEDINGS OF A SYMPOSIUM HELD AT THE LAW CENTER, UNIVERSITY OF OREGON, OCTOBER 27, 1972. Publication No. W-74-001. 167 pp. Price: \$3.00.

Explores issues facing the Oregon Coastal Conservation and Development Commission. Sessions covered legal background for coastal zone management, zoning laws and the coastal zone, and the importance of planning for the Oregon coast. Panels discussed environmental considerations of estuary management, balancing the coastal zone interests, what level of government is appropriate for the coastal zone, and the future needs of the Oregon coastal economy.

ordering publications

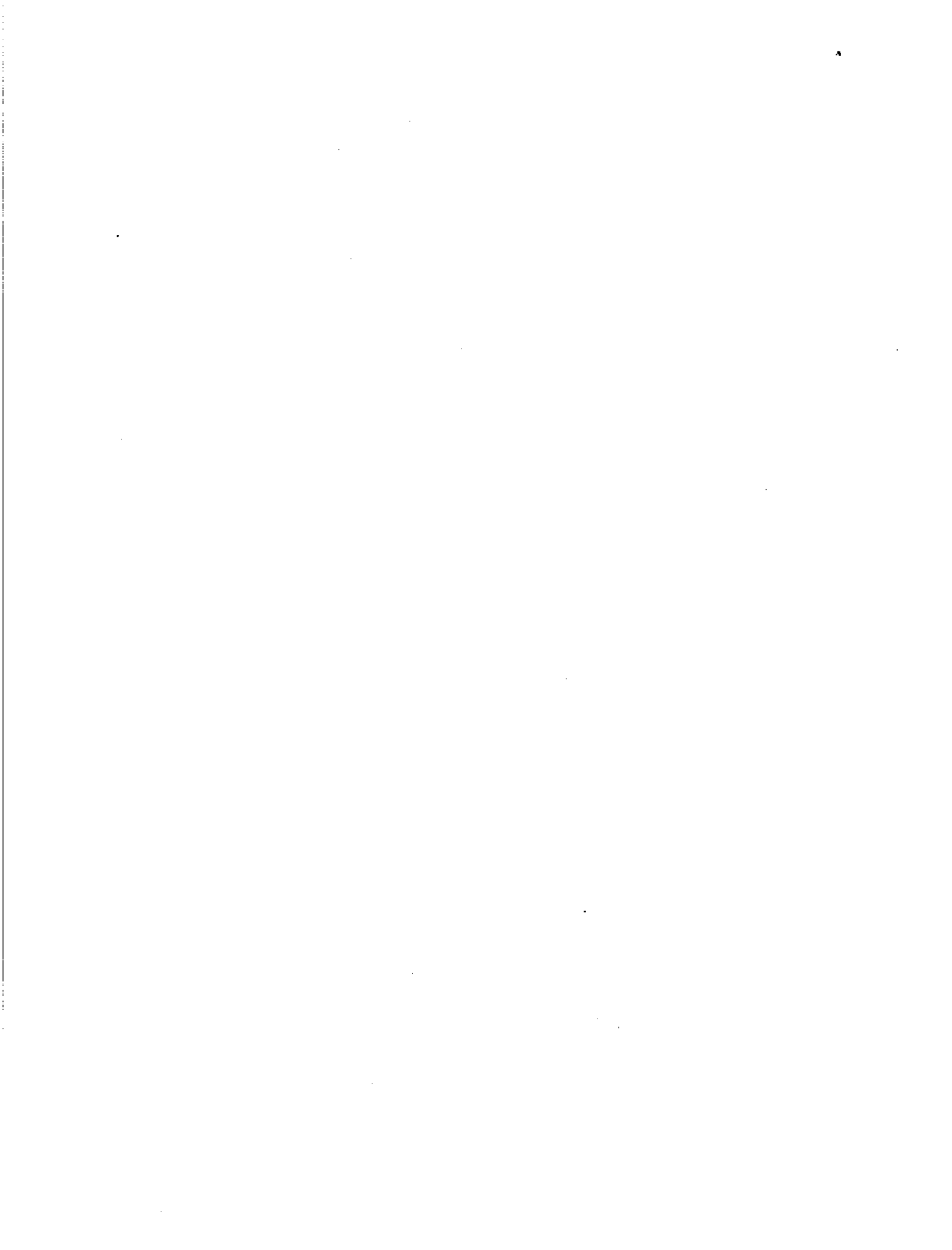
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introduction

This technical report summarizes the results of a three year study of the zooplankton living in the nearshore zone off Newport, Oregon. The sampling program was part of the Early Life History (ELH) project of the Oregon State University Sea Grant Program and was designed to study the ecology of the larval forms of all fishes, shrimps and crabs, as well as the zooplankton. These samples are valuable because they are the first from Oregon to have been collected and analyzed from stations located very near to shore. In the past, zooplankton studies have been based on samples collected along transects beginning at stations 5 or 15 miles from the beach, or on samples collected well offshore over the continental slope. Our samples are also the first collected within the zone of intense coastal upwelling. Huyer (1974), among others, has identified this zone as extending from the beach out to about 10 km from shore.

Other available Oregon zooplankton data are from one of three sources: (1) Oregon State University Master's and Doctoral Theses of Cross (1964), Lee (1971), Hebard (1966) and Laurs (1967), and (2) University of Washington samples collected at an irregular set of stations off the Washington and Oregon coasts during 1961 and 1962 (Peterson and Anderson, 1966; Peterson, 1972). In addition (3), a limited amount of data were collected in August-October 1972 by L. Smith (Holton and Elliot, 1973).

This report is divided into two parts. Part I contains general remarks on zooplankton distribution, abundance and frequency of occurrence in samples collected during several summer upwelling and winter downwelling seasons. Differences between seasons are stressed. Part II contains detailed discussions of the ecology of important taxa. Population dynamics, sex ratios and miscellaneous observations are presented where possible. Some of the results of this study have been presented elsewhere (Miller and Peterson, 1974; Peterson and Miller, 1975). Part III, the appendix contains the zooplankton enumeration data.

MATERIALS AND METHODS

Zooplankton samples were collected along the Newport Hydrographic (NH) line (on 44° 40'N). This line was chosen because an extensive set of hydrographic data were available from the year 1960 to present, as Oregon State University, Department of Oceanography Data Reports. Our samples were gathered at stations NH 1, NH 3, NH 5, and NH 10 during the period 22 June 1969 to 5 August 1972. After 3 February 1971 samples were collected as far seaward as 60 nautical miles (NH 60), weather permitting. Figure 1 is a map of the study area.

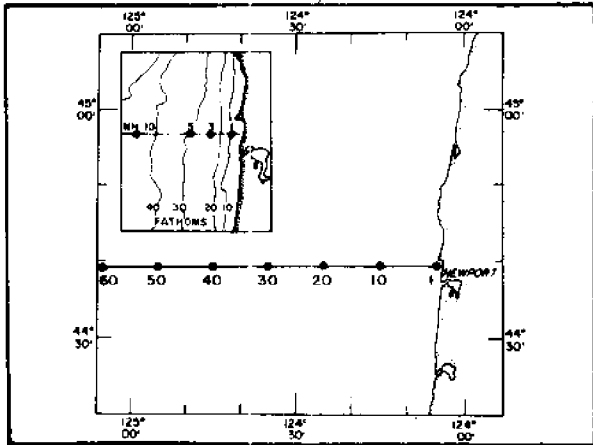


Fig. 1. Map of the study area showing the Newport hydrographic line (solid dark line) and the sampling positions. Inset map shows detail of the first ten miles of the coastline with bathymetry.

Samples were collected with 20 cm "Bongo" nets without an opening-closing mechanism. To construct the net frame, two 20 cm diameter x 30 cm PVC plastic cylinders were bolted to either side of a pivoting wire clamp. When mounted on the towing cable, the net frame was free to move in the vertical plane about 120° of arc, and it could rotate horizontally about the towing cable.

The two plankton nets were 145 cm long and were constructed of NITEX nylon with mesh apertures of 505 μ m and 240 μ m. The ratio of net mesh area/net mouth area was about 11.5:1 for the smaller mesh net. The cod ends were 9 cm dia. x 16 cm PVC plastic buckets with stainless steel mesh screens cemented to laterally positioned filtering windows.

The two cod ends were fastened approximately 15 cm apart with a stainless steel strap, which kept the nets from wrapping about the cable while being towed.

TSK flowmeters were mounted off-center in each net mouth. Tows were made obliquely over the entire water column (or from 0 to 140 m offshore of NH 20) using either a V-fin or Kite-Otter depressor. A time-depth recorder was used to record the towing track. Samples were preserved with buffered formaldehyde solution.

Surface temperature was measured and a surface salinity sample was taken at nearly all stations. Bottom salinity samples were taken on many cruises. Bathythermograph traces were usually taken.

In the laboratory, samples were poured into 500 ml pharmaceutical graduates and allowed to settle. Several hours later the settled volume was read. Water was then decanted off or added to make a diluted volume of five times the settled volume. Aliquots for counting were removed from this volume with a 1 ml piston pipette, after the animals were suspended by agitation.

Animals were enumerated with the aid of a binocular dissecting microscope at 25x magnification. Usually five aliquots were drawn from each sample. Taxa were counted in the first and successive aliquots until 50 in a category were enumerated. Approximately 400 animals were present in each aliquot. The counts were multiplied by appropriate factors to arrive at a number of individuals in a category per five aliquots. A computer was used to convert these raw data into number of individuals per cubic meter and to carry out much of the summary data analysis.

Two morphs of the genus *Metridia* were seen and were separated on the basis of shape of the prosome in lateral view. The *Metridia pacifica* type is more robust and has a steeply sloping forehead while the *M. lucens* type has a much less sloping forehead. Detailed morphological study of the two types has not been done. All adult copepods were divided by sex and identified to species. Copepodite stages were identified for all species except those of *Clausocalanus*, *Gaidius*, *Gaetanus*, and *Heterorhabdus*. Only the nauplii of *Salanus* were distinguished. Both euphausiids and cladocerans were identified to species: *Euphausia pacifica*, *Thysanoessa spinifera*, and *Evadne nordmanni* and *Podon leukartii*. The larvaceans (*Oikopleura*) were not identified to species. The chaetognaths were not counted by species but the following were identified: *Sagitta elegans*, *Eukrohnia hamata*, *Sagitta euneritica*, *S. scrippsii*, *S. bierii*, and *S. minima*. The holoplanktonic mollusks were represented by *Limacina helicina* and *Clione limacina*.

All other holoplanktonic taxa were counted as general groups, e.g., amphipods, ostracods, scyphomedusae, ctenophores, siphonophores, etc. Meroplankton also were counted by general categories such as barnacle nauplii, bivalve veliger, and gastropod veligers. The crab larvae were not counted because they were studied separately from these samples by R.G. Lough (1974).

THE COASTAL ENVIRONMENT

Aspects of the descriptive physical oceanography of Oregon coastal waters can be found in Burt and Wyatt, 1964; Pattullo and Denner, 1964; Cross and Small, 1967; Collins, et al., 1968; Bourke, 1972; Pillsbury, 1972; Huyer, 1974; and Smith, 1974.

Water Circulation Patterns

The California Current is a slow southward flowing current situated within a broad band 300 to 800 km off the Oregon coast. Inshore of this permanent feature the circulation changes with season. During spring and summer months, nearshore flow is southward, driven by northerly winds. During autumn and winter months, after cessation of upwelling, nearshore flow becomes northward. This flow is called the Davidson Current.

Summer Hydrography

Northerly winds predominate from April to September. They produce a generally southward transport of surface water with a component to the right of the wind, away from the coastline. This offshore, near-surface transport is balanced by northward and onshore transport at depth of cold, high salinity, nutrient rich water. When northerly winds are strong and/or persistent, this cold, high salinity water appears on the beach and throughout the entire water column out to about 10 km from shore. This condition is called active or intense upwelling. When north wind stress is weak or nonexistent, the onshore deep transport is weakened and nearshore waters are warmed by solar radiation.

Intense upwelling is not continuous. If northerly winds blow for a day or two, active upwelling will develop. If the wind ceases or changes direction, this upwelling ceases. During July and August, northerly winds are often persistent enough that intense upwelling may continue uninterrupted for several weeks.

Waters offshore of 10 to 20 km do not experience these rapid changes. In these

deeper waters, upwelling is indicated in hydrographic sections by upward sloping isolines of temperature, salinity and density. The upward slope develops in April or May and remains until cessation of upwelling in September. Offshore waters are warm (as high as 17°C) and a mixed layer is well developed. Surface salinities are reduced as a result of the Columbia River plume.

During any given summer, intense southwesterly storms may approach the Oregon coast. The result is an onshore transport of warm surface water. If the winds are of sufficient intensity and duration, water will pile up nearshore. Nearshore hydrography is modified such that isotherms, isohalines and isopycnals either lie parallel to the sea surface or slope downward toward the shoreline. This condition is called downwelling, and is a special case of the overall April to September upwelling condition. Offshore of approximately 10 km, isolines of temperature, salinity and density maintain their upward slope, although the slope may be decreased somewhat. See Huyer (1974) for representative hydrographic sections.

Winter Hydrography

The autumn and winter months are characterized by a high frequency of southwesterly winds. The effect is a transport of offshore surface waters onshore. These onshore winds may also drive the Davidson Current, although this is not certain. The offshore waters show the characteristics of any North Pacific Ocean station in winter: the top 100 meters or so are isothermal and the seasonal pycnocline disappears. Salinities are reduced by rainfall, and at the inshore stations they are reduced by runoff as well. Sea surface temperature over the continental shelf are generally around 8 to 10°C. The nearshore ocean can be warmer in winter than it is in the active upwelling period in summer. This is because warm water is advected from the south by the Davidson Current.

part I: general remarks

SUMMER HYDROGRAPHY AND WINDS

We have compared our surface temperature and salinity observations to Pillsbury's summary (1972) of all surface-to-10m temperature (T) and salinity (S) observations collected at NH 3 and NH 5 between 1960 and 1970. The modal group (28 per cent of the data) in a bivariate plot of these observations was bounded by temperatures of 8.1°C to 9.0°C and salinities of 33.1 to 34.0 ‰. This is called the modal cell. The T-S data are shown in Figure 2. The bounds of the modal cell are indicated. The upwelling season of 1971 is shown to be quite different from 1969 or 1970. About 26 per cent of our data from 1969 and 1970 fell within Pillsbury's modal cell. Only 6 per cent of the 1971 data fell within the limits. Surface temperatures were higher and surface salinities were lower in 1971, indicating the presence of mixed Columbia River plume water and surface oceanic water. Upwelling was weak in 1971.

Wind data support the conclusion that the 1971 upwelling season was weak. We have constructed Progressive Vector Diagrams (PVD's) of winds measured at the south jetty off Newport, Oregon. The PVD's for the years 1969, 1970, 1971 and 1972 are shown in Figures 3, 4 and 5. Winds during the upwelling season (1 May-30 September) are quite different between these years. The 1969 upwelling season had relatively weak winds with only about two and one-half months of persistent northerlies, while the 1970 season had about four months of northerlies. A higher total northerly component was achieved in 1970 than in 1969. The 1971 upwelling season was strikingly different. North wind miles are low and west wind miles are exceptionally high. As a result, upwelling should have been weak in 1971. This explains the low frequency of temperature and salinity observations in the modal cell in 1971. Winds during the 1972 upwelling season had both a strong northerly component (like 1970) and a strong westerly component (like 1971). All four years have the same pattern in September and October: winds are light and variable.

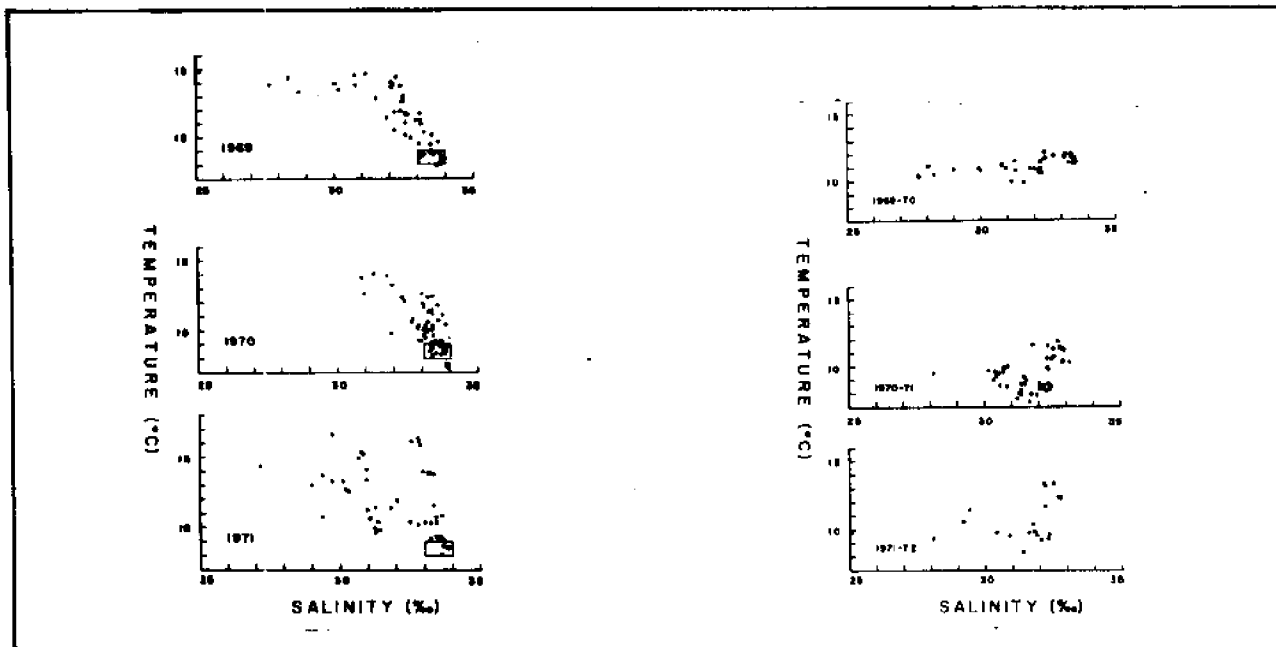


Fig. 2. Temperature-salinity diagrams for NH 1, NH 3, NH 5, and NH 10 for the summers of 1969, 1970 and 1971 between April and September, and winters of 1969-70, 1970-71, and 1971-72 from October through March

Winter Hydrography and Winds

Winter T-S scatter diagrams are also shown in Figure 2. The winter of 1969-70 is seen to have been warmer than the other winters. This may indicate that the transport of the Davidson Current was greater during the winter of 1969-70.

The winds during the winter of 1969-70 were quite different compared to 1970-71 and 1971-72. During the fall and winter months of 1969, there were three intervals with winds from the east: most of October, 23 November-8 December, and 1-12 January. The entire six-month period of winter winds lacked the southwesterly storms that are characteristic of most winters. The other two winter wind patterns shown in Figures 3-5 are probably typical.

Patterns of Surface Salinity

As a result of rainfall and runoff, salinities less than 30 ‰ occur at stations near the beach (NH 1, NH 3 and occasionally NH 5) during the months of January and February.

Beyond NH 5, salinities were always greater than 32 ‰ during these two months. March and April are months of transition. In May and June salinities are again lowered, but this time by the Columbia River plume. Surface salinities of 26-30 ‰ are commonly encountered at varying distances from shore, for example during

middle and late June of 1969 and 1971, salinities of 30-31 ‰ were found as close as 1 mile from shore. In 1970, water of reduced salinity was never found closer to shore than 10 miles on any cruise.

Surface salinities in excess of 33.5 ‰ in the coastal zone are generated only by upwelling. Water of this salinity or greater first appeared in May or June in the years of our study (13 May 1969, 4 June 1970 and 29 May 1971). The autumn months (October-December) are months of transition to lowered salinities as a result of rainfall and runoff.

Bakun's Upwelling Indices

Another parameter useful in studying differences between seasons is the upwelling index. Bakun (1973) has calculated indices which express mean monthly amounts of upwelling or downwelling at points along the west coast of the United States ranging from Baja California (Lat. 18°N) to the Gulf of Alaska (60°N). Monthly index values were calculated for the years 1946-1971. The indices are still being calculated but on a daily instead of monthly basis (Bakun, personal communication). To calculate the indices, Bakun estimates the monthly mean wind stress at selected geographic points from the known atmospheric pressure field. From this he computes the Ekman transport and finally resolves the component of this transport perpendicular to the coast. The units of the index are cubic meters of water

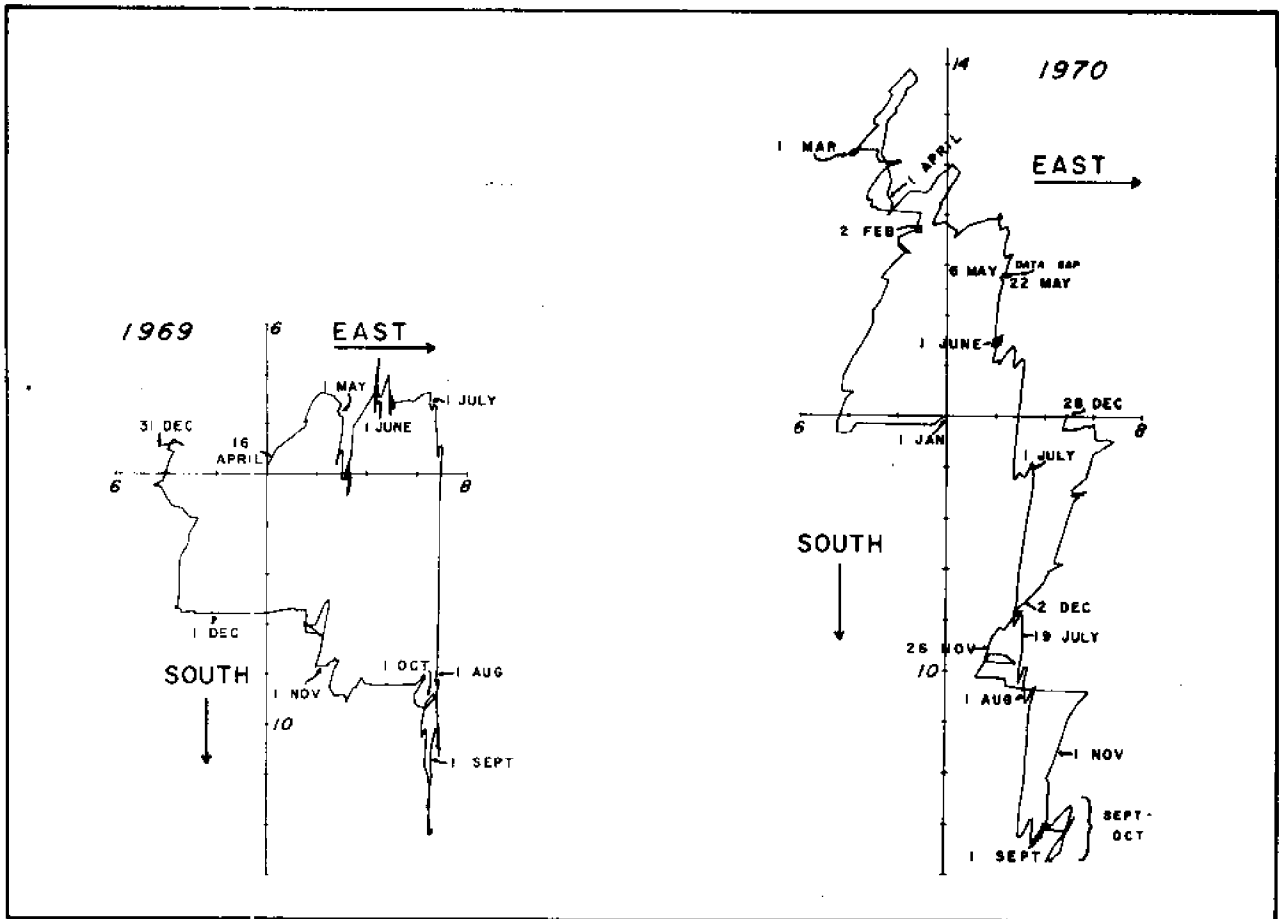


Fig. 3. Progressive vector diagrams for the wind at Newport for the years 1969 from 16 April--31 December and all months of 1970.

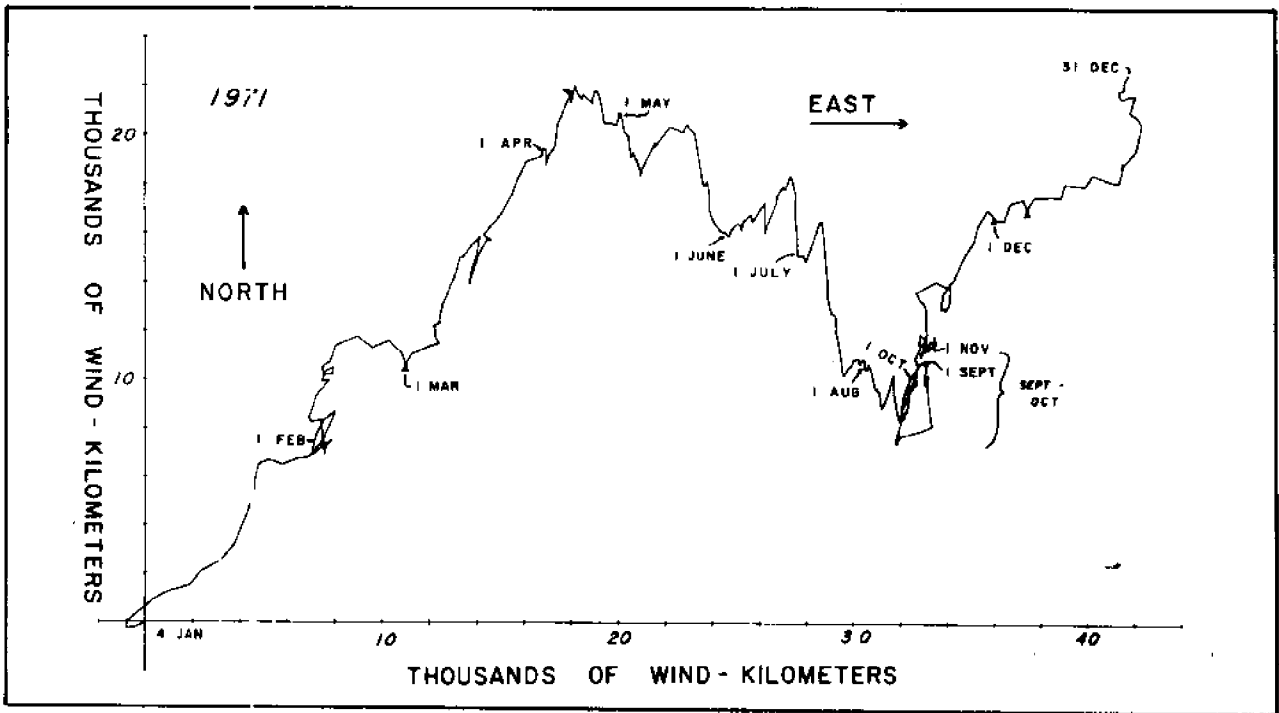


Fig. 4. Progressive vector diagram for the wind at Newport during 1971.

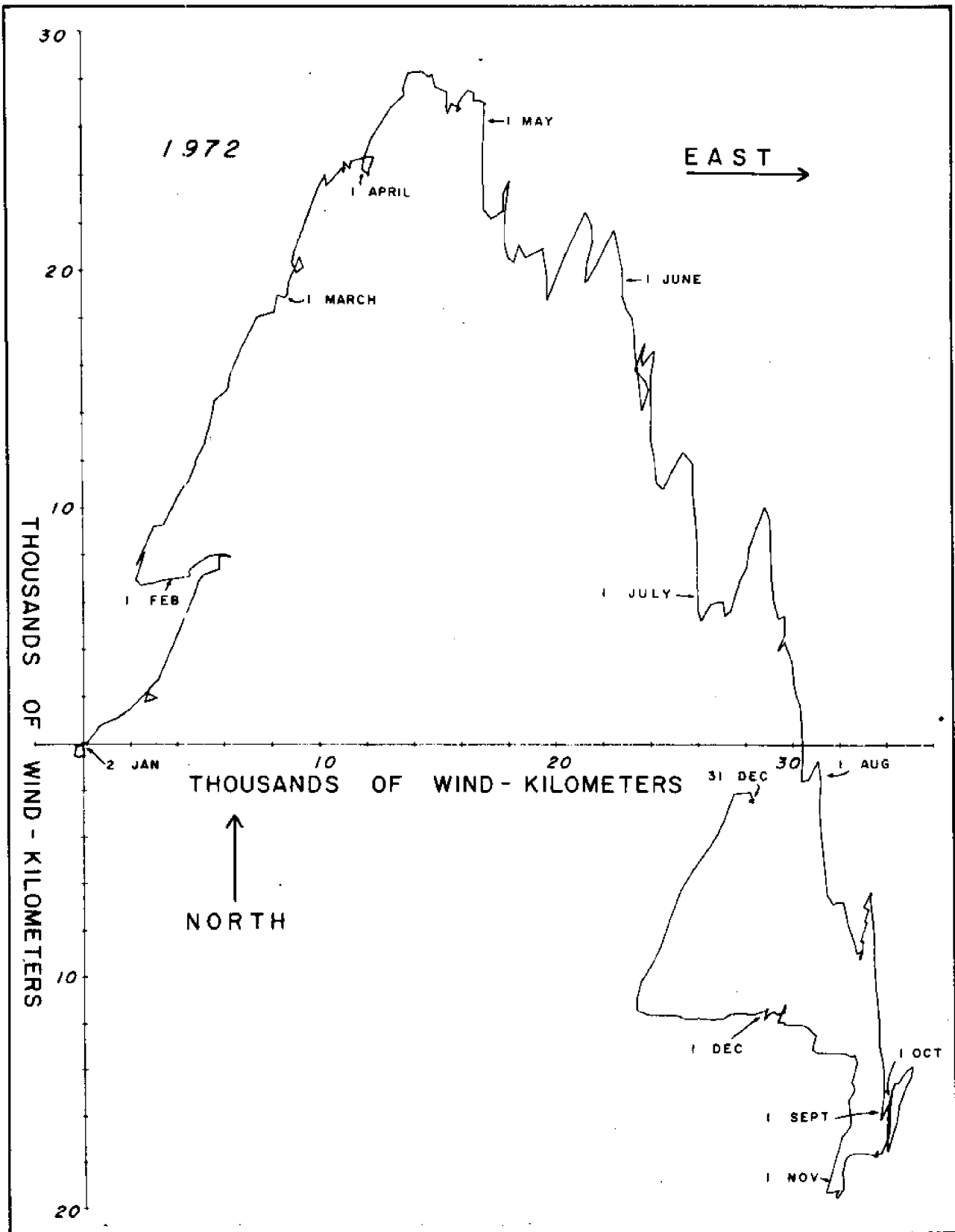


Fig. 5. Progressive vector diagram for the wind at Newport during 1972.

upwelled (or downwelled) per second per 100m of coastline.

The mean monthly values of the index and the anomalies (i.e., the deviations from the 20-year mean) are shown below. The anomalies show that the summers of 1969 and 1970 were near normal, and that the summer of 1971 was unusually low indicating weak upwelling. This supports our observations.

	20 year mean index for month	1969	1970	1971
May	34	-22	- 1	+32
June	43	+13	- 2	-36
July	74	+32	- 3	- 9
August	51	- 5	+23	-27
September	17	-11	- 5	- 8
Totals		+ 7	+12	-48

The winter upwelling index data are shown below. The winter of 1969-70 is quite different from the other two winters. Onshore transport was anomalously high in 1969-70 and anomalously low in 1970-71 and 1971-72. This does not agree entirely with our Newport wind data. Both Bakun's and our data agree that the winter of 1969-70 was different but we disagree as to the direction of surface water transport.

	20 year mean index for month	1969- 1970	1970- 1971	1971- 1972
November	-74	21	+19	+34
December	-93	-64	-12	+66
January	-94	- 4	+62	+75
February	-47	-24	+32	+56
Totals		-71	+101	+119

ZOOPLANKTON DATA COLLECTION AND GENERAL OBSERVATIONS

Zooplankton Data And Their Limitations

A total of 523 Bongo net samples were collected at stations NH 1 through NH 60. At stations NH 1, 3, 5, and 10 only, we collected 329 samples and have counted 213 of them. In addition, 40 samples have been counted from the set collected offshore of NH 10. The total number of samples counted is 253. Within the extensive set of 523 samples are many replicate samples and day-night comparisons. None of these have been counted. This report will deal primarily with the samples collected within 10 miles of shore since that data set is much more complete. Appendix I is a list of the

sampling dates and indicates the types of samples collected (day-night, replicate, day only) and which samples were counted. Appendix II contains zooplankton enumeration data listed by taxa for stations NH 1, 3, 5, and 10. Appendix III lists the data collected offshore of NH 10.

In this report, summer is defined as the upwelling season (April-September) and winter is defined as the other months (October-March).

There are important limitations on these zooplankton data. We chose to express numerical abundance as numbers of individuals per cubic meter (no./m³). Since our nets were towed obliquely through the entire water column, quantitative abundance estimates are actually abundances averaged over the water column. If an animal is equally abundant at all depths then oblique tows will adequately estimate its abundance. If an animal is restricted to a narrow layer then its abundance will be underestimated. We could have used number of individuals beneath a square meter water column by multiplying no./m³ by the water depth, but the effect of tow depth can be handled without this conversion.

Recent work by ourselves and Myers (1975) has shown that highest zooplankton abundances are found within the top 20 to 30m of the water column. Therefore, our oblique tows from depths greater than about 30m do underestimate zooplankton abundances. This becomes a problem in tows taken at stations farther from shore as the water depth increases because an increasing fraction of the water column sampled contains few animals. Therefore, one is not justified in discussing abundance gradients between stations NH 1 (water depth = 20m) and NH 10 (water depth = 80m) unless abundance differences are greater than a factor of four.

Abundances are also underestimated for many copepod taxa because the small copepodite stages could easily pass through our 0.24 mm mesh net. Copepodites of *Pseudocalanus* and *Acartia* species younger than stage III were seldom seen in our samples. Probably only stages IV and V were sampled quantitatively.

This data set gains its value from being a three-year time series of samples collected in exactly the same manner at the same stations. As such, these are good baseline data to which future work can be compared. The data clearly show (1) seasonal and (2) year-to-year variations in zooplankton species composition and abundance, and (3) spatial

(i.e., inshore-offshore) differences in species composition. Point estimates of abundance have little meaning, but comparisons of abundances between seasons and years at a set of stations are valid and meaningful.

Frequency of Occurrence of Zooplankton Taxa

Copepods were the most frequently occurring and the most abundant members of the zooplankton community in the nearshore region off Newport, Oregon. A total of 58 species were seen in our samples (Table 1). Thirty-eight species were found in the summer samples and 51 species in the winter samples. During our study, species from the Subarctic, Transition and Central Pacific water masses were taken.

The copepods in Table 1 can be grouped on the basis of patterns of occurrence. Eight species occur commonly during both winter and summer months: *Calanus marshallae*, *Paracalanus parvus*, *Pseudocalanus* sp., *Metridia lucens*, *Acartia clausii*, *Acartia longiremis*, *Oithona similis*, and *Oithona spinirostris*.

Six species were found only during the summer months and so probably have northern affinities: *Aetideus pacificus*, *Gaidius immatures*, *Gaetanus immatures*, *Racovitzanus antarcticus* s.l., *Metridia pacifica*, and *Oncaea media hymenx*.

Only one species was common during the summer and uncommon during the winter: *Centropages abdominalis*. This species has northern affinities. A group of six species had the opposite characteristic, i.e., common during the winter but uncommon or rare during the summer: *Calanus tenuicornis*, *Clausocalanus arcuicornis*, *Clausocalanus pergens*, *Ctenocalanus vanus* s.l., *Acartia tonsa* and *Corycaeus anglicus*. All of these species are common in warmer water south of Oregon.

The majority of the copepod species (43) were always uncommon in our samples and probably have unimportant roles in the community. However, taxonomic study of these rare or uncommon species is important because in many cases their presence indicates the presence of a particular water type or mixture of types. Most of the species that are found off Newport only during winter months have southern affinities (Central Pacific water mass). They are transported north along the continental shelf by the Davidson current and are probably very near the extreme northerly limit of their range.

Some of these species were *Mecynocera clausii*, *Calocalanus styliremis*, *Calocalanus tenuis*, *Calocalanus* sp., *Clausocalanus mastigophorus*, *Clausocalanus furcatus*, *Clausocalanus jobei*, *Clausocalanus parapergens*, *Clausocalanus paululus*, *Acartia danae*, *Corycaeus amazonicus*, *Oncaea dentipes* and *Oncaea subtilis*.

Other species that were found only during winter months have northern affinities and are usually found in deep water over the continental slope. They were probably transported shoreward as a result of onshore winds. These species are *Calanus cristatus*, *Gaidius brevispinus*, *Gaetanus simplex*, *Candacia columbiae*, *Heterorhabdus immatures*, *Pleuromamma borealis*, and *Pleuromamma abdominalis*.

Eight of the remaining 14 species in Table 1 were uncommon in both summer and winter samples: *Eucalanus bungii*, *Microcalanus pusillus*, *Soolecithricella minor*, *Lucicutia flavicornis*, *Epilabidocera logipedata* (*E. amphitrites*), *Tortanus discaudatus*, *Microsetella* spp., and *Sapphirina* spp. Six species were rare during both seasons: *Rhinocalanus nasutus*, *Paraeuchaeta japonica*, *Oncaea tenella*, *Oncaea borealis*, *Oncaea conifera*, and *Oncaea mediterranea*.

Abundance of Zooplankton Taxa

Tables 2 and 3 list the average relative density and frequency of occurrence of the copepod species, totaled over the four stations, for three individual years, during the summer and winter respectively. Relative density is an animal's mean abundance in those samples in which it occurred. The most abundant copepods found during the summer, in order of decreasing total average abundance were *Pseudocalanus* sp., *Acartia clausii*, *Acartia longiremis*, *Calanus marshallae*, *Centropages abdominalis*, and *Oithona similis*. These six species almost certainly control the grazing dynamics of the zooplankton community. No other copepod species ever approach numbers consistently reached by these six species.

During the winter months, the zooplankton assemblage is quite different and abundances of all species are much lower. Four species are probably dominant: *Pseudocalanus* sp., *Oithona similis*, *Paracalanus parvus*, and *Acartia longiremis*. Other species that may play important roles at certain times between October and March are *Ctenocalanus vanus*, *Clausocalanus immatures*, *Acartia clausii*, *Centropages abdominalis*, and *Calanus marshallae*.

C = occurrence in greater than 50% of the samples taken,
 U = occurrence in less than 50% but more than 5 samples taken,
 R = occurrence in less than 5 samples.

COPEPOD SPECIES	<u>S</u>	<u>W</u>	COPEPOD SPECIES	<u>S</u>	<u>W</u>
<i>Calanus marshallae</i>	C	C	<i>Metridia lucens</i>	C	C
<i>C. tenuicornis</i>	U	C	<i>M. pacifica</i>	U	C
<i>C. plumchrus</i>	R	U	<i>Lucicutia flavicornis</i>	U	U
<i>C. cristatus</i>		R	<i>Candacia columbiae</i>		R
<i>Rhincalanus nasutus</i>	R	R	<i>C. bipinnata</i>	R	R
<i>Eucalanus bungii</i>	U	U	<i>Heterorhabdus immatures</i>		R
<i>Meocyclops clausii</i>		U	<i>Pleuromamma borealis</i>		R
<i>Paracalanus parvus</i>	C	C	<i>P. abdominalis</i>		R
<i>Calocalanus styliremis</i>		U	<i>Centropages mamurichi</i>	C	U
<i>C. tenuis</i>		U	<i>Epilabidocera amphitrites</i>	U	U
<i>C. sp.</i>		R	<i>Acartia clausii</i>	C	C
<i>Pseudocalanus sp.</i>	C	C	<i>A. longiremis</i>	C	C
<i>Microcalanus pusillus</i>	U	U	<i>A. tonsa</i>	U	C
<i>Clausocalanus mastigophorus</i>		U	<i>A. danae</i>		R
<i>C. furcatus</i>		R	<i>Eurytemora sp.</i>	R	
<i>C. arcuicornis</i>	U	C	<i>Tortanus discaudatus</i>	U	U
<i>C. jobei</i>		R	<i>Microsetella sp.</i>	U	U
<i>C. pergens</i>	U	C	<i>Sapphirina sp.</i>	U	U
<i>C. parapergens</i>		U	<i>Oithona similis</i>	C	C
<i>C. paululus</i>		R	<i>O. spinirostris</i>	C	C
<i>Ctenocalanus vanus</i>	U	C	<i>Oncaea tenella</i>	R	R
<i>Aetideus pacificus</i>	U		<i>O. borealis</i>	R	R
<i>Gaidius immatures</i>	U		<i>O. conifera</i>	R	R
<i>Gaidius brevispinus</i>		R	<i>O. mediterranea</i>	R	R
<i>Gaetanus immatures</i>	R		<i>O. dentipes</i>		R
<i>Gaetanus simplex</i>		R	<i>O. subtilis</i>		R
<i>Paraeuchaeta japonica</i>	R	R	<i>O. media hymena</i>	R	
<i>Racovitzianus antarcticus</i>	U		<i>Corycaeus anglicus</i>	R	C
<i>Scolecithricella minor</i>	U	U	<i>C. amazonicus</i>		R

Table 1. A checklist of copepod species taken off Newport, Oregon in summer (S) and winter (W) months during the period of our study.

COPEPOD SPECIES	TOTAL RELATIVE DENSITY			FREQUENCY		
	1969	1970	1971	69	70	71
<i>Calanus marshallae</i>	1475.2	482.5	436.1	32	44	40
<i>C. tenuicornis</i>	1.3	5.1	7.9	1	4	14
<i>Eucalanus bungii</i>	21.1	3.1	9.0	13	10	15
<i>Paracalanus parvus</i>	80.7	147.3	16.8	29	21	20
<i>Pseudocalanus</i> sp.	23776.3	6682.4	3994.5	33	44	40
<i>Microcalanus pusillus</i>	2.2	18.5	1.8	4	17	2
<i>Clausocalanus arcuicornis</i>	0	1.4	4.0	0	3	7
<i>C. pergens</i>	20.2	5.9	6.6	5	5	9
<i>C. immatures</i>	0	0.5	2.1	0	5	2
<i>Ctenocalanus vanus</i>	4.8	31.0	11.0	5	7	16
<i>Aetideus pacificus</i>	1.5	2.3	2.7	4	4	1
<i>Gaidius immatures</i>	2.5	3.4	3.7	3	3	2
<i>Racovitzanus antarcticus</i>	0.6	2.1	1.3	1	2	2
<i>Scolecithricella minor</i>	9.3	4.6	16.0	7	14	16
<i>Metridia lucens</i>	21.4	16.3	48.6	18	29	26
<i>M. pacifica</i>	6.7	2.9	3.7	2	5	6
<i>Lucicutia flavicornis</i>	0	0.4	2.0	0	1	9
<i>Centropages abdominalis</i>	371.8	686.2	110.7	29	42	23
<i>Epilabiocera longipedata</i>	2.9	10.8	0	5	6	0
<i>Acartia clausi</i>	1178.1	6045.1	414.9	31	37	29
<i>A. longiremis</i>	1078.2	1509.2	1331.1	33	44	38
<i>A. tonsa</i>	130.7	27.5	0	31	19	0
<i>Tortanus discaudatus</i>	17.5	12.3	0	3	10	0
<i>Oithona similis</i>	369.9	275.0	416.2	32	42	40
<i>O. spinirostris</i>	19.9	16.0	55.5	19	28	31
<i>Corycaeus anglicus</i>	2.8	8.0	3.6	2	10	3

The following species were found in less than five samples: *Calanus plumchrus*, *Gaetanus immatures*, *Paraeuchaeta japonica immatures*, *Candacia bipinnata*, *Eurytemora thompsoni*, *Rhincalanus nasutus*, *Oncaea borealis*, *Oncaea tenella*, *Oncaea media hymena*, *Oncaea mediterranea*, *Sapphirina* sp. and *Microsetella* sp.

Table 2. Total relative density and frequency of occurrence of the copepod species taken within 18 km of the Oregon coast, during the upwelling seasons of 1969, 1970, and 1971. Relative density is average number per m³ of individuals in samples in which the species occurred. Table entries are sums of relative densities at each of four stations. 33 samples were collected in 1969, 44 in 1970 and 40 in 1971.

COPEPOD SPECIES	TOTAL RELATIVE DENSITY			FREQUENCY		
	1969-70	1970-71	1971-72	69-70	70-71	71-72
<i>Calanus marshallae</i>	62.7	189.0	46.6	22	20	15
<i>C. tenuicornis</i>	15.1	7.9	14.3	11	14	12
<i>C. plumohrus</i>	359.6a	1.9	2.3	4	1	3
<i>Eucalanus bungii</i>	3.4	***	3.5	6	0	8
<i>Mecynocera clausii</i>	0.8	0.4	***	5	2	0
<i>Paracalanus parvus</i>	570.6	277.7	351.4	22	18	16
<i>Calocalanus styliremis</i>	7.4	0.8	1.0	10	3	1
<i>C. tenuis</i>	3.3	0.3	0.5	7	1	1
<i>Pseudocalanus</i> sp.	445.6	2011.1	1260.1	22	20	16
<i>Microcalanus pusillus</i>	3.6	1.1	1.3	3	1	2
<i>Clausocalanus mastigophorus</i>	2.3	***	***	6	0	0
<i>C. arcuicornis</i>	38.9	36.5	31.5	13	16	10
<i>C. pergens</i>	41.1	22.8	30.3	14	15	12
<i>C. parapergens</i>	5.8	3.7	***	8	3	0
<i>C. immatures</i>	156.6a	38.2	32.4	17	16	9
<i>Ctenocalanus vanus</i>	189.0	98.8	65.9	16	16	10
<i>Scolecithricella minor</i>	***	0.9	1.1	0	4	1
<i>Metridia lucens</i>	17.6	42.9	40.8	16	14	10
<i>Lucicutia flavicornis</i>	0.5	0.4	0.8	6	4	3
<i>Centropages momarichi</i>	48.0	33.3	127.5	8	5	7
<i>Epilabidocera amphitrites</i>	1.6	0.8	1.2	5	2	1
<i>Acartia clausii</i>	186.4	78.8b	95.3	14	8	12
<i>A. longiremis</i>	332.8	84.9	25.0	18	20	15
<i>A. tonsa</i>	121.9	8.5	7.4	19	8	4
<i>A. danae</i>	8.5	6.3	4.4	13	4	4
<i>Tortanus discaudatus</i>	6.8	4.2a	***	9	3	0
<i>Oithona similis</i>	1064.0	246.9	625.4	22	20	16
<i>O. spinirostris</i>	15.3	7.1	3.5	21	8	8
<i>Oncaea tenella</i>	15.2a	0.3	***	2	3	0
<i>Corycaeus anglicus</i>	397.1	20.1	***	21	11	0
<i>C. amasonicus</i>	0.9	1.1	***	10	1	0

a = high value the result of one station or sampling date
b = a value of 4500/m³ on 20 October 1970 was omitted from the summation

The following species were found in less than five samples: *Calanus cristatus*, *Phincalanus nasutus*, *Calocalanus* sp., *Clausocalanus jobei*, *C. paululus*, *Caidius brevispinus*, *Gaetanus simplex*, *Paraeuchaeta japonica*, *Pleuromamma borealis*, *P. abdominalis*, *Heterorhabdus immatures*, *Candacia columbiae*, *C. bipinnata*, *Oncaea borealis*, *O. conifera*, *O. dentipes*, *O. subtilis*, *O. mediterranea*, *Microsetella* sp., *Sapphirina* sp., Harpacticoid copepods.

Table 3. Total relative density and frequency of occurrence of the copepod species taken within 18 km of the coast during three winters. Table entries are sums of relative densities at each of four stations. 22 samples were collected during the winter of 1969-70, 20 during 1970-71 and 16 during 1971-72.

A rough estimate of the magnitude of differences in abundance between summer and winter for the most important copepods can be seen in the following table. Abun-

dances (No./m³) in each year have been summed from Tables 2 and 3 to get an overall total abundance.

Copepod Species	SUMMER	WINTER	RATIO BETWEEN SEASONS
<i>Acartia clausii</i>	7,638	360	- 21.2
<i>Pseudocalanus</i> sp.	34,453	3,717	- 9.2
<i>Calanus marshallae</i>	2,394	299	- 8.0
<i>Centropages abdominalis</i>	1,169	209	- 5.8
<i>Acartia longiremis</i>	3,918	1,143	- 3.4
<i>Oithona similis</i>	1,061	1,936	+ 0.6
<i>Paracalanus parvus</i>	245	1,200	+ 4.9
<i>Ctenocalanus vanus</i>	47	354	+ 7.5

Abundances of other zooplankton (the holoplankton and meroplankton) indicate that they were generally not important. Overall abundances and frequency of occurrence of these taxa are given in Tables 4 and 5 for summer and winter respectively. The plankton that were sometimes abundant during the summer were *Calanus nauplii*, *Calanus* eggs, and euphausiid eggs. Other taxa that were occasionally abundant include decapod shrimp mysis, barnacle nauplii and bivalve veligers. During the winter months, *Oikopleura* spp. became abundant, and barnacle nauplii and bivalve veligers remained somewhat important.

The reader can make the comparisons between summer and winter abundances from Tables 4 and 5. Some taxa have similar abundances during both seasons: *Calanus nauplii*, other copepod nauplii and euphausiid nauplii, chaetognaths, scyphomedusae, *Podon leukartii*, pteropods, barnacle nauplii, bivalve veligers and gastropod veligers. Marked differences in abundance are seen for *Thysanoessa spinifera*, *Evadne nordmanni*, decapod mysis, *Calanus* eggs and euphausiid eggs. These were all more abundant during the summer. *Oikopleura* spp. were more abundant during the winter.

Dominant Taxa

Further discussions of abundance patterns will be limited to the more important animals. We have applied a simple filter to our data which objectively categorizes importance. It was assumed that an animal

would be likely to have considerable impact on community structure if it made up at least 1 per cent of the total catch in five or more samples. This rather generous filter removed all but 15 copepod species and 19 other zooplankton taxa from the total species list. Many of the taxa excluded were important to the results of this study only as indicator species. The remainder of this report will deal primarily with the 34 dominant taxa.

Table 6 lists these animals. A comparison of the first two columns reveals that only a few taxa were important in all summer samples. The only taxa that occurred often and frequently made up greater than 1 per cent of the total catch were copepods. With few exceptions, all other taxa made more than 1 per cent of the catch in less than 25 per cent of the summer samples.

The preceding portions of this report have centered on general statements about distribution and abundance of taxa that make up the different zooplankton assemblages found off Newport, Oregon during summer and winter. For simplicity, we disregarded temporal variations and treated the 10-mile wide study area as a homogeneous zone. The area is not homogeneous however. Most of the animals are not equally distributed over the study area and are not equally abundant during all months of a particular season. Both spatial and temporal abundance gradients are present and they are quite pronounced for some of the most important copepod species.

ABUNDANCE PATTERNS

Spatial Abundance Patterns During the Upwelling Season

Three of the six most abundant copepod species almost always have their greatest summer abundance at the station nearest to shore (NH 1). These three are *Pseudocalanus* sp., *Acartia clausii*, and *centropages abdominalis*. The abundance gradients can be quite steep, for example *Pseudocalanus* sp. had the following abundances (no./m³) at the four stations:

DATE	NH 1	NH 3	NH 5	NH 10
22 June 1969	13,975	2,322	2,000	461
18 July 1969	43,053	2,706	8,960	351
23 June 1970	23,773	487	19	104
28 June 1971	5,259	178	78	***
21 July 1971	7,330	155	337	132
5 Aug. 1972	1,524	***	140	290

TAXA	TOTAL RELATIVE DENSITY			FREQUENCY		
	1969	1970	1971	69	70	71
<i>Calanus</i> nauplii	119.5	695.5	172.7	21	40	28
Other Copepod nauplii	43.1	68.1	52.3	10	20	20
Amphipods	8.5	18.5	15.7	5	15	14
Euphausiid nauplii	46.3	85.9	84.0	5	26	18
Euphausiid calyptopis	13.3	14.5	17.2	4	17	11
Euphausiid furcilia	30.2	13.6	17.7	14	20	10
<i>Thysanoessa spinifera</i>	35.4	4.0	87.3	2	7	11
<i>Evadne noronhai</i>	73.7	58.9	9.8	17	26	2
<i>Podon leukarti</i>	2.8	115.3	5.2	2	12	1
Pteropods	10.2	24.6	60.6	11	22	35
Chaetognaths	89.4	50.3	30.8	25	33	34
<i>Oikopleura</i>	69.2	85.7	66.5	11	15	21
Ctenophores	6.0	2.5	34.9	7	5	19
Scyphomedusae	22.9	70.9	22.8	13	28	22
decapod shrimp mysis	142.7	52.6	45.3	16	24	22
barnacle nauplii	59.3	168.3	231.4	8	32	28
barnacle cypris	4.4	64.0	8.3	2	19	10
polychaete post-trochophores	16.2	20.1	21.4	5	23	15
bivalve veligers	170.5	258.9	68.3	20	40	27
gastropod veligers	28.9	79.2	42.2	16	33	23
hydromedusae	6.1	3.2	10.3	2	2	11
unidentified annelid without parapodia	8.2	23.1	35.8	3	3	16
pluteus	0.0	16.0	117.6	0	5	11
large round eggs (fish)	36.8	25.0	17.8	11	13	12
<i>Calanus</i> eggs	870.1 ^a	168.7	226.1	10	28	25
euphausiid eggs, early	55.0	686.1	449.6	11	29	24
euphausiid eggs, late	70.0	57.5	39.6	2	16	14
other fish eggs	19.1	35.1	34.3	12	18	18

a = biased by a single observation of 760 individuals/m³.

The following taxa were found in less than five samples: radiolarians, foraminifera, siphonophores, planula larva, trochophores, *Tomopteris*, heteropods, *Clione*, phoronid larva, ascidian larva, salps, auricularia larva, 1mm starfish, decapod protozoans, unusual barnacle nauplii, *Stylocheiron abbreviatum*, anchovy eggs, and four miscellaneous unidentified meroplanktonic taxa.

Table 4. Total relative density and frequency of occurrence of other holoplanktonic taxa and meroplankton taken within 18 km of the coast during 1969, 1970 and 1971 upwelling seasons. Table entries are sums of average abundances at each of four stations.

TAXA	TOTAL RELATIVE DENSITY			FREQUENCY		
	1969-70	1970-71	1971-72	69-70	70-71	71-72
<i>Calanus</i> nauplii	1188.7a	165.9	35.1	10	15	15
Other Copepod nauplii	29.1	122.5a	20.2	11	13	12
Amphipods	5.9	4.8	5.0	12	4	10
Euphausiid nauplii	2.8	108.4a	3.4	4	5	4
Euphausiid calyptopis	6.4	56.1a	14.5	13	4	8
Euphausiid furcilia	3.1	0.4	7.6	7	2	5
<i>Evadne nordmanni</i>	5.8	24.1	4.8	2	2	4
<i>Podon leukarti</i>	126.3a	27.3	116.4a	4	2	4
Pteropods (<i>Limacina</i>)	66.0	88.0	14.2	17	15	13
Chaetognaths	62.9	47.4	22.4	20	19	13
<i>Oikopleura</i> spp.	551.9	101.2	75.6	22	16	15
Ctenophores	7.0	6.2	10.3	8	8	9
Scyphomedusae	10.0	94.3	16.6	5	6	10
Salps	0.9b	***	***	9	0	0
Isopods	0.5	0.7	***	2	3	0
Mysids	0.2	3.3	2.1	2	1	2
decapod shrimp mysis	3.1	21.4	5.6	7	10	11
barnacle nauplii	309.1	192.7	77.9	11	6	12
barnacle cypris	8.7	188.1a	16.8	4	4	12
polychaete post-trochophores	41.5	13.5	70.8	12	8	11
bivalve veligers	87.8	98.2	118.4	20	18	15
gastropod veligers, assorted	31.3	27.6	37.2	19	18	15
gastropod A	***	1.0	***	0	6	0
hydromedusae	9.2	1.8	3.3	4	2	3
annelids lacking parapodia	40.0	74.9	21.9	5	4	11
echinoderm pluteus	41.7	0.8	22.1	5	2	4
large round eggs (fish)	9.0	5.5	4.9	6	11	8
<i>Calanus</i> eggs	36.5	36.7	4.7	10	11	4
euphausiid eggs	***	274.7a	2.8	0	6	3

a = high value the result of one station or sampling date
b = a value of 34.3/m³ on 29 October 1969 was omitted from the summation

The following taxa were found in less than five samples: The euphausiids *Thysanessa spinifera* and *Euphausia pacifica*, amphipod larvae and eggs, ostracods, cumaceans, siphonophores, *Sagitta scrippsii*, *S. bierii*, *S. minima*, *Lepas* nauplii, other unidentified barnacle nauplii, echinoderm bipinnaria, imm starfish, imm sea urchins, planula larvae, trochophores, foraminifera, radiolarians, *Tomopteris*, cyphonautes larvae, other fish eggs, and six miscellaneous unidentified meroplanktonic taxa.

Table 5. Total relative density and frequency of occurrence of other holoplanktonic and meroplanktonic taxa taken within 18 km of the coast during three winters. Table entries are sums of relative densities at each of four stations.

TAXA	SUMMER		WINTER	BOTH
	ALL SAMPLES	FILTERED SAMPLES	FILTERED SAMPLES	TOTAL FILTERED
<i>Pseudocalanus</i> sp.	141	141	53	196
<i>Calanus marshallae</i>	140	125	33	158
<i>Oithona similis</i>	138	107	48	155
<i>Acartia longiremis</i>	139	114	40	154
<i>Acartia clausii</i>	115	73	16	89
<i>Paracalanus parvus</i>	76	16	49	65
<i>Calanus nauplii</i>	109	44	20	64
<i>Oikopleura</i> sp.	53	17	40	57
<i>Centropages abdominalis</i>	110	49	6	55
bivalve veligers	107	28	23	51
<i>Limacina helicina</i>	88	28	15	43
Chaetognaths	107	14	27	41
barnacle nauplii	83	26	13	39
<i>Calanus</i> eggs	82	29	7	36
euphausiid eggs	48	33	2	35
<i>Ctenocalanus vanus</i>	39	4	30	34
<i>Metridia lucens</i>	81	21	10	31
<i>Clausocalanus</i> immatures	8	1	24	25
<i>Oithona spinirostris</i>	97	19	5	24
<i>Clausocalanus pergens</i>	26	3	19	22
<i>C. arcuicornis</i>	12	1	21	22
<i>Acartia tonsa</i>	53	13	5	18
euphausiid nauplii	53	16	2	18
gastropod veligers	88	7	9	16
worms lacking parapodia	30	7	9	16
<i>Corycaeus anglicus</i>	15	0	14	14
echinoderm pluteus	19	6	7	13
decapod shrimp mysis	74	11	2	13
Scyphomedusae	78	9	2	11
copepod nauplii	57	4	6	10
Ctenophores	42	7	2	9
<i>Calanus tenuicornis</i>	23	0	9	9
<i>Podon leukartii</i>	19	1	6	7
misc. fish eggs	54	6	0	6

Table 6. A list of the species and taxa whose relative abundance was greater than 1% of the total catch in at least five samples. This filter removed about two-thirds of the taxa collected during the period of this study. Differences between frequency of occurrence in all samples and frequency in only those samples in which relative abundance was greater than 1% are compared in the table for the summer data. The list is compiled from all data collected from 1969-1972, a total of 141 summer and 58 winter samples.

Some of the steepest gradients observed for *Centropages abdominalis* were:

DATE	NH 1	NH 3	NH 5	NH 10
18 July 1969	249	14	7	0
25 July 1969	655	55	0	0
23 June 1970	1,370	83	4	3
2 July 1970	1,655	128	107	80
28 June 1971	102	6	0	0

and for *Acartia clausii*:

DATE	NH 1	NH 3	NH 5	NH 10
18 July 1969	528	8	35	19
23 June 1970	25,661	58	0	0
2 July 1970	19,807	100	47	3
12 June 1971	2,640	127	16	3
21 June 1971	762	0	0	0
5 Aug. 1972	297	***	8	0

The other three important copepod species (*Acartia longiremis*, *Calanus marshallae*, and *Oithona similis*) did not show such regular patterns. *Acartia longiremis* was always more abundant at NH 1 in 1971 than at stations farther offshore, but in 1969 and 1970 it was usually more abundant offshore of NH 1. *Calanus* occasionally had their greatest abundance at NH 1, but in all years it usually did not. *Oithona* abundances fluctuated widely at all stations.

The other zooplankton taxa listed in Table 6 had the following patterns of abundance:

1. Highest abundance at NH 1, decreasing offshore

decapod shrimp	mysis	gastropod veligers
barnacle nauplii		bivalve veligers

2. Usually abundant only at NH 1, NH3 and NH 5

<i>Acartia tonsa</i>	Scyphomedusae
euphausiid nauplii	Chaetognaths
copepod nauplii	other fish eggs
worms lacking parapodia	echinoderm pluteus

3. Usually more abundant offshore of NH 1

Ctenophores
Pteropods
Oithona spinirostris

4. Abundance increases as distance offshore increases

Metridia lucens

5. No apparent pattern - can be abundant anywhere

Paracalanus parvus
Calanus nauplii
Calanus eggs
Oikopleura spp.
euphausiid eggs

The abundance patterns of these individual taxa are discussed in greater detail in Part II of this report.

These gradients deduced from absolute abundance data give information about a population's response to the environment. Nothing is learned about the complete zooplankton assemblages. Since different gradient patterns are exhibited by populations, the zooplankton assemblage changes between stations.

Another way to look at gradient patterns is with ranks of abundance. Ranking results in some understanding of how a population's abundance changes relative to the abundance of the total zooplankton assemblage.

Table 7a lists the average rank of abundance of the most important taxa at each station. We ranked only the filtered data, i.e., an animal received a rank in a sample only if it made up greater than one per cent of the catch in that sample. Also given is the mean rank over the four stations. We have listed only those taxa that occurred in ten or more filtered samples summed over the four stations. A value was entered under a station label only if the taxon occurred in five or more filtered samples collected from that station.

Among those copepods which had their highest abundance at NH 1, only *Acartia clausii* had low ranks only at that station. *Centropages abdominalis* had a mean rank of approximately 5 at NH 1, 3, and 5 and *Pseudocalanus* sp. had a mean rank of 1.5 at all four stations. For those copepods that were usually more abundant offshore, *Oithona similis* is seen to have its lowest ranks at NH 1, 3, and 5. *Acartia longiremis* shows evidence of having lowest ranks offshore. There is little doubt that *Calanus marshallae* prefers water offshore of NH 1.

Table 7b shows a similar result but is here expressed in terms of an average relative abundance. *Pseudocalanus* sp. and *Acartia longiremis* are clearly the two most important copepods, on a numerical basis, making up large percentages of the catch. *Acartia clausii* is important only at NH 1 and *Calanus marshallae* is again seen to be

important only offshore of NH 1.

Spatial Abundance Patterns in Winter

The winter data are very different (Tables 8a and 8b). Immediately obvious from a comparison to the summer data is the difference in rank order between the two seasons for the endemic zooplankton species. *Pseudocalanus* sp. was rank 1 during both seasons as averaged over the four stations. During the summer, *Acartia longiremis*, *Calanus marshallae*, *Acartia clausii* and *Oithona similis* occupied ranks 2 through 5. During the winter, *Oithona similis* occupied rank 2, and ranks 3, 4, and 6 were occupied by copepods with southern affinities: *Paracalanus parvus*, *Ctenocalanus vanus* and *Corycaeus anglicus*.

Few definite winter patterns are seen in Tables 8a and 8b. *Pseudocalanus* and *Oithona similis* have greater relative abundance offshore in contrast to the summer. *Ctenocalanus vanus* and *Corycaeus anglicus* had their lowest average ranks nearshore at NH 1 and NH 3. Relative abundances of the important summer copepod species change during winter months. *Pseudocalanus* sp., *Acartia longiremis* and *Calanus marshallae* make up a smaller percentage of the total catch. *Oithona similis* percentages increase significantly during the winter.

Abundance Differences Between Summers

One of the most intriguing problems in the data set is the differences between zooplankton assemblages sampled during 1969, 1970 and 1971. Abundances were so very different between the seasons that one wonders whether any but the most general patterns can be described. Elsewhere (Peterson and Miller, 1975) we discussed some peculiarities in species composition and abundance associated with the 1971 data and related our observations to anomalous winds occurring during that summer. Differences between 1969 and 1970 were noted, but not discussed. Standing stocks were high during both of these upwelling seasons, but abundances of certain copepod species were very different between the two years. Different species dominated the catch. Many of the differences between the three years can be seen in Tables 2 and 4 of this report.

Figure 6 shows the abundance data for three copepod species which had their greatest abundance at the nearshore station. Abundances of *Pseudocalanus* sp. and *Acartia clausii* look as though they may be negatively correlated at station NH 1, both within and between the upwelling seasons of 1969 and 1970. *Pseudocalanus* sp. were clearly more abundant in 1969. *Acartia clausii*

were more abundant in 1970. Maximum abundances for the three species in Figure 6 (*Pseudocalanus* sp., *Acartia clausii* and *Centropages abdominalis*) occurred in June and July of all years. In addition, *Acartia clausii* can have a second peak in September. Differences between stations will be discussed later in this report, and are well illustrated in Figure 6.

Figure 7 shows the abundances of *Calanus marshallae*, *Acartia longiremis* and *Oithona similis*. These are the copepods that were usually more abundant offshore of NH 1. *Calanus marshallae* was clearly most abundant in 1969. Maxima occurred in August and September after the *Pseudocalanus* maximum. No peaks were seen in 1970. Peak heights are greatly reduced in 1971 and are seen only in June and July. *Acartia longiremis* was abundant only in September of 1969 whereas in 1970 it was abundant from July through September. *Oithona similis* was most abundant in June and July of 1969, September 1970 and sporadically in 1971.

The major differences between the two years 1969 and 1970 are perhaps best illustrated by percentage of *Pseudocalanus* sp. in the total catch. Average percentages are shown below for the comparable periods during the two upwelling seasons:

	NH 1	NH 3	NH 5	NH 10
22 June - Sept. 1969	68%	67%	58%	54%
23 June - Sept. 1970	44%	43%	33%	29%

Differences in relative abundance for the other copepod species can be seen in Figures 6 and 7. As previously pointed out, *Acartia clausii* and *Acartia longiremis* were more important during the 1970 upwelling season.

Another way to illustrate differences between the upwelling seasons is with an analysis of the frequency with which various species held different ranks of abundance. Table 9 presents this analysis. We show only the data for the most important copepods. Abundances were ranked over comparable time intervals in 1969, 1970 and 1971: from 22 June 1969, 23 June 1970 and 12 June 1971 through September of the three years. During 1969, *Pseudocalanus* sp. were rank 1 (i.e., most abundant) in 7 of 9 samples from NH 1, 8 of 9 samples from NH 3, 8 of 10 samples at NH 5 and 5 of 7 samples from NH 10. During the same period in 1970, *Pseudocalanus* ranks were quite different. They were rank 1 in only 3 of 7 samples at NH 1, 5 of 7 samples at NH 3, 3 of 8 samples at NH 5 and 2 of 8 samples at NH 10. By contrast, *Acartia clausii* was rank 1 in 4 of

COPEPOD SPECIES	NH 1	NH 3	NH 5	NH10	SUM	MEAN RANK
<i>Pseudocalanus</i>	1.69	1.42	1.46	1.55	6.12	1.53
<i>Acartia longiremis</i>	3.48	3.71	2.81	2.80	12.80	3.20
<i>Calanus marshallae</i>	5.41	3.68	3.43	3.37	15.83	3.96
<i>Acartia clausii</i>	3.03	4.67	3.81	4.83	16.34	4.09
<i>Oithona similis</i>	4.55	4.71	4.70	5.63	17.59	4.40
<i>Centropages abdominalis</i>	4.80	5.57	5.50			
<i>Acartia tonsa</i>		5.80				
<i>Paracalanus parvus</i>				6.28		
<i>Metridia lucens</i>			6.40	4.79		
<i>Oithona spinirostris</i>			7.29	6.88		
OTHER TAXA						
<i>Limacina helicina</i>		6.00	6.67	6.46		
<i>Oikopleura</i> sp.		7.66	8.32			
<i>Sagitta</i> sp.		6.63				
<i>Calanus</i> eggs	5.20	6.77	5.09			
<i>Calanus</i> nauplii	4.79	5.13	5.67	5.29	20.88	5.22
euphausiid eggs	6.50	6.44	5.13	5.83	22.86	5.72
euphausiid nauplii				7.50		
barnacle nauplii	5.85	6.00				
bivalve veligers	6.10	8.27				
decapod mysis		6.50				

Table 7a. Average rank of abundance at each station, sum of ranks and overall rank for those taxa that were taken in five or more summer samples at each station. Rank 1 indicates the greatest abundance.

TAXA	NH 1	NH 3	NH 5	NH10
<i>Pseudocalanus</i> sp.	51.6	46.8	45.0	43.4
<i>Acartia longiremis</i>	11.3	18.3	18.7	34.6
<i>Calanus marshallae</i>	3.3	10.7	11.3	10.5
<i>Acartia clausii</i>	19.5	9.6	12.0	4.5
<i>Oithona similis</i>	6.3	6.4	7.0	7.4
<i>Centropages abdominalis</i>	4.1	3.4	3.2	3.0
<i>Calanus</i> nauplii	7.5	7.1	4.2	3.8
euphausiid eggs	2.6	9.1	8.8	8.6

Table 7b. Mean percent-of-total-catch averaged over only those samples in which the taxa made up greater than 1% of the catch, in five or more samples at each station. Only the more important taxa are listed.

COPEPOD SPECIES	NH 1	NH 3	NH 5	NH10	SUM	MEAN RANK
<i>Pseudocalanus</i> sp.	3.17	2.08	2.08	2.36	9.69	2.42
<i>Oithona similis</i>	3.75	3.00	2.58	2.64	11.97	2.99
<i>Paracalanus parvus</i>	3.77	3.73	4.00	3.43	14.92	3.73
<i>Ctenocalanus varus</i>	4.00	3.80	5.44	5.60	18.84	4.71
<i>Acartia longiremis</i>	4.70	5.18	6.50	5.33	21.71	5.42
<i>Corycaeus anglicus</i>	6.00	4.75	8.40	8.40	27.55	6.88
<i>Calanus marshallae</i>	7.50	6.25	7.50	6.62	27.87	6.96
<i>Clausocalanus arcuicornis</i>	8.67	6.50	8.20	7.22	30.59	7.64
<i>Clausocalanus immature</i>	8.00	8.87	7.00	7.25	31.12	7.78
<i>Clausocalanus pergens</i>	9.33	9.25	9.62	6.83	35.03	8.75
<i>Acartia clausii</i>	3.57	6.60				
<i>Acartia tonsa</i>	6.00	7.00				
<i>Centropages abdominalis</i>	8.75					
<i>Calanus tenuicornis</i>			9.66			
<i>Metridia lucens</i>				5.66		
OTHER TAXA						
<i>Oikopleura</i> spp.	6.33	5.88	5.90	7.10	25.21	6.30
Chaetognaths		7.42	9.40	7.70		
Pteropods	8.66		10.00	8.75		
<i>Calanus</i> nauplii	5.33	5.20	8.33			
barnacle nauplii	6.60	6.00	5.66			
bivalve veligers	5.85	8.25	6.60			
gastropod veligers	7.66	10.33				
polychaetes	6.33					
other worms		8.66	8.66	10.80		

Table 8a. Average rank of abundance at each station, sum of ranks and overall rank for those taxa that made up greater than 1% of the catch in the winter samples.

TAXA	NH 1	NH 3	NH 5	NH10
<i>Pseudocalanus</i> sp.	23.9	29.7	31.0	29.8
<i>Oithona similis</i>	13.9	18.0	13.9	18.3
<i>Paracalanus parvus</i>	16.0	12.2	14.9	13.5
<i>Ctenocalanus varus</i>	3.4	10.2	10.3	10.5
<i>Acartia longiremis</i>	10.8	9.2	5.0	8.8
<i>Corycaeus anglicus</i>	12.6	18.5	6.3	3.0
<i>Calanus marshallae</i>	4.0	2.7	9.1	3.4
<i>Oikopleura</i>	5.1	8.1	5.5	3.9
<i>Calanus</i> nauplii	8.8	6.0	3.3	***
<i>Acartia clausii</i>	21.8	15.0	***	***

Table 8b. Mean percent-of-total-catch averaged over only those samples which the taxa made up greater than 1% of the catch, in five or more samples at each station. Only the more important taxa are listed.

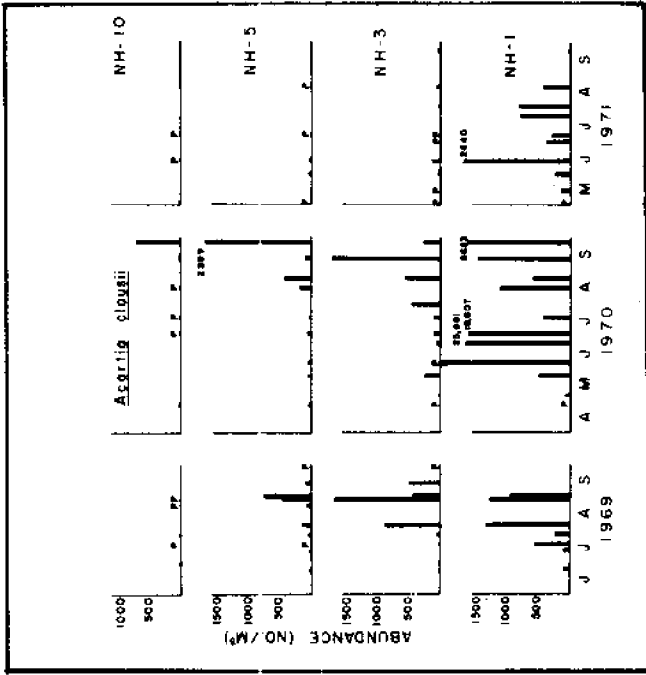
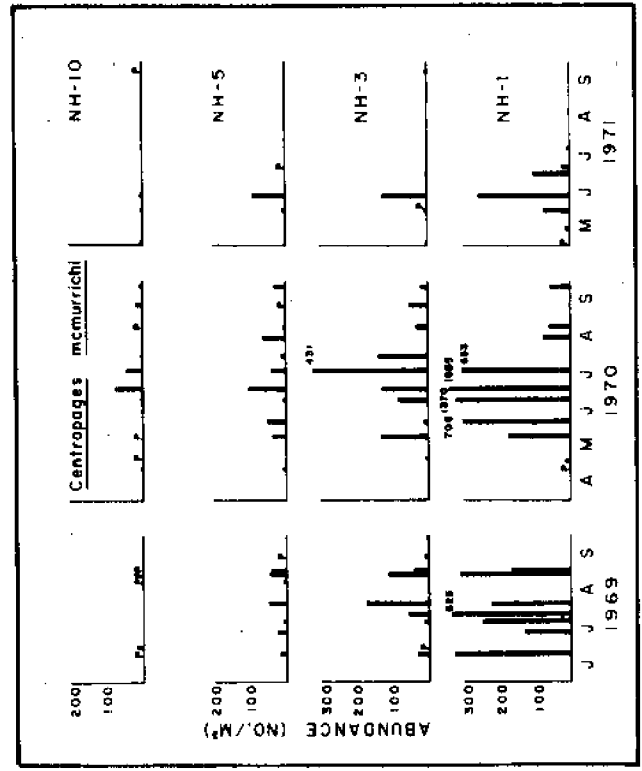
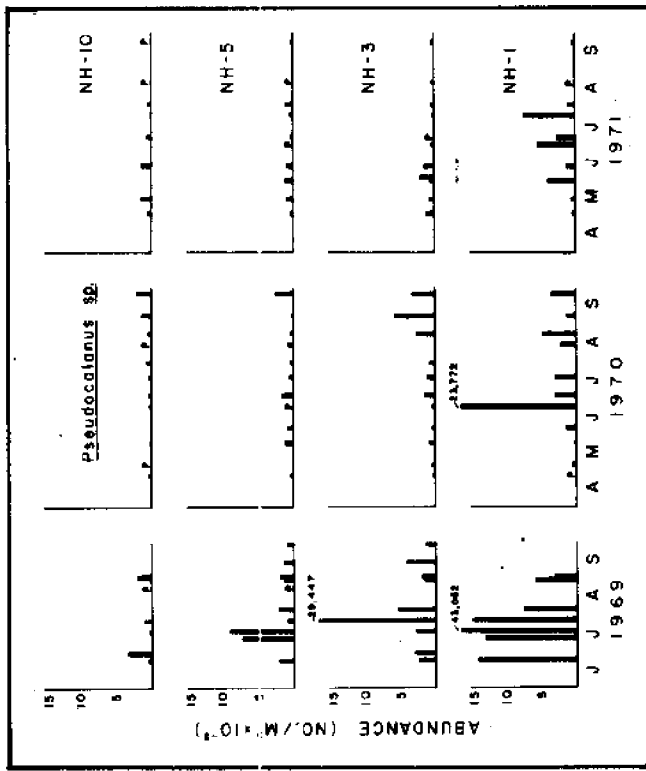


Fig. 6. Density of *Pseudocalanus* sp., *Acartia clausii*, and *Centropages mcmurricchi* at NH1, NH 3, NH 5, and NH 10 during the summer upwelling seasons of 1969, 1970 and 1971.

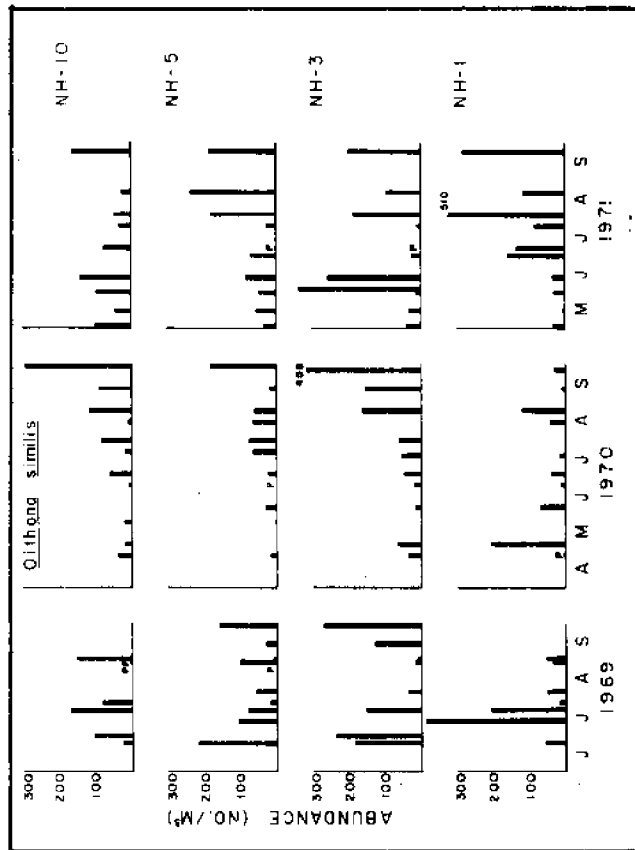
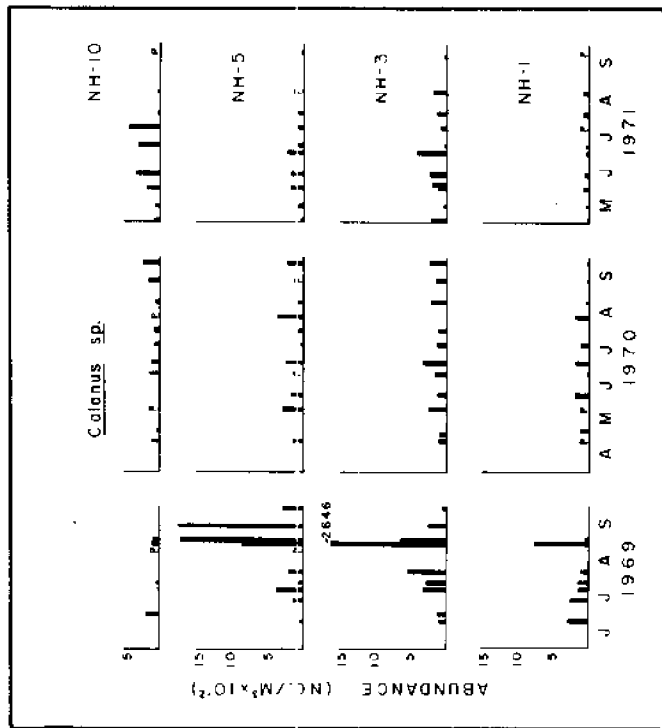
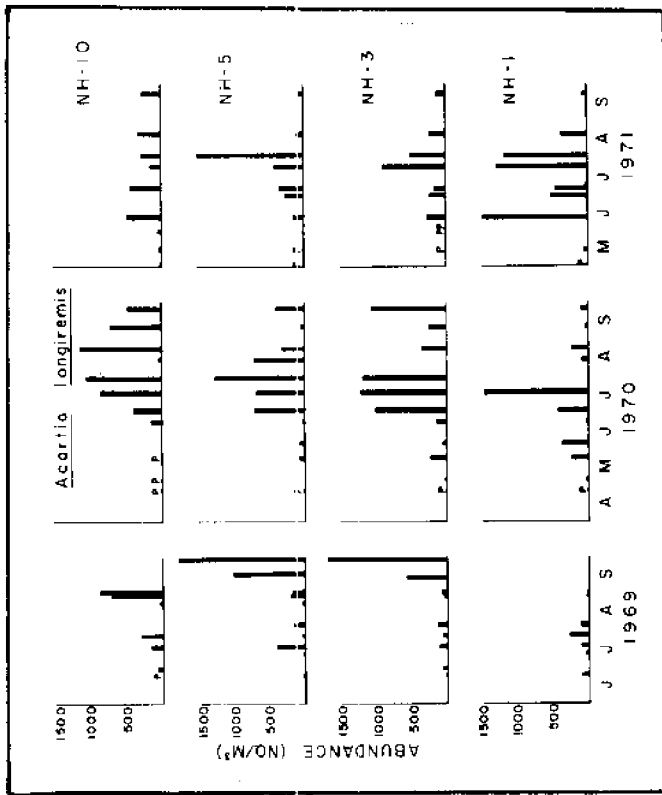


Fig. 7. Density of *Calanus marshalliae*, *Acartia longiremis* and *Oithona similis* at NH 1, NH 3, NH 5, and NH 10 during the summer upwelling seasons of 1969, 1970 and 1971.

7 samples at NH 1 as compared to a rank of 1 in only 1 of 8 samples in 1969. *Calanus marshallae* is seen to have highest ranks in 1969 at all stations. *Acartia longiremis* had its highest ranks in 1970.

Three other copepod species had different abundance patterns between the two years of good upwelling, 1969 and 1970. *Paracalanus parvus* occurred commonly during the months June-September 1969 but in 1970 it was common only during the spring and fall months. During 1970, the population was shifted offshore during late June, July and early August. The relative density of *Acartia tonsa* was greatest during the 1969 upwelling season (see Table 2). These two species are the only coastal neritic species with temperate-subtropical affinities that occur off Oregon. The third species, *Eucalanus bungii* occurred in an equal number of samples from the three upwelling seasons but was much more abundant during the 1969 upwelling season. Mean density was $21/m^3$ in 1969, $3/m^3$ in 1970 and $9/m^3$ in 1971. These averages are based on 13, 10 and 15 samples respectively. *Eucalanus bungii* is a sub-arctic oceanic species. It always had its greatest abundance at the offshore stations and was taken at NH 1 only during the 1971 upwelling season.

The only other taxon that had a clear pattern related to the 1969 upwelling season was barnacle nauplii. They occurred in only a small fraction of the samples compared to 1970 or 1971.

The 1970 upwelling season was the best one for the copepods *Centropages abdominalis* and *Microcalanus pusillus*. Although average density of *Centropages abdominalis* was about the same in 1969 and 1970, the peak densities were much higher during the 1970 season (see Figure 6 and the appendix data). *Microcalanus pusillus* appeared much more frequently and was more abundant during the 1970 upwelling season.

The strong dominance of *Pseudocalanus* sp. during the 1969 upwelling season, the persistence of *Paracalanus parvus* and *Acartia tonsa* through the summer, and the low abundance of the other two *Acartia* species in 1969 compared to 1970 when dominance was shared by *Pseudocalanus* sp. and the two *Acartia* species, must somehow be related to environmental factors. There were some environmental differences between 1969 and 1970 but they were difficult to evaluate. The pattern of northerly winds is different between the two years. In 1969, northerly winds did not begin to blow steadily until the end of June. *Pseudocalanus* sp. had

reached high numbers by this time. In 1970, northerly winds blew from late April through August (see Figure 3). As a consequence of this wind pattern, the Columbia River plume was found nearshore at NH 1 through late June 1969 but was never found within 10 miles of shore in 1970.

The extent to which this water of reduced salinity and high temperature may modify the planktonic environment is uncertain. It is likely that different kinds of phytoplankton would be found in surface waters influenced by the plume compared to surface waters influenced by active upwelling. Different food resources may explain the occurrence of a different zooplankton assemblage found during the late June-July period of the 1969 upwelling season. Perhaps *Acartia clausii* could not utilize the food resource resulting from phytoplankton growing in a mixture of plume and coastal water in 1969 and as a result no population outbursts were observed. As the 1969 upwelling season progressed, *Acartia clausii* became important at NH 1 in August. *Acartia longiremis* became important offshore, at NH 10, only after intense upwelling had developed. The 1970 upwelling season began in April. Intense upwelling was frequently present nearshore from mid-May through September. During this season, *Acartia clausii* was more abundant than *Pseudocalanus* sp. on most sampling dates (see Figure 6), and was frequently dominant. Beyond the data period, we have observed the 1969 pattern of *Pseudocalanus* sp. dominance with *Acartia clausii* in lesser abundance during early summer of 1973. The wind patterns in 1969 and 1973 were very similar. Plume water was onshore throughout June, and active upwelling did not begin until early July. *Acartia clausii* was not abundant until mid-August 1973.

Abundance Differences Between Winters

Between winters, variability in species composition was the most notable difference, but there were differences in abundances as well. These differences may be a function of total northward transport of the Davidson Current. Unfortunately, estimates of the transport are not available.

However, our zooplankton data, temperature-salinity diagrams, Newport wind data and Bakun's upwelling index data all indicate that the winter of 1969-70 was an unusual one. Some of the southern zooplankton species that had their greatest abundance during this winter were *Paracalanus parvus*, immature *Clausocalanus*, *Ctenocalanus vanus*, *Acartia tonsa* and *Corycaeus anglicus*. Other copepod species with southern affinities

appeared in samples with much greater frequency during the winter of 1969-70. They were: *Mecynocera clausii*, *Calocalanus styli-remis*, *Calocalanus tenuis*, *Clausocalanus mastigophorus*, *Clausocalanus parapergens*, *Acartia danae* and *Corycaeus amazonicus*. In addition, four other southern species were seen only during this winter: *Clausocalanus jobei*, *Clausocalanus paululus*, *Oncaea dentipes*, and *Oncaea subtilis*. All of the above 16 copepods are indicators of water originating south of at least Cape Mendocino, California (Olsen, 1949; Fleminger, 1967; Frost and Fleminger, 1968).

Seasonal Cycle of Total Zooplankton Abundance

Given the variability between individual summers and winters, generalizations about the annual cycle of zooplankton abundance are difficult to make. The problem is compounded by our lack of understanding of the timing of upwelling events and other environmental factors, and the response of zooplankton production to such events.

The annual cycles for stations NH 1, 3, 5, and 10 are shown in Figure 8, 9 and 10 respectively. The simplest temporal pattern is the annual cycle. Abundances are high during the upwelling season and low during the winter months. All four stations have this basic pattern. There are important differences between the cycles at the four stations. Variations on the basic pattern seem to be related to distance from shore. At the nearshore stations (NH 1 and NH 3), the winter low extends from mid-November through January, while at the offshore stations, the low extends at least through February. Peak amplitudes are also a function of distance from shore. Station NH 1 had 16 sampling dates with abundances greater than 5000/m³. Median abundances also show the same pattern and are listed below:

STATION	SUMMER	WINTER
NH 1	4350/m ³	850/m ³
NH 3	2250	800
NH 5	1550	530
NH 10	1000	365

The annual cycle at NH 1 has the most detail. The winter low has a duration of approximately two and one half months, from mid-November through January of all years. A peak in zooplankton was seen during all three years in either February or March. The 25 February 1970 sample had high numbers of copepod nauplii (1840/m³ = 27% of the catch). This indicates the presence of an actively reproducing adult copepod population.

A diatom bloom was in progress at this time as well. Our nets were clogged with the diatom *Thalassiosira* at stations NH 1, 3, and 5. The 16 February 1971 peak had high numbers of *Pseudocalanus* sp. (680/m³ = 12% of the catch), *Calanus* (240/m³ = 15%) and *Calanus nauplii* (192/m³ = 12%). The *Pseudocalanus* sp. population was 50% adult females and 50% immatures. The *Calanus* population was almost entirely stage I copepodites. Female *Calanus* were found farther offshore. These facts again indicate an actively reproducing adult copepod population. In both of these years, abundances decreased after the February peak to lower values in March or April.

In 1972, no samples were collected in January or February. The 15 March sample had high numbers of *Pseudocalanus* sp. (1844/m³ = 62%), *Oithona similis* (690/m³ = 23%) and *Acartia longiremis* (265/m³ = 9%). Half of the total catch were immature *Pseudocalanus* sp., and half of the *Acartia longiremis* were immatures.

The months of April and May are periods of transition in the field of the wind. The atmospheric high pressure cell begins to form over the North Pacific Ocean and the winds begin blowing from the north with greater frequency. These months are also months of transition for the zooplankton. Copepod species with southern affinities are generally missing by May or are taken in greatly reduced numbers. In all years of this study, thick phytoplankton blooms were seen during this period. The blooms are probably associated with the replenishment of nutrients within the photic zone by upwelling. The blooms were found on 27 April 1970, 3 and 14 May 1971, 20 April 1972 and 22 May 1972. Zooplankton abundances were low at these times.

By late May and June (4 June 1970 and 29 May 1971) zooplankton abundances had reached 5000/m³. Numbers remained high through June and July of all years, reaching maximum numbers of 44,000/m³ on 18 July 1969, and 51,372/m³ on 23 June 1970. The peak in 1971 occurred on 21 July and was only 9577/m³. No large peak was seen in our 1972 samples.

Abundances were lower in August, as compared to June and July, during all years of this study. Abundances continued to decline through September and October of 1969 and of 1971. In 1970, a large peak was seen on 25 September, 9 October and 20 October. *Acartia clausii* was the single dominant, making up 50% of the catch in September and 83% and 61% on the October dates.

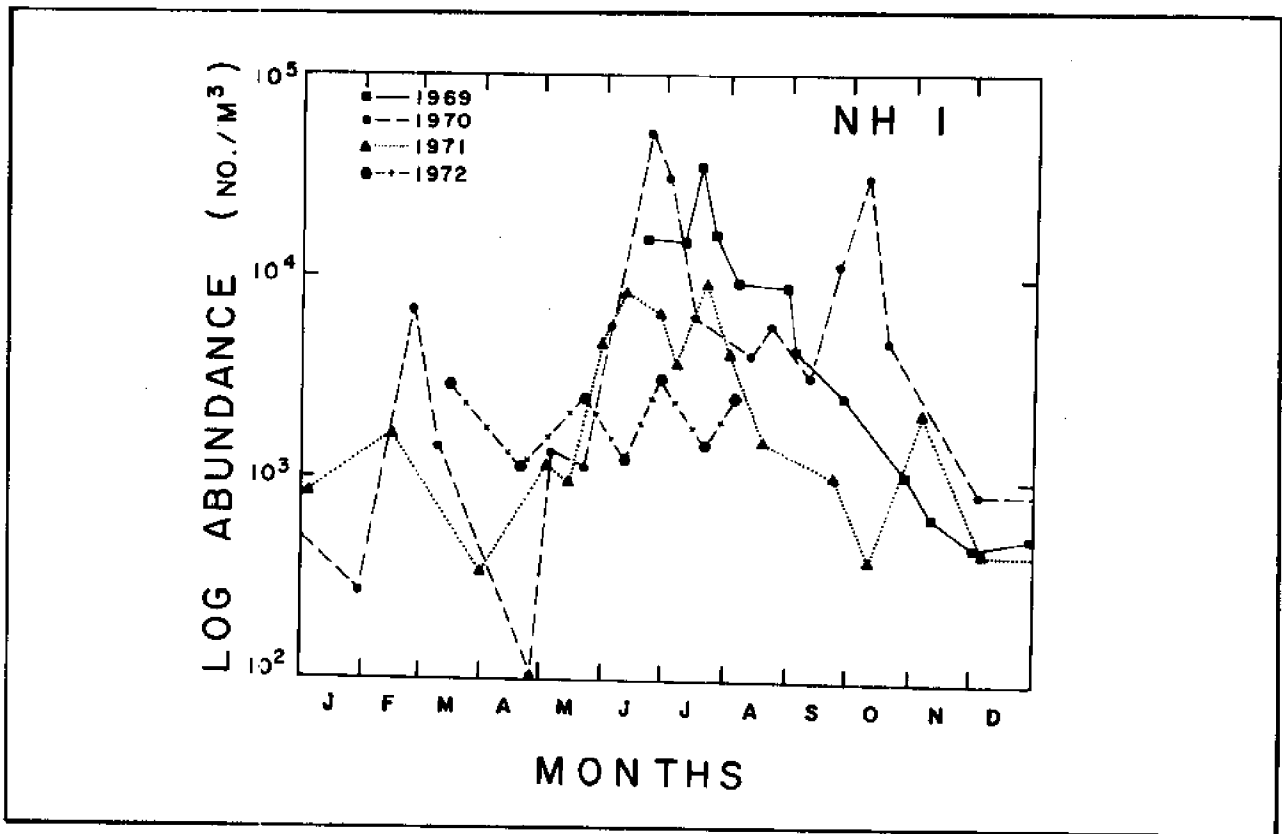


Fig. 8. Annual cycle of totalized zooplankton abundance at NH 1, during the three year study period.

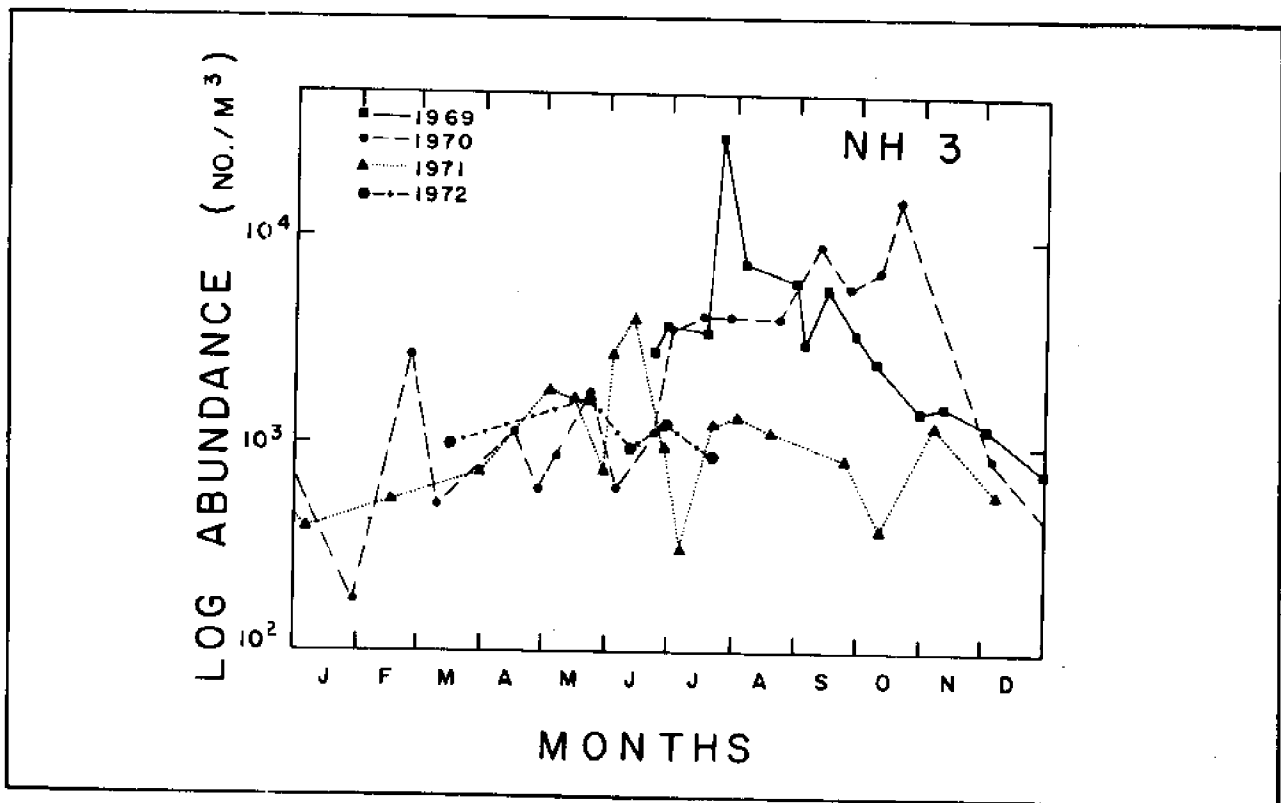


Fig. 9. Annual cycle of totalized zooplankton abundance at NH 3, during the three year study period.

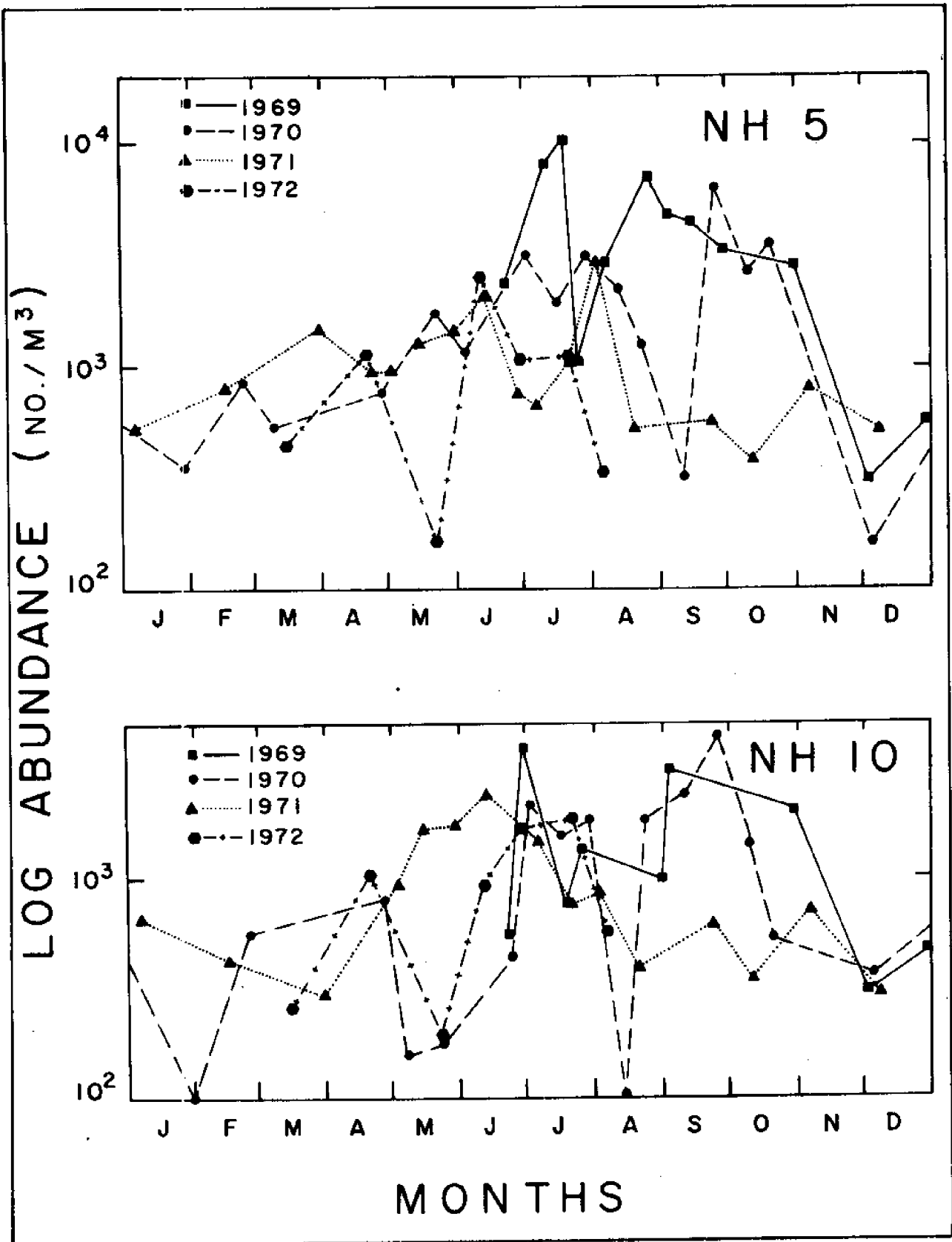


Fig. 10. Annual cycle of total zooplankton abundance at NH 5 and NH 10 during the three year study period.

Our data indicate that the transitional period between an upwelling system and one dominated by the northward flowing Davidson Current extends at least through October. By December of all years copepod species with southern affinities were well represented and abundant off Newport.

The annual cycle at NH 3 is similar to the cycle at NH 1, but amplitudes are lower. The pattern of low abundance in December and January is present. The February peak was seen only in 1970. The low abundances extended through February in 1971 and 1972. The late spring-early summer peak that began to develop in June at NH 1 did not develop at NH 3 until July of 1969 and 1970. The 1971 peaks are strikingly reduced, and are probably a result of reduced coastal upwelling during that summer. The September and October peak seen in 1970 at NH 1 is also seen at NH 3. On 25 September and 9 October, the NH 3 peak was associated with *Pseudocalanus* sp. dominance (53% and 45% respectively) rather than dominance by *Acartia clausii* as at NH 1 on the same date. The 20 October peak at NH 3 was dominated by *Acartia clausii* (60%).

At NH 5 the annual cycle is different. Amplitudes are greatly reduced as compared to NH 1 and NH 3, and winter-spring peaks do not develop until April and May. There seems to be a recurrent summer abundance pattern: peaks are seen through July and mid-August, and a low is present from mid-August through September of all years. An autumn peak developed in September and October of 1969 and 1970. The September peak was dominated by *Acartia clausii* and the October peak by *Pseudocalanus* sp. in 1970, and by *Pseudocalanus* sp. and *Calanus marshallae* in early and mid-September 1969, by *Acartia longiremis* on 28 September 1969, and by winter species in late October 1969 (*Paracalanus parvus*, *Oithona similis* and *Oikopleura* spp.).

The annual cycle at NH 10 is similar to that at NH 5, in that the late winter peak seen at the nearshore stations is not present and the spring peak does not begin to develop until May. Two peaks are present during the summer months, in July-August and September-October. August lows are seen at NH 10. Abundances were never greater than $5000/\pi^3$ at NH 10.

SEASONAL CYCLE OF RELATIVE SPECIES ABUNDANCE

The seasonal cycle of the relative abundance of the abundant (and therefore important) copepod species is shown in Figure 11 for NH 1, NH 3, NH 5 and NH 10. The figures

are cumulative percentage of the total catch for the copepods *Pseudocalanus* sp., *Acartia clausii*, *Centropages abdominalis*, *Acartia longiremis*, *Calanus marshallae* adults, immatures and nauplii pooled, *Paracalanus parvus* and *Oithona similis*. The most general result contained in these figures was summarized in Tables 7b and 8b.

The figures are rather complex but deserve careful study because some interesting patterns are present. The simplest pattern is the sinusoidal annual cycle. The same pattern was seen in the plots of total zooplankton abundance. One can conclude from a comparison of the zooplankton abundance plots (Figures 8, 9, and 10) and the relative species abundance plots (Figure 11) that low abundances during winter months are coincident with a decrease in relative abundance of the endemic copepod species, and an increase in importance of non-copepod taxa. *Oikopleura* spp, chaetognaths and warm-water copepod species become important during the winter.

There is considerable seasonality in the relative abundance of each taxa. At NH 1, *Pseudocalanus* sp. were important through September 1969, April-September 1970, February-July 1971 and late September-November 1971. *Acartia clausii* and *A. longiremis* were always important during the autumn after the cessation of upwelling. *Centropages abdominalis* was never important after August, with the exception of November 1971. *Calanus marshallae* copepodites and nauplii had their greatest importance during the spring. *Paracalanus parvus* and *Oithona similis* appear most importantly during the winter.

There are large differences between years at NH 1 as previously noted. *Pseudocalanus* sp. had a much higher relative abundance during the 1969 and 1971 upwelling seasons. During the 1970 season, *Acartia clausii* and *Pseudocalanus* sp. shared dominance in many samples. *Centropages abdominalis* were less important during the 1971 upwelling season. *Acartia longiremis* were about equally important at various times during all three upwelling seasons. *Oithona similis* was more important during the 1969 and 1971 upwelling seasons. *Paracalanus parvus* were important over broader time intervals in 1969 and 1970 as compared to 1971.

At NH 3, the most striking aspect of the annual cycle compared to NH 1 is the greatly decreased importance of *Acartia clausii* and increased importance of *Acartia longiremis* and *Calanus marshallae*. *Acartia clausii* made up a large fraction of the catch only

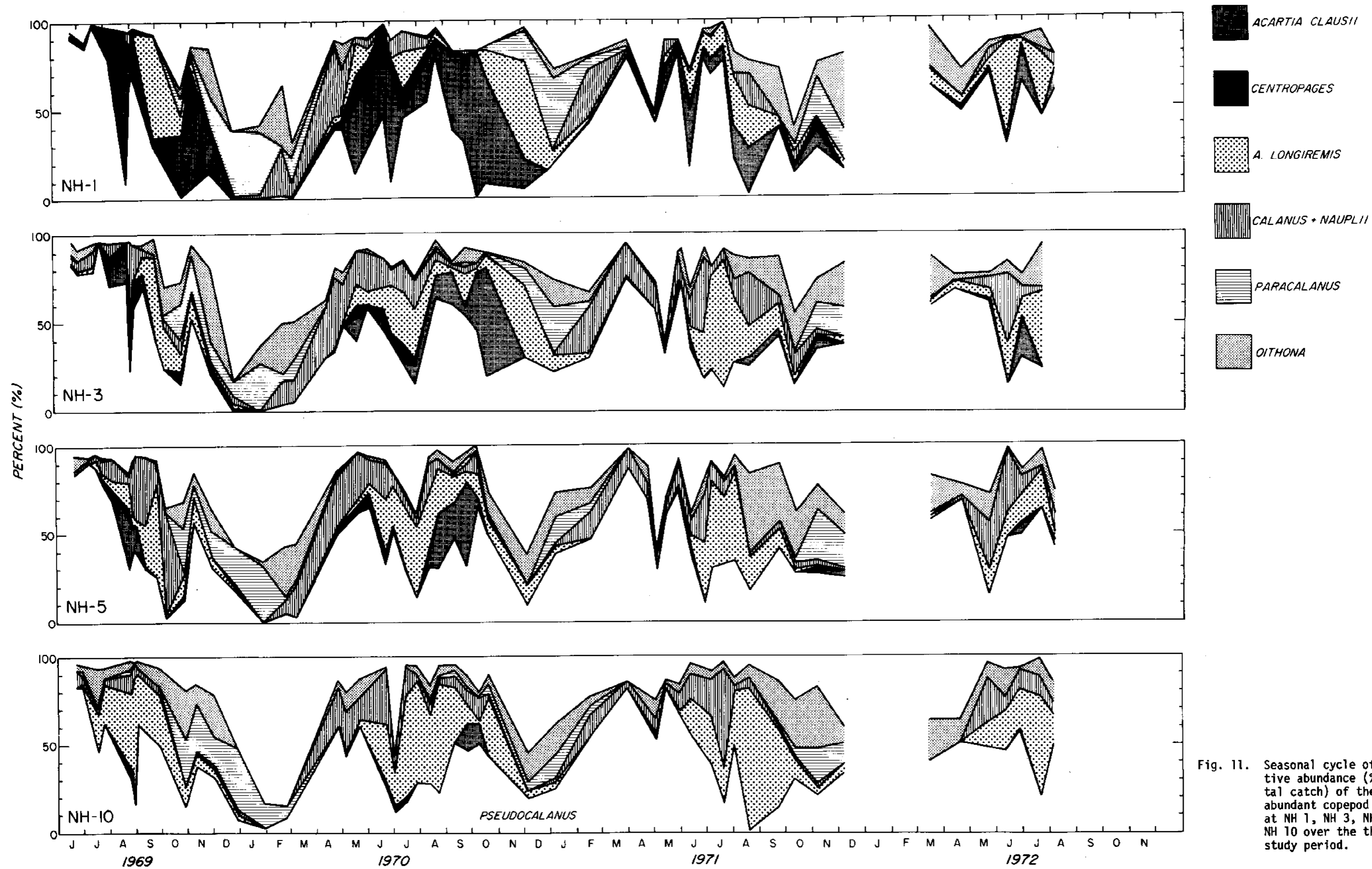


Fig. 11. Seasonal cycle of relative abundance (% of total catch) of the most abundant copepod species at NH 1, NH 3, NH 5, and NH 10 over the three year study period.

during October 1970. *Acartia longiremis* and *Calanus marshallae* were important over broader intervals in 1970 and 1971 at NH 3.

The annual cycle of *Pseudocalanus* sp. relative abundance at NH 3 was about the same as for NH 1 except for two periods: July of 1970 and 1971. During both times *Pseudocalanus* sp. was important at NH 1, whereas *Acartia longiremis* was important at NH 3.

The NH 5 plot is similar to that for NH 3, particularly between November 1969 and May 1970, and between January and July 1971. Similarly to NH 3, the importance of *Acartia clausii* is greatly reduced and the importance of *Acartia longiremis*, *Calanus marshallae*, and *Oithona similis* are increased, relative to the stations closer to shore.

The NH 10 plot follows the NH 5 plot closely during 1970 and 1971 with one exception: in September 1970 *Acartia clausii* was important at NH 5 but not NH 10.

SUMMARY OF PART I

The zooplankton community is different between summer and winter partly as a result of major changes in nearshore circulation patterns. In summer when the net water transport is to the south, species with northern affinities dominate. In winter when transport is northward, species with southern affinities are mixed with the endemic fauna. Abundances are about an order of magnitude higher in summer than winter presumably because of coastal upwelling.

We found year-to-year variations during both summer and winter in zooplankton abundance and species composition. During the summer upwelling season, the observed differences can be explained by differences in upwelling strength resulting from differences in the pattern of the wind stress during each of the three summers. During the winter months, the differences in species composition were probably a result of either differences in transport of the Davidson Current or else in the position of the current relative to the nearshore zone. Both cases are a function of the pattern of the winds.

On a spatial scale, zooplankton were consistently most abundant at the station one mile from shore. Persons interested in coastal zone management should be interested in this result because man's activities that could have an impact on zooplankton are most likely to be most intense very close to shore.

part II: remarks on important taxa

In this section taxa will be discussed separately. Seasonal cycles of abundance will be presented and distribution patterns will be related to environmental variables wherever possible. Life cycle information and sex ratios will be discussed for the copepod species. Emphasis will be given to the 34 taxa listed in Table 6. Also included in this section will be observations on phytoplankton blooms, large numbers of medusae, and other miscellaneous occurrences.

COPEPOD SPECIES

Pseudocalanus sp.

The importance of *Pseudocalanus* sp. in the zooplankton assemblages occurring off Newport was shown in Tables 2, 7, and 9 above. It is the one copepod that frequently had a rank of abundance of 1 or 2 in samples collected from all four stations (see Table 9). When *Pseudocalanus* sp. was not rank 1 it was usually replaced by an *Acartia* species. High abundances of *Pseudocalanus* sp. frequently occur on days of active upwelling, and it is on those days that the dominance of the zooplankton by this species is most extreme. The contingency of abundance and dominance upon upwelling conditions was tested in the following manner. Abundance data were divided into high and low categories by ranking the 34 samples collected at NH 1 between the dates 1 May and 30 September. Ranks 1-17 were called high abundance and ranks 18-34 were called low abundance. Dominance data were divided according to whether *Pseudocalanus* sp. was more or less than 50 per cent of the total assemblage. The criterion for active upwelling on a particular date was surface salinity 33.5% or greater. If salinity data were not available for a date, then the wind data (Fig. 4) were consulted. If northerly winds preceded the sampling date by a few days, upwelling was assumed to have been active.

The contingency tables are as follows:

Pseudocalanus sp. abundance at NH 1

	High	Low
Active	12	4
Inactive	5	13

$$\chi^2 = 5.79, p = 0.02$$

Pseudocalanus sp. dominance at NH 1

	>50%	<50%
Active	11	5
Inactive	6	13

$$\chi^2 = 3.43, p = 0.07$$

The conclusion is that *Pseudocalanus* sp. abundance tends to be high at NH 1 on days of active upwelling, and that on those days it tends to be more strongly dominant. The six dates on which *Pseudocalanus* sp. was strongly dominant despite weak upwelling were primarily in May and June: 22 June 1969, 14 May 1971, 28 June 1971, 22 May 1972, 28 June 1972, and 30 August 1969. It is possible that dominance by this species during the spring period is related to the timing of the spring phytoplankton bloom, and not to upwelling. Hints like these from the animal data make it clear that better information is needed on the annual cycle of plant abundance in the Oregon coastal zone. The five dates on which *Pseudocalanus* sp. was not dominant, but when active upwelling was in progress, were 4 June, 23 June, 16 July and 11 September 1970 and 21 July 1972. *Acartia clausi* was rank 1 and *Pseudocalanus* sp. was rank 2 in three of the samples (4 June, 23 June and 11 September 1970). *Pseudocalanus* were rank 1, but not quite 50 per cent of the plankton in the other two samples: 46 per cent on 16 July 1970 and 44 per cent on 21 July 1972. Rank 2 was occupied by *Acartia longiremis* on both of these dates.

The analysis used here is based on the untrue assumption that *Pseudocalanus* abundance and dominance are independently determined on the different dates of the study. Thus significance can arise if *Pseudocalanus* is dominant and abundant throughout one year of strong upwelling and less abundant in other years. In fact, it is certain that the observed relationship is at least partly a result of differences between the years. We also think, however, that *Pseudocalanus* is probably concentrated near shore by the

short term episodes of the upwelling process.

At NH 3, no relationship between abundance and upwelling was expected because, as noted earlier in this report, abundances are frequently low there during active upwelling, when strong abundance gradients are seen between NH 1 and offshore stations. Abundances may be reduced due to upwelling circulation patterns. NH 3 is an area of divergence, so low zooplankton abundances are not surprising. Note however, the relationship between dominance and upwelling was checked. The contingency table was:

Pseudocalanus dominance

	>50%	<50%
Active	10	6
Inactive	6	11

$$\chi^2 = 1.47, p > 0.10$$

There is no strong relationship between *Pseudocalanus* sp. dominance and upwelling at NH 3. There is, however, some suggestion of a pattern. *Pseudocalanus* sp. was dominant in spite of no upwelling on 22 June and 29 June 1969, 3 May 1971 and 22 May 1972, and 26 August 1969 and 25 September 1970. The first four dates are in spring months. The opposite relationship of no dominance during upwelling had the following dates: 23 June, 2 July, 16 July 1970, 6 July and 21 July 1971, and 21 July 1972. These are all early summer months. *Pseudocalanus* sp. was rank 1 but not dominant in two of the samples (23 June 1970 = 44 per cent and 2 July 1970 = 37 per cent). *Acartia longiremis* was rank 1 in the other four samples.

At NH 5, there were only 10 sampling dates with active upwelling, as compared to 16 dates at NH 3 and 15 dates at NH 1. No relationship between *Pseudocalanus* sp. dominance and active upwelling is seen in the contingency table. But once again, a pattern can be recognized in the opposite cells.

Pseudocalanus dominance

	>50%	<50%
Active	3	7
Inactive	9	12

$$\chi^2 = 0.086, p > 0.75$$

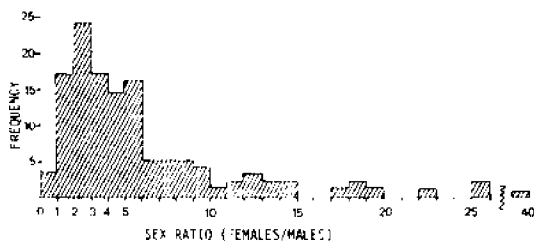
Dates when *Pseudocalanus* sp. were dominant when upwelling was weak or nonexistent were from April through July (22 June,

10 July, 18 July and 6 August 1969, 22 May, 4 June and 2 July 1970, 14 May 1971, and 20 April and 21 July 1972). Dates when upwelling was strong but *Pseudocalanus* sp. were rank 1 in four of the samples but were not dominant: 26 August 1969 = 31 per cent; 3 September 1969 = 40 per cent; 11 September 1970 = 47 per cent; and 5 August 1972 = 42 per cent. The other three dates were 14 September 1969, *Calanus* = 39 per cent; 13 August 1970, *Acartia longiremis* = 32 per cent; and 21 July 1971, *Acartia longiremis* = 38 per cent.

Active upwelling as indicated by surface salinities in excess of 33.5‰ was never seen at NH 10. The upwelling front always intersected the sea surface inshore of this station.

Virtually no information on the life history of *Pseudocalanus* sp. can be gleaned from the data of the Early Life History Program. The mesh size of the plankton nets used was too large to capture young copepodite stages, nauplii, or eggs. Copepodite stages I and II were captured only occasionally. Stage III were often seen, but were probably not sampled quantitatively. Therefore, it was not possible to follow peaks of eggs and nauplii through successive stages to adult in order to estimate generation time.

Sex ratio data for adult *Pseudocalanus* sp. indicate a preponderance of females. Uneven sex ratios favoring females are characteristic of members of the copepod section Amphiscandria. Adult males do not feed, so they suffer mortality soon after molting. However, there were four samples in which males were more abundant than females. All four samples were from 1969, the year of greatest *Pseudocalanus* sp. abundance: 6 August and 30 August at NH 1 and 30 August and 3 September at NH 3. The frequency distribution of sex ratios is shown below. The dispersion of observed sex ratio is greatest at NH 1 and least at NH 10. We have no explanation for this slight trend.



Sex Ratio (Females/Males)	NH 1	NH 3	NH 5	NH 10	Totals
<1	2	2			4
1-2	4	3	5	8	20
2-3	3	5	10	6	24
3-4	5	5	4	3	17
4-5	2	7	3	2	14
5-6	5	4	2	5	16
6-7	1	2	1	1	5
7-8	2	2	1		5
8-9	2		2	1	5
9-10	3		1		4
>10	5	3	5	5	18

Sex ratios of immature *Pseudocalanus* sp. were also determined. This was possible because immature males have fifth legs whereas females do not. The data shown below are pooled copepodite stages IV and V. The range of ratios is much less compared to the data on adult *Pseudocalanus* sp. About 80 per cent of the data were sex ratios between 1:1 and 1:2 males:females. Since most of data fell within this interval, we have expanded it to intervals of 0.25 over the ratio range of 1:1.00 -- 1:1.99. In all cases N>40.

Ratio	NH 1	NH 3	NH 5	NH 10	Σ
<1.0	4	5	5	3	17
1.00-1.24	11	6	5	5	27
1.25-1.49	5	5	9	10	29
1.50-1.74	5	7	3	1	16
1.75-1.99	2	2	3	0	7
2-2.99			2	5	7
3-3.99			1		1
4-4.99		1			1

Acartia clausii

Acartia clausii has its greatest abundance at NH 1 and was most abundant during the summer of 1970. Highest numbers were seen in June of 1970, 1971 and 1972. It is possible that the beginning of our sampling program on 22 June 1969 missed a 1969 June peak. A September peak developed in 1969, 1970, and, according to data of L. Smith (in Holton and Elliott, 1973), in 1972 as well. It is only at this time that *Acartia clausii* can be found in large numbers offshore of NH 1. This autumn period corresponds to a time when the winds are light and variable, fluctuating between northerly and southerly directions. No peak was seen in September 1971. August and September 1971 were both months of anomalously low numbers of all zooplankton (see Figures 8-10). These low numbers probably resulted from an effect on the nearshore environment of onshore transport of warm, low salinity water.

There is no statistical relationship between *Acartia clausi* abundance and the short term intensity of upwelling at NH 1. The contingency table (see *Pseudocalanus* sp. discussion above for the method) was:

		Acartia clausi abundance	
		High	Low
Active upwelling		9	7
Inactive upwelling		8	10

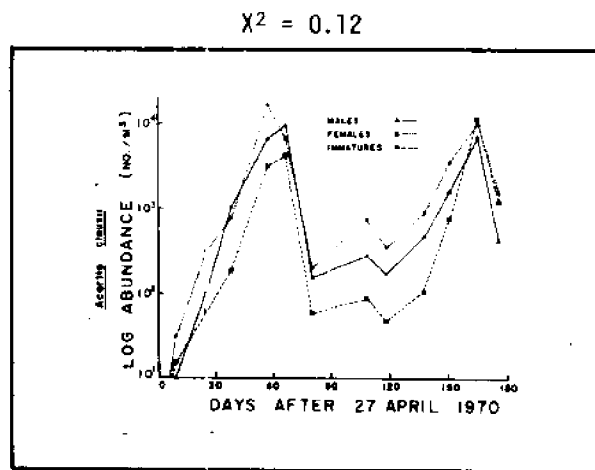


Fig. 12. Abundance of *Acartia clausi* at NH 1 during the 1970 upwelling season over the six month period beginning on 27 April.

Abundance data are plotted against time in Figure 12 for the 1970 upwelling season. Two peaks are seen: in June and September. Peaks of males, females, and immatures are synchronous. It seems likely that eggs, which were responsible for these peaks, were laid over very short intervals, probably less than one week. Generation times might be estimated to be about 60-70 days. The time interval between 27 April 1970, when 45 individuals/m³ were present to 23 June 1970 when about 25,000/m³ were present is about 60 days.

There are no published data on fecundity of *Acartia clausi*. *Acartia tonsa* has been shown to produce 1200-1300 eggs in a 40 day adult life span (Johnson, 1974; Wilson and Parrish, 1971). Fecundity of *A. clausi* is likely to be of the same general order. If there were no mortality this would be sufficient to account for the entire increase within one generation. However, any more probable mortality rate requires that much of the population increase must have come from overlap of several generations. It is likely, therefore, that the generation time is much less than 60 days.

The precipitous drop in *A. clausi* abundances between 2 July and 16 July 1970 is not yet understood. The wind had been steady from the north from 2 through 14 July. On 15 July the wind switched around to the southwest. Our sampling followed that switch by only one day. It is doubtful that this brief shift in wind direction could have been responsible for the fifteenfold reduction in *A. clausi* abundance. Abundances of *Calanus*, *Pseudocalanus*, and *Oithona* were unchanged between the two dates. *Acartia longiremis* increased threefold and *Centropages abdominalis* decreased threefold over the 2 July to 16 July interval. The extreme reduction in *A. clausi* may have been caused by some highly specific predation or other biotic process. A preliminary study of stomach contents of juvenile smelt (*Allosmerus elongatus*) being carried out by one of us (WTP) is showing that these fish selectively eat *Acartia clausi* when that copepod is abundant. These fish are of 5.5 cm fork length. They were collected 22 August 1974. We will pursue this preliminary observation further.

The sex ratio data are shown below. There are differences in sex ratios between upwelling seasons. During the 1969 season, males were more abundant than females in 12 of 19 samples. During the 1970 season, males were more abundant in only 5 of 28 samples. This agrees with the *Pseudocalanus* data where we found more males than females only in 1969. Heinle (1970) found that sex ratio in *Acartia* was a function of population density. At low densities, females were more abundant. We find here the opposite relationship: In the year that *Acartia clausi* was a dominant organism, sex ratios were usually between 1:1 and 2:1::females:males.

	1969	1970	1971	1972
SEX RATIO (FEMALES/MALES)				
<1	12	5	2	1
1-2	1	13	3	5
2-3	1	8	3	
3-4	1	2	4	1
4-5			1	
5-6	2			1
6-7				
7-8				
8-9				
9-10				
10-1	1			
11-1	1			

Centropages abdominalis

There was an onshore-offshore gradient in standing stocks of *Centropages abdominalis*. Abundances were always highest at NH 1.

There was also a gradient in frequency of occurrence in the samples: over all samples collected 1969 through 1972, this copepod occurred in 34 of 35 samples at NH 1, decreasing to 27 of 34 at NH 3, to 27 of 35 at NH 5, and to a low of 22 of 33 at NH 10.

In our data (listed in the appendix), the population peaked on 25 July 1969, 2 July 1970, and 12 June 1971. There was an autumn peak in two of the three years: 29 October 1969 and 6 November 1971. Typically, no *C. abdominalis* are found during the winter months from December through March. Notable exceptions were seen at NH 1 on 25 February 1970 and 16 February 1971. Both of these dates have been shown to be unusual in that zooplankton production was seen. *Pseudocalanus* sp. and *Calanus marshallae* both showed peaks on these two dates. This matter was discussed briefly on page 30 of this report.

Absolute abundances were different on a year-to-year basis. The upwelling season of 1970 had highest abundances, followed by 1969 and 1971. Relative abundances in 1969 and 1970 however, were similar. At NH 1, from 22 June through September 1969, *C. abdominalis* made up 3.4 per cent of the catch. From 23 June through September 1970, it made up 4.2 per cent of the catch. In 1969, *C. abdominalis* had an average rank of 3.0, but in 1970, its mean rank dropped to 4.2. It was displaced one rank in 1970 because *Acartia clausii* was more abundant during that year.

Sex ratios were variable. Males were more abundant than females in one half of the 1969 samples. Males were more abundant in 73 per cent of the 1970 samples, but only 33 per cent of the 1971 samples. The data are:

	RATIO FEMALES:MALES		
	<1	1:1	>1
1969	12	4	8
1970	24	4	5
1971	6	4	8

Acartia longiremis

Two general abundance patterns have already been noted in this report for this species. First, *Acartia longiremis* has its highest ranks at the offshore stations, and secondly, this species was abundant longer and more extensively during the 1970 upwelling season than in other years.

Abundance of *Acartia longiremis* varies

over rather narrow limits compared to *Pseudocalanus* sp. or *Acartia clausii*. The highest abundances and median abundances listed below are remarkably similar at each station:

STATION	MAXIMUM	MEDIAN
NH 1	1477/m ³	108/m ³
NH 3	1618/m ³	159/m ³
NH 5	1776/m ³	163/m ³
NH 10	1142/m ³	262/m ³

Also, some of our data suggest that *Acartia longiremis* abundance changes very little between different upwelling seasons. Total relative densities (i.e., relative density summed from each station) listed in Table 2 varied little between the three upwelling seasons. Table entries for 1969 were 1078/m³, for 1970 were 1509/m³, and for 1971 were 1331/m³.

There is no direct relationship between active upwelling and abundance of *Acartia longiremis*. Contingency tables were set up in the same manner as described for *Pseudocalanus* sp., and are shown below for stations NH 1, 3 and 5:

Acartia longiremis abundance

UPWELLING	NH 1		NH 3		NH 5	
	High	Low	High	Low	High	Low
	Active	8	8	8	8	5
Inactive	8	9	9	8	13	14

None of the tables is significant. We conclude that the abundances of this species are not affected by short term variations in coastal upwelling.

Further support for a hypothesis that upwelling differences have little effect on numbers of *A. longiremis* is given below. The average abundance (no./m³) at each station during each upwelling season is not very different between stations and seasons.

	NH 1	NH 3	NH 5	NH 10
1969	97/m ³	294	380	307
1970	273	491	385	441
1971	593	238	281	218
1972	237	208	134	284

On a date-by-date basis, there was no consistent pattern in the abundance of *Acartia longiremis*. In 1970, numbers were generally high between May and December. In both 1971 and 1972, high abundances were

seen only from June through mid-August. There was no September peak in either 1971 or 1972.

The importance of *Acartia longiremis* within the zooplankton assemblage can only be seen by examining its relative abundance. Table 7b, page 24, shows that the average relative abundance of this copepod changes from 11 per cent of the catch at NH 1, to 18 per cent at NH 3 and NH 5, to 34 per cent of the catch at NH 10. Clearly, this species is increasingly important offshore.

Sex ratio data for *Acartia longiremis* are similar to data for other copepods: ratios are variable from year to year. The data are listed below:

	1969	1970	1971	1972
SEX RATIO (FEMALES/MALES)				
<1	14	23	7	4
1:1	3	1		
1-2	8	15	5	10
2-3	3	1	3	5
3-4			2	1
4-5	3	1	1	
5-6			3	
6-7	1		2	
>7	1		7	
TOTALS	33	41	30	20

During 1970 when *A. longiremis* abundances were highest, sex ratios were about equal. Males dominated in 56 per cent of the samples and females dominated in 42 per cent. There were no ratios in excess of four females per male. The range in female:male ratios was narrower in 1972, but females were more abundant than males in all but 20 per cent of the samples. In 1969 and 1971 the range of ratios was broad. There was one ratio in 1969 of ten females per male. In 1971, the seven ratios in excess of six to one were 11, 12, 13, 13, 19, 21, and 28:1 females per male. We do not yet have any ideas about what relationship sex ratio has to environmental factors in this species.

Calanus marshallae

Calanus marshallae is the only copepod for which we have adequate life history data. Since it is a much larger copepod than either *Pseudocalanus* sp. or the *Acartia* species, all copepodite stages were retained by our plankton nets.

The onshore-offshore distribution of eggs, nauplii and copepodites was interesting because the younger stages tended to be found

near shore and the older copepodites offshore. The trend is clearly shown in Table 10. This table lists the abundance of eggs, nauplii, and copepodite stages at the four study stations, averaged over 33 dates when data were available for all stations on a date. The abundance data have also been converted to percentages of the total abundance of each category over the four stations.

Eggs, nauplii and stage I and II copepodites were most abundant at stations NH 1 and NH 3. Stage III copepodites were abundant at NH 1, 3, and 5. Stage IV copepodites were most abundant at NH 3 and 5 and Stage V's at NH 3, 5, and 10. Adults were most abundant at NH 3 and 5 only. This observed distribution of stages is probably linked to coastal water circulation patterns. The vertical distribution of the stages must be known before we can understand these observations.

Another problem apparent in Table 10 is the difference in abundance of each stage. Natural and predation mortality should lead to decreased abundance of each successive copepodite stage with time, if the time spent in each stage is the same and if predation is not age specific. However, stages IV and V are much more abundant than stages I-III. This cannot be explained by differential escapement through net meshes because our .24mm mesh net was small enough to retain even the youngest copepodite stage. A likely explanation is that stages IV and V are longer lived than stages I-III.

Because of the onshore-offshore gradient in distribution of life cycle stages, it is difficult to objectively follow development through time utilizing data from one or several stations. But we have learned something about generation times simply by looking at abundances of eggs or nauplii with time because they appear in pulses. The beginning of a generation is indicated by the presence of large numbers of eggs, nauplii or stage I copepodites. This occurs at regular intervals and several generations per year are indicated. In both 1970 and 1971, generations began in mid-February, late April, in June, and in August. A fifth generation began in October 1971. Less than 12 months of data are available for 1969 and 1972. In 1969, generations appear to have begun in late May, mid-July and late October. In 1972, the first generation began in February, the second in April but the third generation did not appear until August.

These observations are in agreement with those of Marshall and Orr (1955) from the

	NH 1	NH 3	NH 5	NH 10
EGGS	16.8	23.7	8.6	3.7
NAUPLII	202.2	43.4	15.7	10.1
STAGE I	24.1	14.0	5.2	3.6
STAGE II	10.2	8.8	5.8	6.0
STAGE III	12.3	14.6	13.7	7.5
STAGE IV	9.7	33.9	36.6	15.8
STAGE V	2.7	24.6	30.1	26.1
♂	0.6	1.7	2.4	1.1
♀	3.2	17.6	16.6	6.6
EGGS	31.8	44.9	16.2	7.1
NAUPLII	74.5	16.0	5.8	3.7
STAGE I	51.5	29.8	11.1	7.6
STAGE II	33.1	28.6	18.9	19.5
STAGE III	25.5	30.3	28.6	15.6
STAGE IV	10.1	35.3	38.1	16.5
STAGE V	3.3	29.5	36.0	31.3
♂	10.0	29.4	40.9	19.7
♀	7.2	40.0	37.7	15.0

Table 10. Abundance of *Calanus marshallae* eggs, nauplii and copepodite stages at the four sampling stations. Data were averaged over 33 dates when samples were successfully obtained from all stations on a date. The upper table is number/m³ and the lower table is percentage of a category at each station. Eggs, nauplii, and younger copepodites are found nearer to shore than the older copepodites.

English Channel and Clyde Sea area. Generation times there are about two months. The first generation begins in mid-February, the second in April-May, and the third in July. Usually no more than three generations are seen. There are four off Oregon in most years.

Abundances (no./m³) of *Calanus*, averaged from February to October for 1970 and 1971 are shown below:

	1970	1971
NH 1	75.1	49.3
NH 3	151.6	133.1
NH 5	131.3	94.9
NH 10	74.8	121.2

Little difference in abundance is seen between these two years. *Calanus marshallae* and *Acartia longiremis* have similar abundance patterns. Both are usually more abundant offshore of NH 1 and neither shows much year-to-year variation in numbers.

Sex ratios of adult *Calanus* are shown below. Females are usually more abundant than males. Males can be more abundant than females at times preceding spermatophore transfer because stage V *Calanus* males molt before the females (Marshall and Orr, 1955).

	1969	1970	1971	1972
<1	2	2	1	2
1-2	2	3	6	4
2-3	1	1	2	
3-4		4	3	
4-5	1	1	2	4
5-6	1	11	22	
>6:1	8	7	6	

Males have a regular pattern of occurrence. They usually were found only between about February and July in 1970, 1971, and 1972. In 1969, males persisted between July and September.

When males are present in the samples, females are typically present also. There is a slight tendency for males to be found without females at NH 1. It is not statistically significant. Occurrence between the months of February and October at each of the four stations is shown below:

Station	NH 1	NH 3	NH 5	NH 10
Number of Dates Sampled	48	49	51	47
Number containing females	19	38	45	36
Number containing males	8	20	27	21
Number of joint occurrences	4	19	26	20

Dithona similis

Of the zooplankton occurring off Oregon, *Oithona similis* was one of the few taxa important in both summer and winter samples. Its mean rank and mean percentage of the total catch during summer and winter are shown below. It was relatively more important during the winter.

AVERAGE RANK OF ABUNDANCE

	NH 1	NH 3	NH 5	NH 10
Summer	4.6	4.7	4.7	5.6
Winter	3.8	3.0	2.6	2.6

AVERAGE PERCENT-OF-TOTAL CATCH

	NH 1	NH 3	NH 5	NH 10
Summer	6.3	6.4	7.0	7.4
Winter	13.9	18.0	13.9	18.3

In addition, *O. similis* is another taxon which was about equally abundant during all three upwelling seasons. No large differences are seen in the table of mean relative density (no./m³) shown below:

	NH 1	NH 3	NH 5	NH 10
1969	114.3	128.2	78.0	75.4
1970	53.6	106.2	48.3	66.9
1971	138.0	107.9	91.2	79.1

We tried to determine if *O. similis* abundance was related to sea surface temperature, or if abundance had some temporal pattern. All of the quantitative estimates of the abundance of *O. similis* (including

zero estimates) were plotted against the surface temperature at the station (fig. 13). The only clear conclusion is that the higher abundances (greater than 200/m³) mostly occur at surface temperatures greater than 10°C. The best explanation is that this species is not abundant in the very deep layers which are moved up and ashore during the strongest upwelling events. These events also result in the lowest temperatures observed in the sampling area. There was no temporal pattern in the data. Dates from all months of the year, except April, were represented in the 20 dates with highest abundance.

Paracalanus parvus

This copepod is a broadly neritic temperate-subtropical form that occurs at least as far south as Baja California and as far north as the Queen Charlotte Islands (Fleminger, 1964; Cameron, 1957). Off Oregon it is most abundant during the winter, but frequently occurs during the summer upwelling season. Winter and summer densities (no./m³) are shown below:

Winter	NH 1	NH 3	NH 5	NH 10
1969-70	123.3	117.0	170.2	160.4
1970-71	139.2	67.3	33.6	37.6
1971-72	144.4	74.4	84.8	47.8
Summer	NH 1	NH 3	NH 5	NH 10
1969	23.9	26.4	13.9	13.7
1970	31.1	55.1	37.7	22.7
1971	4.4	6.3	3.4	2.7

Paracalanus was abundant over the entire study area during the winter of 1969-70, but during the other two winters, it had its greatest average abundance nearshore. *Paracalanus* was not abundant (and occurred infrequently) during the 1971 upwelling season. There were also abundance differences between the 1969 and 1970 seasons that are not apparent in the above averaged densities. *Paracalanus* was common throughout the June to September period in 1969. In 1970, it was common only in the spring and fall, and the population was shifted offshore during late June, July and early August.

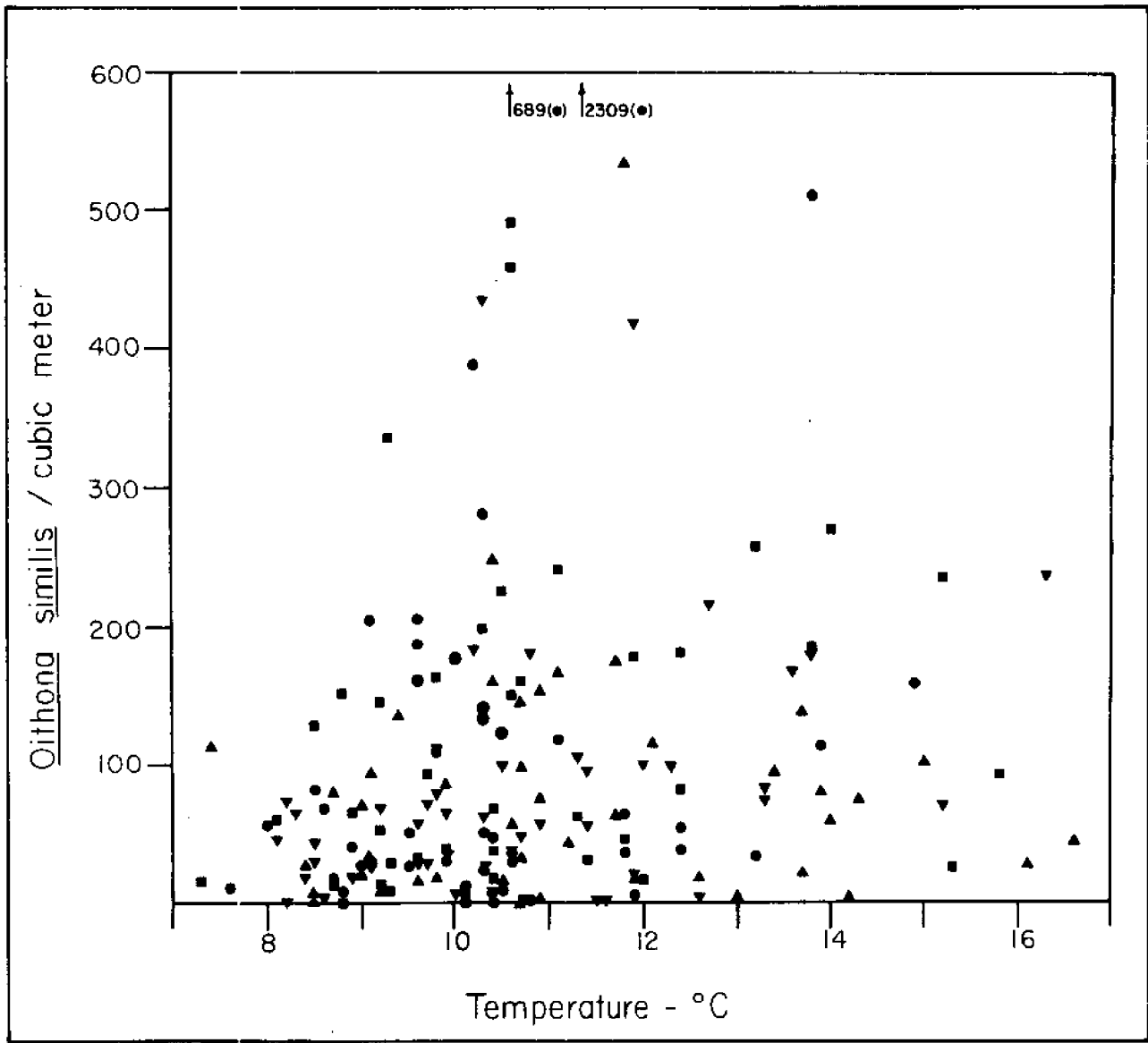


Fig. 13. Scatter diagram of *Oithona similis* abundance vs. sea surface temperature. Caption symbols are ● = NH 1, ■ = NH 3, ▼ = NH 5, and ▲ = NH 10.

Ctenocalanus vanus

Ctenocalanus vanus abundance patterns are similar to *Paracalanus*: Highest abundances are seen during the winter months. *Cteno-*

calanus, like *Paracalanus*, were most abundant during the winter of 1969-70, particularly between 29 December 1969 and 29 January 1970. Average densities (no./m³) are shown below for the three winters:

	NH 1	NH 3	NH 5	NH 10
1969-70	37.3	42.5	61.3	47.9
1970-71	21.9	20.3	22.5	24.1
1971-72	15.8	13.2	19.5	17.4

Abundance and occurrence are usually low during the summers. During the summer of 1969, *Ctenocalanus* occurred in only 5 of 33 samples and averaged 1.6/m³. During the 1970 upwelling season, it was taken in 7 of 44 samples. Five of the seven samples were in the months of April and May before the onset of active upwelling. Average abundance was 7.8/m³. During the weak upwelling season of 1971, *Ctenocalanus* occurred in all months from May through September in 16 of 40 samples with an average density of 2.8/m³. In 1972, it also occurred in a large number of samples (10 of 21 samples) and averaged 2.9/m³. Of the 38 summer occurrences, *Ctenocalanus* occurred at NH 1 in only four samples.

Metridia lucens

Metridia lucens was one of the small number of taxa that increased in abundance as distance offshore increased, at least to 10 miles offshore. The abundance gradient was evident during both summer and winter as shown by the table of average densities (no./m³) below:

Summer	NH 1	NH 3	NH 5	NH 10
1969	3.3	4.2	4.7	9.2
1970	3.4	4.3	2.6	5.9
1971	2.1	6.3	11.8	28.4
1972	0.0	9.9	9.9	29.6
Mean	2.9	6.2	7.3	18.3
Winter	NH 1	NH 3	NH 5	NH 10
1969-70	2.3	4.4	1.1	9.8
1970-71	1.3	1.0	4.1	36.5
1971-72	2.4	3.2	19.3	15.9
Mean	2.0	2.9	8.2	20.7

There was a similar gradient in frequency of occurrence. It occurred in only eight summer samples at NH 1, but in 21 at NH 3, in 24 at NH 5, and in 31 at NH 10. In the winter samples, the gradient was 6, 11, 11, and 12 at NH 1, NH 3, NH 5, NH 10 respectively.

Metridia lucens was much more abundant during 1971. This fact lends support to the hypothesis that water which usually lies farther offshore was advected onshore during this weak upwelling season. High average abundances in 1972 were a result of high numbers in April and June only; it was not

abundant over that summer as a whole.

Oithona spirostris

There were no large differences between summer and winter average abundances (no./m³) of *Oithona spirostris*, nor were there any obvious differences between stations. Abundances were highest during the 1971 upwelling season, like those of *Metridia lucens*.

Summer	NH 1	NH 3	NH 5	NH 10
1969	5.1	7.0	4.8	3.0
1970	3.8	4.8	4.4	3.0
1971	19.6	6.1	15.6	14.2
1972	1.4	4.2	2.8	5.2
Winter	NH 1	NH 3	NH 5	NH 10
1969-70	4.7	6.6	1.9	2.1
1970-71	0.4	0.0	2.4	4.3
1971-72	6.8	1.9	7.3	2.6

Frequency of occurrence was also similar to *Metridia lucens*. In all summer samples, *Oithona spirostris* occurred in only seven samples at NH 1, but in 22 from NH 3, in 25 from NH 5, and in 24 from NH 10.

These similarities in occurrence between *Metridia* and *Oithona* led us to look at joint occurrences of these two species. Using an index of affinity (Fager & McGowan, 1963), we found that the two are related and that the degree to which they occur together increases offshore. The data are shown below. Values of the index greater than .500 were taken to be indicative of significant association.

	NH 1	NH 3	NH 5	NH 10
Occurrences of <i>Metridia lucens</i>	8	20	19	26
Occurrences of <i>Oithona spirostris</i>	7	22	25	24
Frequency of Joint Occurrences	5	15	17	23
Index of Affinity	.479	.608	.680	.819

This result is expected since both are increasingly frequent and abundant at the offshore stations.

Clausocalanus arcuicornis

This copepod occurs most frequently and is most abundant during the winter. It first appeared in the nearshore zone in the month of December in all years of this study. In 1970 and 1972 it persisted until April. In 1969 it persisted until May. In 1971, the year of weak summer upwelling, it was found in May, June, August and September.

Clausocalanus pergens

The abundance pattern of *Clausocalanus pergens* was similar to that of *C. arcuicornis*. It was important only during the winter months, being advected to the Oregon coast by the Davidson Current. It did not appear in the plankton until December in 1969 and in 1970. It was taken through mid-May of 1970, 1971 and 1972. After the month of May, it either did not occur (1970) or else was found only at NH 10 (1971 and 1972). In 1969, *Clausocalanus pergens* was found nearshore in June and July. This observation appears to be exceptional.

Acartia tonsa

The distribution and abundance of *Acartia tonsa* were peculiar because its abundance declined and it disappeared from the study area during the three-year sampling period. Mean relative densities (no./m³) are tabulated below for summer and winter:

	NH 1	NH 3	NH 5	NH 10
Summer				
1969	44.8	36.0	41.0	8.9
1970	10.5	7.7	3.3	6.1
1971	0.0	0.0	0.0	0.0
1972	0.0	0.0	0.0	2.0
Winter				
69-70	38.4	46.6	22.7	14.2
70-71	2.7	2.1	1.6	2.1
71-72	2.7	1.0	3.0	0.7

Abundances were about constant between the summer of 1969 and the following winter, and between the summer of 1970 and the following winter. Abundances decreased between these two periods. No *Acartia tonsa* were taken during the summer of 1971 and none occurred after April 1972. We conclude that the decline is not clearly related to a seasonal cycle.

There are similarities between the distribution and abundance of *Acartia tonsa* and *Paracalanus parvus*. Of the five copepods listed by Fleminger (1967) as (1) coastal-neritic temperate-subtropical species

and (2) as occurring off the coasts of California and Baja California (*Acartia tonsa*, *Paracalanus parvus*, *Temora discaudata*, *Clausocalanus farrani* Type 1, and *Candacia curta*), only *Acartia tonsa* and *Paracalanus parvus* are found off Oregon. In our summer data, both of these copepods were abundant only in 1969 and 1970. During the winter, both species were abundant at all stations in 1969-70, and abundances were reduced during the other two winters.

Calanus tenuicornis

This copepod never made up more than 1 per cent of the catch in any summer sample. It only occurred in one sample in 1969, and four samples in 1970. By contrast, it was taken frequently during the 1971 upwelling season, occurring in 14 of 40 samples. The copepod *Ctenocalanus vanus* had the same pattern of greater occurrence in 1971. Abundance of *C. tenuicornis* was not great in winter either but it did make up more than 1 per cent of the catch in nine of 37 samples in which it occurred. The densities (no./m³) are shown below:

	NH 1	NH 3	NH 5	NH 10
69-70	0.6	8.5	4.5	1.5
70-71	1.2	0.8	1.2	4.7
71-72	2.3	3.7	5.2	3.1

Corycaeus anglicus

This cyclopoid copepod was abundant only during the winter of 1969-70. It appeared first in September, was most abundant in December and January, and disappeared by June in two years. It did not appear in any samples collected during the summer of 1971 or 1972, nor during the winter of 1971-72. Other copepods that occurred during the first two winters but not during the winter of 1971-72 were *Mecynocera clausii*, *Clausocalanus parapergens*, *Tortanus discaudatus*, *Oncaea tenella*, and *Corycaeus amazonicus*.

OTHER HOLOPLANKTONIC TAXA AND MEROPLANKTON

Euphausiid Developmental Stages

Euphausiid eggs and nauplii were counted in our samples, but we cannot be certain if they are those of *Euphausia pacifica* or *Thysanoessa spinifera*. The latter species is a coastal-neritic form (Brinton, 1963), and it is likely that most of the eggs and nauplii are of that species. Furcilia and juveniles in our samples were *Thysanoessa spinifera*. In samples collected on the extended transects of 1971 and 1972, *Euphausia pacifica* adults or juveniles did not occur

	1969	1970	1971	1972
EGGS	JULY	APRIL JUNE JULY AUGUST SEPTEMBER OCTOBER	MAY JUNE JULY AUGUST	APRIL MAY JUNE AUGUST
NAUPLII	JULY	APRIL JULY AUGUST SEPTEMBER OCTOBER	MAY SEPTEMBER	APRIL AUGUST
CALYPTOPIS	JULY	JULY SEPTEMBER OCTOBER	JUNE	APRIL
FURCILIA	JULY AUGUST SEPTEMBER	JULY SEPTEMBER	JUNE JULY NOVEMBER	MAY JUNE
JUVENILES + ADULTS	SEPTEMBER		JUNE JULY	JUNE

Table 11. The months of the year when euphausiid developmental stages were present in densities greater than $10/m^3$.

less than 15 miles from shore. The months in which eggs, nauplii, calyptopis, furcilia and juveniles were abundant are shown in Table 11. There are temporal patterns in the table, but they are different in different years. This makes the patterns hard to evaluate. Two spawning periods are seen in 1970, 1971 and 1972. These are in April-May and in July. Either *Thysanoessa spinifera* spawns twice yearly, or we are seeing the eggs and nauplii of *T. spinifera* at one time and *E. pacifica* at the other. We could find no published data on the spawning times of *T. spinifera*, but since it is a coastal-neritic species adapted to an upwelling environment, it is reasonable that it would spawn in the spring so that actively feeding furcilia and juveniles are present in July during the most active upwelling. Spring or late winter spawning is the rule for most crabs (Lough, 1974), for pink shrimp *Pandalus jordani* Rathbun (Rothlisberg, 1975), and for most fish (Sally Richardson, personal communication). *E. pacifica* is known to spawn off Oregon in July (Smiles and Percy, 1971). Even though adult *E. pacifica* are found only offshore of 15 miles, their eggs could be spawned at depth there and be carried into the nearshore zone by the shoreward-moving deep water. This hypothesis can be checked if nauplii and/or calyptopis can be identified. We did not try to do this.

The frequency of abundance estimates for *Thysanoessa spinifera* within various intervals, and the average abundance of each developmental stage are tabulated below.

This table is provided as a summary of the mean abundance and ranges of abundances because the data for each stage are listed in the appendix on separate pages and are not easily compared. These data can be compared to previous data on *Euphausia pacifica* off Oregon. Smiles and Percy (1971) found about 1 individual/m³ with maximum values of 27 and 14/m³. They sampled at stations from 15 to 65 miles from shore off Newport. Hebard (1966) found 2/m³ at NH 15 and 9/m³ at NH 25 with a maximum of 50/m³. Thus *T. spinifera* appears from our data to be about an order of magnitude more

abundant very close to shore than *E. pacifica* is in the adjacent zone to seaward.

Cladocerans

Evadne and *Podon* were both seen frequently, but they seldom occurred together. No taxonomic study was done on these animals, and it was assumed that the specific names in common use at OSU are correct: *Evadne nordmanni* and *Podon leukartii*.

Evadne were abundant in July and late August 1969, and June, July and September-October of 1970. They occurred in only two samples in 1971 in June and did not occur in 1972. *Podon* were abundant only in the autumn on 29 October 1969, September-October 1970 and November 1971.

Pelagic Mollusks

The pelagic mollusks are represented off Oregon by *Limacina helicina* (Type B, McGowan, 1963) and *Clione limacina*. *C. limacina* appeared in only three samples from the nearshore, on 29 May 1971 at NH 10 and 23 September 1971 at NH 5 and NH 10. They were found offshore on 12 June 1971 at NH 30, 35, 40 and 50, on 21 July 1971 at NH 40. *Limacina helicina* occurred in over half of our samples from the nearshore zone. It was one of several zooplankton species that was most abundant and occurred most frequently during the weak upwelling season of 1971 (Peterson and Miller, 1975).

Mean relative density (no./m³) and percentage frequency of occurrence of *L. helicina* are listed on the following page for summer and winter:

	ABUNDANCE INTERVALS - NO./m ³						MEAN DENSITY
	>1000	500-1000	100-500	50-100	10-50	<10	
Eggs	1	3	12	13	20	30	93.7
Nauplii		3	3	5	17	37	8.4
Calyptopis					7	55	4.1
Furcilia					10	57	5.4
Juveniles				2	8	14	15.4
Adults							

Summer	1969	1970	1971	1972
NH 1		7.1	26.5	40.0
NH 3	7.1	5.8	10.5	261.3
NH 5	2.1	8.3	5.8	139.8
NH 10	1.0	3.4	17.8	108.5
Frequency	33%	59%	88%	95%

Winter	1969-70	1970-71	1971-72
NH 1	30.1	32.3	3.0
NH 3	16.5	20.8	1.6
NH 5	10.5	31.9	4.9
NH 10	8.9	3.0	4.7

During the summers of 1969, 1970, and 1971 *L. helicina* occurred most frequently off-shore of NH 3. During the summer of 1972 they occurred frequently at all stations.

May and June were the months when *L. helicina* were most abundant during all four years of our study. In 1971, they were abundant in August as well. Phenomenally large numbers were found on 28 June 1972 at NH 3 and NH 5. Abundances were 185/m³ and 112/m³ respectively. On 30 May 1972 several samples were collected that qualitatively appeared to be almost entirely *Limacina helicina*, at a station ten miles off Cascade Head (latitude 45° 16' N). Large numbers were also encountered once outside the May-June period on 20 October 1970.

Chaetognaths

A number of species of chaetognaths occur off Oregon, but they were not differentiated in our counts. During the summer, *Sagitta elegans* predominates, but *Eukrohnia hamata* also occurs. During the winter months, both *Sagitta elegans* and *Sagitta euneritica* are important. Other species found close to shore off Oregon during the winter and offshore during the summer are *Sagitta scrippsii*, *S. bierii* and *S. minima*.

Chaetognaths occurred in 107 of 141 summer samples and 52 of 58 winter samples. They made up more than 1 per cent of the total catch in only 14 summer samples, but in nearly half (27 of 58) of the winter samples.

There was no relationship between chaetognath abundance and upwelling. Of the 34 samples with abundances greater than 10/m³ during the upwelling season, there were 17 from days of relaxed upwelling and 17 from days of active upwelling. Seven of the 34 samples were from NH 1, 17 from NH 3, 8 from NH 5 and only 2 from NH 10.

There is a suggestion in the data that chaetognaths were more abundant during the two summers of good upwelling, 1969 and 1970; than during 1971. The mean relative densities (no./m³) at the four stations are shown for summer and winter. There is very little difference between average summer and winter abundances.

SUMMER AVERAGED ABUNDANCE

	NH 1	NH 3	NH 5	NH 10
1969	43.5	25.6	15.3	5.0
1970	6.5	30.8	8.6	4.4
1971	8.3	13.3	7.5	1.7
1972	6.9	2.5	5.3	2.5

WINTER AVERAGED ABUNDANCE

	NH 1	NH 3	NH 5	NH 10
1969-70	17.3	15.8	20.5	9.3
1970-71	1.9	25.5	11.0	9.0
1971-72	7.1	5.6	7.1	2.6

Oikopleura

Oikopleura were more abundant during the fall, winter and spring months and were most abundant during the winter of 1969-70. Mean relative density (no./m³) at the four stations during the summer and winter sampling periods are shown below:

Summer	NH 1	NH 3	NH 5	NH 10
1969	18.1	35.1	12.5	3.5
1970	10.1	55.3	15.0	5.3
1971	18.7	18.0	14.2	15.6
1972	10.6	0.0	7.0	8.3
Winter	NH 1	NH 3	NH 5	NH 10
1969-70	199.7	226.8	85.8	39.6
1970-71	14.7	40.4	33.8	12.3
1971-72	26.7	21.1	15.9	11.9

Presence of *Oikopleura* in samples collected during the upwelling season was strongly correlated with surface salinity. *Oikopleura* occurred in 53 of 130 summer samples from 1969-1972. We have surface salinity data from 47 of the 53 samples. Presence and absence in the 47 samples were compared to surface salinities greater than and less than 33.0‰ and 33.5‰ with contingency tables (2 x 2). The tables and respective chi-square (χ^2) values are shown below. Both tables are highly significant, indicating an association between presence of *Oikopleura* and lowered surface salinity.

	PRESENT	ABSENT	PRESENT	ABSENT		
Surface Salinity	<33.0	38	20	<33.5	44	49
	>33.0	9	63	>33.5	3	34

$\chi^2 = 36.8$ $\chi^2 = 16.0$
 $p < 0.01$ $p < 0.01$

These data indicate that *Oikopleura* is an offshore form found only in waters of reduced salinity and suggest that it may be particularly abundant in the Columbia River plume. *Oikopleura* was seldom present in active upwelling areas (salinities >33.5 ‰).

Ctenophores

Ctenophores occurred infrequently during the 1969 and 1970 upwelling seasons. The average abundance was 2/m³ in seven samples in 1969 and 0.8/m³ in five samples in 1970. Ctenophores were never taken at NH 1 during 1969 and 1970. For the winter of 1969-70, mean abundance was 1.8/m³ in eight samples; for 1970-71, 1.6/m³ in eight samples, and for the winter of 1971-72, 2.6/m³ in nine samples. Greatest abundances occurred during the 1971 and 1972 upwelling seasons. Average abundance was 8.7/m³ in 19 samples from 1971 and 7.6/m³ in 11 samples from 1972. Ctenophores were abundant only during May and June. This agrees with observations made by Nielsen (1937) in the North Sea and off Iceland. Ctenophores were not taken in the autumn months, except during 1971. Hirota (1974), in work off La Jolla, California, found ctenophores to be most abundant in the autumn months.

Medusae

In some of our samples, medusae were quite numerous. The dates when they made up a large fraction of the total sample settled volume are listed in Table 12. We have no estimates of absolute abundance of large medusae because all medusae with diameters greater than about 2 cm were removed from the samples before subsampling. The conclusions that can be drawn from Table 12 are that medusae were never abundant in 1969, and were most frequently abundant in 1970. They were important only in June of 1971 and 1972.

Decapod Shrimp Mysis

These meroplankton appeared in 74 samples collected during the summer months. The frequency distribution of abundance is shown below:

FREQUENCY	ABUNDANCE INTERVALS (NO./M ³)					
	>40	30-40	20-30	10-20	1-10	<1
	10	1	3	14	35	11

The highest abundance was 620/m³. This category made up 1 per cent of the total catch in only 11 summer samples.

During the winter months, abundances are greatly reduced. Decapod mysis were seen in 28 samples but they made up less than 1 per cent of the total catch in all but two samples. The two estimates were 47/m³ on 16 February 1971 at NH 1 and 7/m³ on 30 March 1971 at NH 1.

Barnacle Nauplii

Barnacle nauplii appeared in 76 summer samples and 29 winter samples. Abundances were usually low. More than half of the abundance estimates were numbers less than 10 nauplii/m³. Frequency of abundances within seven abundance intervals are shown below:

	Summer	Winter
>1000/m ³	1	
>100	9	4
50-100	8	2
20-50	9	5
10-20	8	2
1-10	32	10
<1	9	6

The maximum abundance was 1105/m³ at NH 1 on 12 June 1971. Barnacle nauplii were virtually absent in all samples collected in December and January. They were seen on all but two summer dates at either NH 1 or NH 3 during the upwelling seasons 1970-72. Those dates were 23 August 1970 and 21 July 1971. By contrast, there were many dates during the 1969 upwelling season when nauplii were not taken at any station: 25 July, 6 August, 26 August, 30 August, 14 September, and 28 September 1969.

There is a suggestion in the data that highest abundance occurs during relaxed upwelling. In 1969 northerly winds blew nearly continuously from 29 June to 16 August, were calm for six days, then blew steadily from the north until mid-September. Barnacle nauplii were not found in any samples during

DATE	STATION (NH)
23 JUNE 1970	5, 10
16 JULY	10
13 AUGUST	1, 3
9 OCTOBER	3
20 OCTOBER	10
4 NOVEMBER	3, 5, 10
12 JUNE 1971	5
28 JUNE	3
6 JULY	1, 3
28 JUNE 1972	5

Table 12. Dates when medusae comprised at least 100 ml of the sample settled volume.

this extended event. In 1970 both dates having zero barnacle nauplii were at the end of extended upwelling events. High numbers on 25 February 1970, 25 September and 20 October 1970, and the three 1971 dates were associated with calm or southerly winds. Of the other five dates, 4 June, 2 July and 11 September 1970 were preceded by about a week of calm or southerly winds. Nearshore waters could have easily been warmed during these intervals. High abundances on 16 July 1970 and 5 August 1972 were not in agreement with this hypothesis. Both were during active upwelling and were preceded by many days of active upwelling.

Bivalve Veligers

No attempt was made to differentiate this taxon into species. It represents the larvae of both clams and mussels. They were found in 107 of 138 summer samples and 54 of 58 winter samples. Peak numbers were seen once in the summer and once in the autumn. No dramatic peaks were seen during the winter. More than half of the abundance estimates were numbers less than 10/m³. The frequency distribution of abundances is shown below:

	Summer	Winter
>100/m ³	8	3
40-100	10	2
30-40	7	3
20-30	7	2
10-20	8	7
1-10	51	28
<1	14	9

The highest summer abundance was 769/m³ on 11 September 1970 at NH 3, and the highest winter abundance was 211/m³ on 6 November 1971 at NH 1. Bivalve veligers had high ranks of abundance in five samples. They were rank 4 on 30 August 1969 and 11 September 1970 at NH 1, rank 3 on 11 September 1970 at NH 3, and 23 September 1971 at NH 1, and rank 1 on 11 October 1971.

Gastropod Veligers

This is another broad category. It represents a large number of gastropod mollusk species which occurred in 88 summer samples and nearly all winter samples (52 of 58). Abundances were greater than 60/m³ on only two dates: 25 September 1970 (227/m³) and 2 July 1970 (173/m³). Usually abundances were less than 10/m³. The frequency distribution of abundances is shown below:

	Summer	Winter
>100/m ³	2	
60-100	0	
30-60	8	3
10-30	10	7
1-10	53	33
<1	15	9

There is little evidence of pattern in the abundance data. This is no doubt a result of lumping the veligers of a large number of gastropod species into this category. Highest abundances in 1969 were seen in July and September; in 1970 in February, June and September; in 1971 in May, June, October and November, and in 1972 in August.

Echinoderm Larvae

Given the great abundance of echinoderms along the Oregon coast (sea urchins, starfish, sea cucumbers, crinoids and brittle stars), we were surprised that their larvae seldom appeared in our plankton samples. Auricularia occurred in three summer samples and no winter samples. Bipinnaria occurred in two winter samples but no summer samples. Plutei occurred in 11 of 58 winter samples and 16 of 117 summer samples. They were most abundant during 1971 on 12 June and 19 August. Their rare occurrence indicates that either the pelagic larvae spend little time in the plankton, or the larvae are not dispersed more than one mile from the shore.

bibliography

- Bakun, A. 1973. Coastal upwelling indices west coast of North America, 1946-71. U.S. Dept. Commer., NOAA Tech. Rep. NMFS SSRF-671, 103p.
- Bourke, R.H. 1972. A study of the seasonal variation in temperature and salinity along the Oregon-Northern California coast. Ph.D. Thesis, Oregon State Univ., Corvallis, 107p.
- Brinton, E. 1962. Variable factors affecting the apparent range and estimated concentration of euphausiids in the North Pacific. *Pac. Sci.* 16:374-408.
- Burt, W.V., and B. Wyatt. 1964. Drift bottle observations of the Davidson Current off Oregon. In K. Yoshida (editor), *Studies on Oceanography*, p. 156-165. Univ. Tokyo Press, Tokyo.
- Cameron, F.E. 1957. Some factors influencing the distribution of pelagic copepods in the Queen Charlotte Islands area. *J. Fish. Res. Board Can.* 14: 165-202.
- Collins, C.A., C.N.K. Mooers, M.R. Stevenson, R.C. Smith, and J.G. Pattullo. 1968. Direct current measurements in the frontal zone of a coastal upwelling region. *J. Oceanogr. Soc. Japan* 24:295-306.
- Cross, F.A. 1964. Seasonal and geographical distribution of pelagic copepods in Oregon coastal waters. M.S. Thesis, Oregon State Univ., Corvallis, 73p.
- Fager, E.W., and J.A. McGowan. 1963. Zooplankton species groups in the North Pacific. *Science* 140:453-460.
- Fleminger, A. 1964. Distributional atlas of calanoid copepods in the California Current region, Pt. I. Calif. Coop. Ocean. Fish. Invest., Atlas no. 7, 213p.

- Frost, B. and A. Fleminger. 1968. A revision of the genus *Clausocalanus* (Copepoda: Calanoida) with remarks on distributional patterns in diagnostic characters. Bull. Scripps Inst. Oceanogr. 12:1-235.
- Hebard, J.F. 1966. Distribution of Euphausiacea and Copepoda off Oregon in relation to oceanographic conditions. Ph.D. Thesis, Oregon State Univ., Corvallis, 85p.
- Heinle, D.R. 1970. Population dynamics of calanoid copepods. Helgolander wiss. Meeresunters 20:360-372.
- Hirota, J. 1974. Quantitative natural history of *Pleurobraachia bachei* in La Jolla Bight. Fish. Bull. U.S. 72:295-335.
- Holton, R.L. and W.P. Elliott. 1973. The development of methods for studying physical and biological processes in the near-shore zone on the Pacific coast of the United States. Progress Report. School of Oceanography, Oregon State Univ., Corvallis, Ref 73-3, 18 num pages and appendices.
- Huyer, A. 1974. Observations of the coastal upwelling region off Oregon during 1972. Ph.D. Thesis, Oregon State Univ., Corvallis, 149p.
- Johnson, J.K. 1974. The dynamics of an isolated population of *Acartia tonsa* Dana (copepoda) in Yaquina Bay, Oregon. M.S. Thesis, Oregon State Univ., Corvallis, 97p.
- Laurs, R.M. 1967. Coastal upwelling and the ecology of lower trophic levels. Ph.D. Thesis, Oregon State Univ., Corvallis, 212p.
- Lee, W. 1971. The copepods in a collection from the southern Oregon coast, 1963. M.S. Thesis, Oregon State Univ., Corvallis, 62p.
- Lough, R.G. 1974. Dynamics of crab larvae (Anomura, Brachyura) off the central Oregon coast, 1969-1971. Ph.D. Thesis, Oregon State Univ., Corvallis, 299p.
- Marshall, S.M. and A.P. Orr. 1955. The biology of a marine copepod *Calanus finmarchicus* (Gunnerus). Oliver and Boyd, Edinburgh, vii and 188p.
- McGowan, J.A. 1963. Geographical variation in *Limacina helicina* in the north Pacific. Speciation in the Sea. Systematics Assn. Pub. No. 5, Brit. Mus. Natl. Hist., London, 109-128.
- Miller, C.B. and W.T. Peterson. 1974. Year-to-year variations in coastal zooplankton community structure in the upwelling zone off Oregon. Invited paper, AAAS meeting, 1 March 1974, San Francisco, California.
- Myers, A.H. 1975. Vertical distribution of zooplankton in the Oregon coastal zone during an upwelling event. M.S. Thesis, Oregon State Univ., Corvallis, 60p.
- Nielsen, E. Steeman. 1937. On the relation between the quantities of phytoplankton and zooplankton in the sea. J. Cons. int. Explor. Mer. 12:147-155.
- Olsen, J.B. 1949. The pelagic cyclopoid copepods of the coastal waters of Oregon, California and lower California. Ph.D. Thesis, University of California, Los Angeles, 208p. and XLI Plates.
- Pattullo, J. and W. Denner. 1965. Processes affecting seawater characteristics along the Oregon coast. Limnol. Oceanogr. 10:443-450.
- Peterson, W.K. and G.C. Anderson. 1966. Net zooplankton data from the Northeast Pacific Ocean: Columbia River effluent area, 1961, 1962. Univ. Wash. Tech. Rep. 160, 225p.
- Peterson, W.K. 1972. Distribution of pelagic Copepoda off the coasts of Washington and Oregon during 1961 and 1962. In A.T. Pruter and D.L. Alverson (editors), The Columbia River Estuary and adjacent ocean waters, p. 313-343. Univ. Wash. Press, Seattle.
- Peterson, W.T. and C.B. Miller. 1975. Year-to-year variations in the planktology of the Oregon upwelling zone. Fish. Bull. U.S. 73:642-653.
- Pillsbury, R.D. 1972. A description of hydrography, winds, and currents during the upwelling season near Newport, Oregon. Ph.D. Thesis, Oregon State Univ., Corvallis, 163p.
- Rothlisberg, P.C. 1975. Larval ecology of *Pandalus jordani* Rathbun. Ph.D. Thesis, Oregon State Univ., Corvallis, 117p.

- Smiles, M.C. and W.G. Pearcy. 1971. Size structure and growth rate of *Euphausia pacifica* off the Oregon coast. Fish. Bull. U.S. 69:79-86.
- Smith, R.L. 1974. A description of current, wind, and sea level variations during coastal upwelling off the Oregon coast, July-August 1972. J. Geophys. Res. 79:435-443.
- Wilson, D.R. and K.K. Parish. 1971. Remating in a planktonic marine calanoid copepod. Marine Biology 9:202-204.

part III: appendices

DATE	NH 1	NH 3	NH 5	NH 10
22 June 1969	X	X	X	X
29 " "		X		X
10 July "	X		X	
18 " "	X	X	X	X
25 " "	X	X	X	X
30 " "				0
6 Aug "	X	X	X	
26 " "	X	X	X	X
30 " "	X	X	X	X
3 Sept "	X	X	X	X
14 " "		X	X	
28 " "		X	X	
8 Oct "		X	X	
23 " "	0	0	0	0
29 " "	X	X	X	X
11 Nov "	0	0	0	0
18 " "	R	R	0	0
2 Dec "	X	X	X	X-R
9 " "	0	0	0	
29 " "	X	X	X	X-R
13 Jan 1970	0			
29 " "	X	X	X	X
13 Feb "	0	0	0	R
25 " "	X	X	X	X
9 Mar "	0	0	0	0
16 Apr "		0		
27 " "	X	X	X	X
1 May "	0	0	R	0
6 " "	X	X-R		X
22 " "	X-R	X	X	X
4 June "	X	X	X	
23 " "	X	X	X	X
2 July "	X	X	X	X
16 " "	X	X	X	X
29 " "	0	X	X	X
13 Aug "	X		X	X
27 " "	X	X	X	X
11 Sept "	X	X	X	X
25 " "	X-R	X	X	X
9 Oct "	0	0	0	0
20 " "	X	X	X	X
4 Nov "	0	0	0	0
4 Dec "	X	X	X	X
21 Dec "	0	0	0	0
6 Jan 1971	X	X	X	X
18 " "	0	0	0	0

APPENDIX I. A list of sampling dates and samples collected

X = Sample counted
 0 = Sample collected but not counted
 R = Replicate samples collected but neither counted
 X-R = Replicate samples collected but only one counted

DATE	NH 1	NH 3	NH 5	NH 10	NH 15	NH 20	NH 25	NH 30	NH 35	NH 40	NH 50	NH 60
3 Feb 1971	0	0	0	0		0		R				
16 "	X	X	X	X		X		X		X	X	X
20 Mar	0	0	0	0	0	0		0	0	0	0	0
30 "	X	X	X	X	0	0		0		0	0	0
22 Apr			0	0	0	0	0	0	0	0	0	0
3 May	X	X	X	X	0	0	0	0	0	0	0	0
14 May	X	X	X	X	X	X	0	0	0	0	0	0
29 May	X	X	X	X								
1 June	0	X	X	X	0	0	0	0	0	0	0	0
12 "	X-R	X-R	X-R	X-R	X	X	X	X	X	X	X	X
28 "	X-R	X-R	X-R									
N28 "	R	R	R	R								
29 "												
N29 "												
6 July	X-X	X-R	X-R	X-R								
21 "	X-R	X-R	X-R	X-R	X	X	X	0	0	X	X	0
22 "												
2 Aug	X-R	X-R	X-R	X-R	X	X-R	X-R	X-R	X	X	X	X
N 2 "	R	R	R					R	R	R	R	0
19 "	X-R	X-R	X-R	X-R	X	X	0	0	0	0	0	0
N19 "	0	0	0	0								
23 Sept	X	X	X	X	X	X	0	0	0	0	0	0
11 Oct	X	X	X	X	0	0	0	0	0	0	0	0
6 Nov	X	X	X	X	0	0	0	0	0	0	0	0
7 Dec	X	X	X	X	0	0	0	0	0	0	0	0
3 Mar 1972	0	0	0	0	0	0	0	0	0	0	0	0
15 "	X	X	X	X	0	0	0	0	0	0	0	0
29 "	0	0	0	0	0	0	0	0	0	0	0	0
11 Apr	R	R	R	R	0	R	0	0	0	0	0	0
20 "	X	X	X	X	0	0	0	0	0	0	0	0
22 May	X-R	X-R	X	X	0	0	0	0	0	0	0	0
11 June	X	X	X	X	X-R	X-R	R	0	0	0	0	0
28 "	X	X	X	X	X-R	X-R	R	R	R	R	R	R
N28 "					R	R	R	R	R	R	R	R
21 July	X-R	X-R	X-R	X-R	X	0	0	0	0	0	0	0
22 "	0	0	0	0								
5 Aug	X-R	X-R	X-R	X-R	X	0	0	0	0	0	0	0

APPENDIX I (CONTINUED). A list of sampling dates and samples collected. N = Night samples

NUMBER PER QUIC METER OF A. LONGIREMIS AT EARLY LIFE HISTORY STATIONS

DATE	NH01			NH03			NH05			NH10			IMPS
	MALES	FEMALES	IMPS	MALES	FEMALES	IMPS	MALES	FEMALES	IMPS	MALES	FEMALES	IMPS	
06/22/69	48	48	6	25	0	0	4	2	0	4	3	1	12
07/10/69	16	14	2	26	0	0	2	1	0	3	4	0	71
07/18/69	19	21	5	41	0	0	6	0	0	8	0	0	35
08/06/69	22	24	7	51	0	0	0	0	0	0	0	0	9
08/16/69	25	23	9	16	0	0	4	0	0	0	0	0	0
08/30/69	21	7	4	16	0	0	1	0	0	6	0	0	0
09/03/69	0	0	0	20	0	0	8	0	0	2	0	0	0
09/14/69	0	0	0	35	0	0	6	0	0	0	0	0	0
09/28/69	0	0	0	27	0	0	4	0	0	0	0	0	0
10/08/69	4	14	8	67	0	0	0	0	0	0	0	0	0
10/29/69	1	2	2	6	0	0	0	0	0	0	0	0	0
12/29/70	0	0	0	12	0	0	0	0	0	0	0	0	0
01/22/71	0	0	0	0	0	0	0	0	0	0	0	0	0
02/25/71	0	0	0	0	0	0	0	0	0	0	0	0	0
05/06/71	2	1	1	0	0	0	0	0	0	0	0	0	0
05/22/71	0	0	0	0	0	0	0	0	0	0	0	0	0
06/04/71	12	5	17	114	0	0	3	0	0	0	0	0	0
06/23/71	21	11	33	159	0	0	0	0	0	0	0	0	0
07/02/71	28	17	45	202	0	0	0	0	0	0	0	0	0
07/16/71	4	0	0	30	0	0	0	0	0	0	0	0	0
07/31/71	0	0	0	0	0	0	0	0	0	0	0	0	0
08/13/71	5	3	0	0	0	0	0	0	0	0	0	0	0
08/29/71	12	8	21	227	0	0	0	0	0	0	0	0	0
09/11/71	13	13	32	192	0	0	0	0	0	0	0	0	0
09/25/71	10	2	0	127	0	0	0	0	0	0	0	0	0
10/07/71	18	2	0	246	0	0	0	0	0	0	0	0	0
10/20/71	0	0	0	0	0	0	0	0	0	0	0	0	0
11/03/71	0	0	0	0	0	0	0	0	0	0	0	0	0
11/16/71	0	0	0	0	0	0	0	0	0	0	0	0	0
12/03/71	15	27	37	5	0	0	0	0	0	0	0	0	0
01/14/71	0	0	0	0	0	0	0	0	0	0	0	0	0
02/29/71	0	0	0	0	0	0	0	0	0	0	0	0	0
03/12/71	25	11	6	54	0	0	0	0	0	0	0	0	0
03/28/71	22	16	7	82	0	0	0	0	0	0	0	0	0
04/06/71	11	18	2	31	0	0	0	0	0	0	0	0	0
04/19/71	9	3	2	22	0	0	0	0	0	0	0	0	0
05/02/71	1	0	0	0	0	0	0	0	0	0	0	0	0
05/15/71	0	0	0	0	0	0	0	0	0	0	0	0	0
05/29/71	0	0	0	0	0	0	0	0	0	0	0	0	0
06/11/71	0	0	0	0	0	0	0	0	0	0	0	0	0
06/25/71	0	0	0	0	0	0	0	0	0	0	0	0	0
07/08/71	0	0	0	0	0	0	0	0	0	0	0	0	0
07/22/71	0	0	0	0	0	0	0	0	0	0	0	0	0
08/05/71	0	0	0	0	0	0	0	0	0	0	0	0	0
08/19/71	0	0	0	0	0	0	0	0	0	0	0	0	0
09/02/71	0	0	0	0	0	0	0	0	0	0	0	0	0
09/16/71	0	0	0	0	0	0	0	0	0	0	0	0	0
10/01/71	0	0	0	0	0	0	0	0	0	0	0	0	0
10/15/71	0	0	0	0	0	0	0	0	0	0	0	0	0
10/29/71	0	0	0	0	0	0	0	0	0	0	0	0	0
11/12/71	0	0	0	0	0	0	0	0	0	0	0	0	0
11/26/71	0	0	0	0	0	0	0	0	0	0	0	0	0
12/09/71	0	0	0	0	0	0	0	0	0	0	0	0	0
12/23/71	0	0	0	0	0	0	0	0	0	0	0	0	0
01/06/72	0	0	0	0	0	0	0	0	0	0	0	0	0
01/20/72	0	0	0	0	0	0	0	0	0	0	0	0	0
02/03/72	0	0	0	0	0	0	0	0	0	0	0	0	0
02/17/72	0	0	0	0	0	0	0	0	0	0	0	0	0
03/03/72	0	0	0	0	0	0	0	0	0	0	0	0	0
03/17/72	0	0	0	0	0	0	0	0	0	0	0	0	0
04/01/72	0	0	0	0	0	0	0	0	0	0	0	0	0
04/15/72	0	0	0	0	0	0	0	0	0	0	0	0	0
05/01/72	0	0	0	0	0	0	0	0	0	0	0	0	0
05/15/72	0	0	0	0	0	0	0	0	0	0	0	0	0
06/01/72	0	0	0	0	0	0	0	0	0	0	0	0	0
06/15/72	0	0	0	0	0	0	0	0	0	0	0	0	0
07/01/72	0	0	0	0	0	0	0	0	0	0	0	0	0
07/15/72	0	0	0	0	0	0	0	0	0	0	0	0	0
08/01/72	0	0	0	0	0	0	0	0	0	0	0	0	0
08/15/72	0	0	0	0	0	0	0	0	0	0	0	0	0
09/01/72	0	0	0	0	0	0	0	0	0	0	0	0	0
09/15/72	0	0	0	0	0	0	0	0	0	0	0	0	0
10/01/72	0	0	0	0	0	0	0	0	0	0	0	0	0
10/15/72	0	0	0	0	0	0	0	0	0	0	0	0	0
11/01/72	0	0	0	0	0	0	0	0	0	0	0	0	0
11/15/72	0	0	0	0	0	0	0	0	0	0	0	0	0
12/01/72	0	0	0	0	0	0	0	0	0	0	0	0	0
12/15/72	0	0	0	0	0	0	0	0	0	0	0	0	0

NUMBER PER CUBIC METER OF GALANUS SP. AT EARLY LIFE HISTORY STATIONS

DATE	NH01	NH03	NH05	NH10
	MALES FEMALES	MALES FEMALES	MALES FEMALES	MALES FEMALES
06/22/69	0	0	0	0
06/29/69	0	10.8	0	0
07/10/69	0	8.0	0	0
07/18/69	5.9	0	0	0
07/25/69	0	8.2	0	0
08/06/69	0	0	0	0
08/26/69	0	0	0	0
09/03/69	1.3	10.1	0	0
09/14/69	0	2.0	0	0
09/20/69	0	0	0	0
10/07/69	0	0	0	0
12/29/70	0	4.0	0	0
01/22/71	0	0	0	0
02/25/71	0	0	0	0
03/04/71	0	0	0	0
03/22/71	0	0	0	0
05/02/71	0	0	0	0
05/22/71	0	0	0	0
07/04/71	0	0	0	0
07/20/71	0	0	0	0
07/31/71	0	0	0	0
08/11/71	0	0	0	0
08/23/71	0	0	0	0
09/13/71	0	0	0	0
09/21/71	0	0	0	0
10/04/71	0	0	0	0
12/06/71	0	0	0	0
02/13/72	0	0	0	0
03/30/72	0	0	0	0
05/04/72	0	0	0	0
05/19/72	0	0	0	0
06/02/72	0	0	0	0
06/12/72	0	0	0	0
07/09/72	0	0	0	0
08/01/72	0	0	0	0
08/11/72	0	0	0	0
09/01/72	0	0	0	0
11/20/72	0	0	0	0
01/13/73	0	0	0	0
04/22/73	0	0	0	0
05/21/73	0	0	0	0
06/21/73	0	0	0	0
07/21/73	0	0	0	0
08/21/73	0	0	0	0
09/21/73	0	0	0	0
10/21/73	0	0	0	0
11/21/73	0	0	0	0
12/21/73	0	0	0	0
01/21/74	0	0	0	0
02/21/74	0	0	0	0
03/21/74	0	0	0	0
04/21/74	0	0	0	0
05/21/74	0	0	0	0
06/21/74	0	0	0	0
07/21/74	0	0	0	0
08/21/74	0	0	0	0
09/21/74	0	0	0	0
10/21/74	0	0	0	0
11/21/74	0	0	0	0
12/21/74	0	0	0	0
01/21/75	0	0	0	0
02/21/75	0	0	0	0
03/21/75	0	0	0	0
04/21/75	0	0	0	0
05/21/75	0	0	0	0
06/21/75	0	0	0	0
07/21/75	0	0	0	0
08/21/75	0	0	0	0
09/21/75	0	0	0	0
10/21/75	0	0	0	0
11/21/75	0	0	0	0
12/21/75	0	0	0	0
01/21/76	0	0	0	0
02/21/76	0	0	0	0
03/21/76	0	0	0	0
04/21/76	0	0	0	0
05/21/76	0	0	0	0
06/21/76	0	0	0	0
07/21/76	0	0	0	0
08/21/76	0	0	0	0
09/21/76	0	0	0	0
10/21/76	0	0	0	0
11/21/76	0	0	0	0
12/21/76	0	0	0	0
01/21/77	0	0	0	0
02/21/77	0	0	0	0
03/21/77	0	0	0	0
04/21/77	0	0	0	0
05/21/77	0	0	0	0
06/21/77	0	0	0	0
07/21/77	0	0	0	0
08/21/77	0	0	0	0
09/21/77	0	0	0	0
10/21/77	0	0	0	0
11/21/77	0	0	0	0
12/21/77	0	0	0	0
01/21/78	0	0	0	0
02/21/78	0	0	0	0
03/21/78	0	0	0	0
04/21/78	0	0	0	0
05/21/78	0	0	0	0
06/21/78	0	0	0	0
07/21/78	0	0	0	0
08/21/78	0	0	0	0
09/21/78	0	0	0	0
10/21/78	0	0	0	0
11/21/78	0	0	0	0
12/21/78	0	0	0	0
01/21/79	0	0	0	0
02/21/79	0	0	0	0
03/21/79	0	0	0	0
04/21/79	0	0	0	0
05/21/79	0	0	0	0
06/21/79	0	0	0	0
07/21/79	0	0	0	0
08/21/79	0	0	0	0
09/21/79	0	0	0	0
10/21/79	0	0	0	0
11/21/79	0	0	0	0
12/21/79	0	0	0	0
01/21/80	0	0	0	0
02/21/80	0	0	0	0
03/21/80	0	0	0	0
04/21/80	0	0	0	0
05/21/80	0	0	0	0
06/21/80	0	0	0	0
07/21/80	0	0	0	0
08/21/80	0	0	0	0
09/21/80	0	0	0	0
10/21/80	0	0	0	0
11/21/80	0	0	0	0
12/21/80	0	0	0	0
01/21/81	0	0	0	0
02/21/81	0	0	0	0
03/21/81	0	0	0	0
04/21/81	0	0	0	0
05/21/81	0	0	0	0
06/21/81	0	0	0	0
07/21/81	0	0	0	0
08/21/81	0	0	0	0
09/21/81	0	0	0	0
10/21/81	0	0	0	0
11/21/81	0	0	0	0
12/21/81	0	0	0	0
01/21/82	0	0	0	0
02/21/82	0	0	0	0
03/21/82	0	0	0	0
04/21/82	0	0	0	0
05/21/82	0	0	0	0
06/21/82	0	0	0	0
07/21/82	0	0	0	0
08/21/82	0	0	0	0
09/21/82	0	0	0	0
10/21/82	0	0	0	0
11/21/82	0	0	0	0
12/21/82	0	0	0	0
01/21/83	0	0	0	0
02/21/83	0	0	0	0
03/21/83	0	0	0	0
04/21/83	0	0	0	0
05/21/83	0	0	0	0
06/21/83	0	0	0	0
07/21/83	0	0	0	0
08/21/83	0	0	0	0
09/21/83	0	0	0	0
10/21/83	0	0	0	0
11/21/83	0	0	0	0
12/21/83	0	0	0	0
01/21/84	0	0	0	0
02/21/84	0	0	0	0
03/21/84	0	0	0	0
04/21/84	0	0	0	0
05/21/84	0	0	0	0
06/21/84	0	0	0	0
07/21/84	0	0	0	0
08/21/84	0	0	0	0
09/21/84	0	0	0	0
10/21/84	0	0	0	0
11/21/84	0	0	0	0
12/21/84	0	0	0	0
01/21/85	0	0	0	0
02/21/85	0	0	0	0
03/21/85	0	0	0	0
04/21/85	0	0	0	0
05/21/85	0	0	0	0
06/21/85	0	0	0	0
07/21/85	0	0	0	0
08/21/85	0	0	0	0
09/21/85	0	0	0	0
10/21/85	0	0	0	0
11/21/85	0	0	0	0
12/21/85	0	0	0	0
01/21/86	0	0	0	0
02/21/86	0	0	0	0
03/21/86	0	0	0	0
04/21/86	0	0	0	0
05/21/86	0	0	0	0
06/21/86	0	0	0	0
07/21/86	0	0	0	0
08/21/86	0	0	0	0
09/21/86	0	0	0	0
10/21/86	0	0	0	0
11/21/86	0	0	0	0
12/21/86	0	0	0	0
01/21/87	0	0	0	0
02/21/87	0	0	0	0
03/21/87	0	0	0	0
04/21/87	0	0	0	0
05/21/87	0	0	0	0
06/21/87	0	0	0	0
07/21/87	0	0	0	0
08/21/87	0	0	0	0
09/21/87	0	0	0	0
10/21/87	0	0	0	0
11/21/87	0	0	0	0
12/21/87	0	0	0	0
01/21/88	0	0	0	0
02/21/88	0	0	0	0
03/21/88	0	0	0	0
04/21/88	0	0	0	0
05/21/88	0	0	0	0
06/21/88	0	0	0	0
07/21/88	0	0	0	0
08/21/88	0	0	0	0
09/21/88	0	0	0	0
10/21/88	0	0	0	0
11/21/88	0	0	0	0
12/21/88	0	0	0	0
01/21/89	0	0	0	0
02/21/89	0	0	0	0
03/21/89	0	0	0	0
04/21/89	0	0	0	0
05/21/89	0	0	0	0
06/21/89	0	0	0	0
07/21/89	0	0	0	0
08/21/89	0	0	0	0
09/21/89	0	0	0	0
10/21/89	0	0	0	0
11/21/89	0	0	0	0
12/21/89	0	0	0	0
01/21/90	0	0	0	0
02/21/90	0	0	0	0
03/21/90	0	0	0	0
04/21/90	0	0	0	0
05/21/90	0	0	0	0
06/21/90	0	0	0	0
07/21/90	0	0	0	0
08/21/90	0	0	0	0
09/21/90	0	0	0	0
10/21/90	0	0	0	0
11/21/90	0	0	0	0
12/21/90	0	0	0	0
01/21/91	0	0	0	0
02/21/91	0	0	0	0
03/21/91	0	0	0	0
04/21/91	0	0	0	0
05/21/91	0	0	0	0
06/21/91	0	0	0	0
07/21/91	0	0	0	0
08/21/91	0	0	0	0
09/21/91	0	0	0	0
10/21/91	0	0	0	0
11/21/91	0	0	0	0
12/21/91	0	0	0	0
01/21/92	0	0	0	0
02/21/92	0	0	0	0
03/21/92	0	0	0	0
04/21/92	0	0	0	0
05/21/92	0	0	0	0
06/21/92	0	0	0	0
07/21/92	0	0	0	0
08/21/92	0	0	0	0
09/21/92	0	0	0	0
10/21/92	0	0	0	0
11/21/92	0	0	0	0
12/21/92	0	0	0	0
01/21/93	0	0	0	0
02/21/93	0	0	0	0
03/21/93	0	0	0	0
04/21/93	0	0	0	0
05/21/93	0	0	0	0
06/21/93	0	0	0	0
07/21/93	0	0	0	0
08/21/93	0	0	0	0
09/21/93	0	0	0	0
10/21/93	0	0	0	0
11/21/93	0	0	0	0
12/21/93	0	0	0	0
01/21/94	0	0	0	0
02/21/94	0</			

NUMBER PER CUBIC METER OF CALANUS NAUPLII AT EARLY LIFE HISTORY STATIONS

DATE	NH01	NH02	NH03	NH04	NH05	NH10
	MALES FEMALE	IMPS	MALES FEMALE	IMPS	MALES FEMALE	IMPS
06/22/69	0	0	6.0	0	8.5	0
06/29/69	43.1	0	65.1	0	5.0	14.0
07/10/69	58.0	0	6.0	0	3.0	8.0
07/18/69	0	0	27.0	0	15.0	0
08/05/69	0	0	112.0	0	3.0	0
08/26/69	0	0	3.0	0	1.0	0
09/03/69	1.0	0	3.0	0	8.5	0
09/14/69	0	0	81.0	0	2.0	0
09/28/69	68.0	0	119.0	0	16.0	44.0
10/29/69	0	0	0	0	0	0
12/29/69	0	0	0	0	0	0
01/22/70	0	0	0	0	0	0
02/22/70	184.0	0	237.0	0	31.0	37.0
03/06/70	241.0	0	195.0	0	66.0	57.0
03/22/70	9.0	0	88.0	0	18.0	2.0
06/04/70	0	0	19.0	0	15.0	0
06/23/70	366.0	0	222.0	0	14.0	86.0
07/16/70	708.0	0	585.0	0	24.0	163.0
07/29/70	7.0	0	20.0	0	14.0	7.0
08/13/70	33.0	0	35.0	0	44.0	11.0
08/23/70	216.0	0	172.0	0	2.0	14.0
09/11/70	0	0	1.0	0	2.0	10.0
09/20/70	0	0	0	0	0	0
10/20/70	19.0	0	49.0	0	1.0	1.0
11/06/70	17.0	0	15.0	0	1.0	1.0
02/10/71	16.0	0	21.0	0	3.0	2.0
03/03/71	6.0	0	7.0	0	2.0	2.0
05/19/71	140.0	0	35.0	0	10.0	10.0
06/22/71	0	0	0	0	0	0
06/28/71	15.0	0	16.0	0	0	0
07/06/71	1.0	0	12.0	0	0	0
07/21/71	1.0	0	1.0	0	0	0
08/19/71	1.0	0	1.0	0	0	0
09/23/71	1.0	0	1.0	0	0	0
10/16/71	3.0	0	1.0	0	0	0
11/07/71	3.0	0	1.0	0	0	0
01/15/72	4.0	0	5.0	0	0	0
04/22/72	0	0	0	0	0	0
05/11/72	0	0	0	0	0	0
06/21/72	0	0	0	0	0	0
07/21/72	15.0	0	4.0	0	0	0
08/05/72	15.0	0	4.0	0	0	0
08/18/72	0	0	0	0	0	0
09/08/72	0	0	0	0	0	0
10/21/72	0	0	0	0	0	0
11/07/72	0	0	0	0	0	0
01/15/73	0	0	0	0	0	0
04/22/73	0	0	0	0	0	0
05/11/73	0	0	0	0	0	0
06/21/73	0	0	0	0	0	0
07/21/73	0	0	0	0	0	0
08/05/73	0	0	0	0	0	0
08/18/73	0	0	0	0	0	0
09/08/73	0	0	0	0	0	0
10/21/73	0	0	0	0	0	0
11/07/73	0	0	0	0	0	0
01/15/74	0	0	0	0	0	0
04/22/74	0	0	0	0	0	0
05/11/74	0	0	0	0	0	0
06/21/74	0	0	0	0	0	0
07/21/74	0	0	0	0	0	0
08/05/74	0	0	0	0	0	0
08/18/74	0	0	0	0	0	0
09/08/74	0	0	0	0	0	0
10/21/74	0	0	0	0	0	0
11/07/74	0	0	0	0	0	0
01/15/75	0	0	0	0	0	0
04/22/75	0	0	0	0	0	0
05/11/75	0	0	0	0	0	0
06/21/75	0	0	0	0	0	0
07/21/75	0	0	0	0	0	0
08/05/75	0	0	0	0	0	0
08/18/75	0	0	0	0	0	0
09/08/75	0	0	0	0	0	0
10/21/75	0	0	0	0	0	0
11/07/75	0	0	0	0	0	0
01/15/76	0	0	0	0	0	0
04/22/76	0	0	0	0	0	0
05/11/76	0	0	0	0	0	0
06/21/76	0	0	0	0	0	0
07/21/76	0	0	0	0	0	0
08/05/76	0	0	0	0	0	0
08/18/76	0	0	0	0	0	0
09/08/76	0	0	0	0	0	0
10/21/76	0	0	0	0	0	0
11/07/76	0	0	0	0	0	0
01/15/77	0	0	0	0	0	0
04/22/77	0	0	0	0	0	0
05/11/77	0	0	0	0	0	0
06/21/77	0	0	0	0	0	0
07/21/77	0	0	0	0	0	0
08/05/77	0	0	0	0	0	0
08/18/77	0	0	0	0	0	0
09/08/77	0	0	0	0	0	0
10/21/77	0	0	0	0	0	0
11/07/77	0	0	0	0	0	0
01/15/78	0	0	0	0	0	0
04/22/78	0	0	0	0	0	0
05/11/78	0	0	0	0	0	0
06/21/78	0	0	0	0	0	0
07/21/78	0	0	0	0	0	0
08/05/78	0	0	0	0	0	0
08/18/78	0	0	0	0	0	0
09/08/78	0	0	0	0	0	0
10/21/78	0	0	0	0	0	0
11/07/78	0	0	0	0	0	0
01/15/79	0	0	0	0	0	0
04/22/79	0	0	0	0	0	0
05/11/79	0	0	0	0	0	0
06/21/79	0	0	0	0	0	0
07/21/79	0	0	0	0	0	0
08/05/79	0	0	0	0	0	0
08/18/79	0	0	0	0	0	0
09/08/79	0	0	0	0	0	0
10/21/79	0	0	0	0	0	0
11/07/79	0	0	0	0	0	0
01/15/80	0	0	0	0	0	0
04/22/80	0	0	0	0	0	0
05/11/80	0	0	0	0	0	0
06/21/80	0	0	0	0	0	0
07/21/80	0	0	0	0	0	0
08/05/80	0	0	0	0	0	0
08/18/80	0	0	0	0	0	0
09/08/80	0	0	0	0	0	0
10/21/80	0	0	0	0	0	0
11/07/80	0	0	0	0	0	0
01/15/81	0	0	0	0	0	0
04/22/81	0	0	0	0	0	0
05/11/81	0	0	0	0	0	0
06/21/81	0	0	0	0	0	0
07/21/81	0	0	0	0	0	0
08/05/81	0	0	0	0	0	0
08/18/81	0	0	0	0	0	0
09/08/81	0	0	0	0	0	0
10/21/81	0	0	0	0	0	0
11/07/81	0	0	0	0	0	0
01/15/82	0	0	0	0	0	0
04/22/82	0	0	0	0	0	0
05/11/82	0	0	0	0	0	0
06/21/82	0	0	0	0	0	0
07/21/82	0	0	0	0	0	0
08/05/82	0	0	0	0	0	0
08/18/82	0	0	0	0	0	0
09/08/82	0	0	0	0	0	0
10/21/82	0	0	0	0	0	0
11/07/82	0	0	0	0	0	0
01/15/83	0	0	0	0	0	0
04/22/83	0	0	0	0	0	0
05/11/83	0	0	0	0	0	0
06/21/83	0	0	0	0	0	0
07/21/83	0	0	0	0	0	0
08/05/83	0	0	0	0	0	0
08/18/83	0	0	0	0	0	0
09/08/83	0	0	0	0	0	0
10/21/83	0	0	0	0	0	0
11/07/83	0	0	0	0	0	0
01/15/84	0	0	0	0	0	0
04/22/84	0	0	0	0	0	0
05/11/84	0	0	0	0	0	0
06/21/84	0	0	0	0	0	0
07/21/84	0	0	0	0	0	0
08/05/84	0	0	0	0	0	0
08/18/84	0	0	0	0	0	0
09/08/84	0	0	0	0	0	0
10/21/84	0	0	0	0	0	0
11/07/84	0	0	0	0	0	0
01/15/85	0	0	0	0	0	0
04/22/85	0	0	0	0	0	0
05/11/85	0	0	0	0	0	0
06/21/85	0	0	0	0	0	0
07/21/85	0	0	0	0	0	0
08/05/85	0	0	0	0	0	0
08/18/85	0	0	0	0	0	0
09/08/85	0	0	0	0	0	0
10/21/85	0	0	0	0	0	0
11/07/85	0	0	0	0	0	0
01/15/86	0	0	0	0	0	0
04/22/86	0	0	0	0	0	0
05/11/86	0	0	0	0	0	0
06/21/86	0	0	0	0	0	0
07/21/86	0	0	0	0	0	0
08/05/86	0	0	0	0	0	0
08/18/86	0	0	0	0	0	0
09/08/86	0	0	0	0	0	0
10/21/86	0	0	0	0	0	0
11/07/86	0	0	0	0	0	0
01/15/87	0	0	0	0	0	0
04/22/87	0	0	0	0	0	0
05/11/87	0	0	0	0	0	0
06/21/87	0	0	0	0	0	0
07/21/87	0	0	0	0	0	0
08/05/87	0	0	0	0	0	0
08/18/87	0	0	0	0	0	0
09/08/87	0	0	0	0	0	0
10/21/87	0	0	0	0	0	0
11/07/87	0	0	0	0	0	0
01/15/88	0	0	0	0	0	0
04/22/88	0	0	0	0	0	0
05/11/88	0	0	0	0	0	0
06/21/88	0	0	0	0	0	0
07/21/88	0	0	0	0	0	0
08/05/88	0	0	0	0	0	0
08/18/88	0	0	0	0	0	0
09/08/88	0	0	0	0	0	0
10/21/88	0	0	0	0	0	0
11/07/88	0	0	0	0	0	0
01/15/89	0	0	0	0	0	0
04/22/89	0	0	0	0	0	0
05/11/89	0	0	0	0	0	0
06/21/89	0	0	0	0	0	0
07/21/89	0	0	0	0	0	0
08/05/89	0	0	0	0	0	0
08/18/89	0	0	0	0	0	0
09/08/89	0	0	0	0	0	0
10/21/89	0	0	0	0	0	0
11/07/89	0	0	0	0	0	0
01/15/90	0	0	0	0	0	0
04/22/90	0	0	0	0	0	0
05/11/90	0	0	0	0	0	0
06/21/90	0	0	0	0	0</	

NUMBER PER CUBIC METER OF OITHONA SIMILIS AT EARLY LIFE HISTORY STATIONS

DATE	NH01		NH03		NH05		NH10		IMPS	IMFS	MALES FEMALES	IMPS	IMFS	MALES FEMALES	IMPS	IMFS	MALES FEMALES	IMPS	IMFS	MALES FEMALES
	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES												
06/22/69	6.0	48.4	4.9	123.7	12.7	128.2	73.0	16.4	3.0	1.5	16.4	53.8	128.2	12.7	128.2	73.0	16.4	3.0	1.5	16.4
07/10/69	0.0	317.8	0.0	145.7	2.3	759.7	16.8	64.7	2.5	2.5	64.7	43.0	759.7	2.3	759.7	16.8	64.7	2.5	2.5	64.7
07/18/69	0.0	205.8	18.6	98.7	3.3	51.8	16.8	95.0	3.2	3.2	95.0	43.0	51.8	3.3	51.8	16.8	95.0	3.2	3.2	95.0
07/25/69	5.9	229.6	0.0	24.0	1.0	9.0	8.0	3.0	0.0	0.0	3.0	10.0	9.0	1.0	9.0	8.0	3.0	0.0	0.0	3.0
08/06/69	0.0	31.4	6.8	10.1	2.0	8.7	8.0	3.0	0.0	0.0	3.0	6.1	8.7	2.0	8.7	8.0	3.0	0.0	0.0	3.0
09/12/69	0.0	0.0	11.5	171.4	11.0	135.7	16.0	148.7	0.0	0.0	148.7	16.0	135.7	11.0	135.7	16.0	148.7	0.0	0.0	148.7
10/08/69	0.0	21.8	35.4	255.2	7.0	172.8	22.0	255.2	31.0	31.0	255.2	22.0	172.8	7.0	172.8	22.0	255.2	31.0	31.0	255.2
12/29/69	2.4	1.2	35.4	47.3	7.0	112.0	14.0	47.3	3.0	3.0	47.3	14.0	112.0	7.0	112.0	14.0	47.3	3.0	3.0	47.3
01/25/70	21.4	1.2	42.5	230.5	7.0	91.5	14.0	230.5	0.0	0.0	230.5	14.0	91.5	7.0	91.5	14.0	230.5	0.0	0.0	230.5
02/27/70	4.4	17.5	42.5	14.5	1.0	11.5	5.0	14.5	0.0	0.0	14.5	5.0	11.5	1.0	11.5	5.0	14.5	0.0	0.0	14.5
05/06/70	7.5	5.6	3.0	11.5	1.0	11.5	2.0	11.5	0.0	0.0	11.5	2.0	11.5	1.0	11.5	0.0	0.0	0.0	0.0	11.5
05/22/70	0.0	19.2	0.0	36.8	3.0	49.3	7.0	49.3	0.0	0.0	49.3	7.0	36.8	3.0	49.3	0.0	0.0	0.0	0.0	49.3
06/23/70	1.1	11.0	19.2	11.5	1.0	11.5	1.0	11.5	0.0	0.0	11.5	1.0	11.5	1.0	11.5	0.0	0.0	0.0	0.0	11.5
07/02/70	0.0	40.3	0.0	126.0	12.0	137.7	2.0	137.7	0.0	0.0	137.7	2.0	137.7	12.0	137.7	0.0	0.0	0.0	0.0	137.7
07/16/70	0.0	15.2	0.0	32.3	2.0	32.3	1.0	32.3	0.0	0.0	32.3	1.0	32.3	2.0	32.3	0.0	0.0	0.0	0.0	32.3
08/13/70	0.0	12.2	0.0	126.0	16.0	144.7	1.0	144.7	0.0	0.0	144.7	1.0	144.7	16.0	144.7	0.0	0.0	0.0	0.0	144.7
09/15/70	0.0	12.2	0.0	126.0	16.0	144.7	1.0	144.7	0.0	0.0	144.7	1.0	144.7	16.0	144.7	0.0	0.0	0.0	0.0	144.7
10/06/71	0.0	12.2	0.0	126.0	16.0	144.7	1.0	144.7	0.0	0.0	144.7	1.0	144.7	16.0	144.7	0.0	0.0	0.0	0.0	144.7
03/03/71	0.0	12.2	0.0	126.0	16.0	144.7	1.0	144.7	0.0	0.0	144.7	1.0	144.7	16.0	144.7	0.0	0.0	0.0	0.0	144.7
05/14/71	0.0	12.2	0.0	126.0	16.0	144.7	1.0	144.7	0.0	0.0	144.7	1.0	144.7	16.0	144.7	0.0	0.0	0.0	0.0	144.7
05/29/71	0.0	12.2	0.0	126.0	16.0	144.7	1.0	144.7	0.0	0.0	144.7	1.0	144.7	16.0	144.7	0.0	0.0	0.0	0.0	144.7
06/02/71	0.0	12.2	0.0	126.0	16.0	144.7	1.0	144.7	0.0	0.0	144.7	1.0	144.7	16.0	144.7	0.0	0.0	0.0	0.0	144.7
06/28/71	7.5	138.2	5.7	107.4	2.0	67.7	5.0	107.4	0.0	0.0	107.4	5.0	67.7	2.0	67.7	0.0	0.0	0.0	0.0	107.4
07/06/71	10.9	320.0	13.7	155.5	1.0	82.7	1.0	82.7	0.0	0.0	82.7	1.0	82.7	1.0	82.7	0.0	0.0	0.0	0.0	82.7
08/19/71	1.7	123.7	1.7	155.5	4.0	155.5	1.0	155.5	0.0	0.0	155.5	1.0	155.5	4.0	155.5	0.0	0.0	0.0	0.0	155.5
10/05/71	3.8	174.5	3.8	155.5	4.0	155.5	1.0	155.5	0.0	0.0	155.5	1.0	155.5	4.0	155.5	0.0	0.0	0.0	0.0	155.5
11/10/71	0.0	174.5	0.0	155.5	4.0	155.5	1.0	155.5	0.0	0.0	155.5	1.0	155.5	4.0	155.5	0.0	0.0	0.0	0.0	155.5
12/07/71	0.0	174.5	0.0	155.5	4.0	155.5	1.0	155.5	0.0	0.0	155.5	1.0	155.5	4.0	155.5	0.0	0.0	0.0	0.0	155.5
01/20/72	0.0	174.5	0.0	155.5	4.0	155.5	1.0	155.5	0.0	0.0	155.5	1.0	155.5	4.0	155.5	0.0	0.0	0.0	0.0	155.5
05/18/72	0.0	174.5	0.0	155.5	4.0	155.5	1.0	155.5	0.0	0.0	155.5	1.0	155.5	4.0	155.5	0.0	0.0	0.0	0.0	155.5
06/06/72	0.0	174.5	0.0	155.5	4.0	155.5	1.0	155.5	0.0	0.0	155.5	1.0	155.5	4.0	155.5	0.0	0.0	0.0	0.0	155.5
07/21/72	0.0	174.5	0.0	155.5	4.0	155.5	1.0	155.5	0.0	0.0	155.5	1.0	155.5	4.0	155.5	0.0	0.0	0.0	0.0	155.5
08/18/72	0.0	174.5	0.0	155.5	4.0	155.5	1.0	155.5	0.0	0.0	155.5	1.0	155.5	4.0	155.5	0.0	0.0	0.0	0.0	155.5
09/05/72	0.0	174.5	0.0	155.5	4.0	155.5	1.0	155.5	0.0	0.0	155.5	1.0	155.5	4.0	155.5	0.0	0.0	0.0	0.0	155.5
10/22/72	0.0	174.5	0.0	155.5	4.0	155.5	1.0	155.5	0.0	0.0	155.5	1.0	155.5	4.0	155.5	0.0	0.0	0.0	0.0	155.5
01/18/73	0.0	174.5	0.0	155.5	4.0	155.5	1.0	155.5	0.0	0.0	155.5	1.0	155.5	4.0	155.5	0.0	0.0	0.0	0.0	155.5
02/11/73	0.0	174.5	0.0	155.5	4.0	155.5	1.0	155.5	0.0	0.0	155.5	1.0	155.5	4.0	155.5	0.0	0.0	0.0	0.0	155.5
03/05/73	0.0	174.5	0.0	155.5	4.0	155.5	1.0	155.5	0.0	0.0	155.5	1.0	155.5	4.0	155.5	0.0	0.0	0.0	0.0	155.5
04/22/73	0.0	174.5	0.0	155.5	4.0	155.5	1.0	155.5	0.0	0.0	155.5	1.0	155.5	4.0	155.5	0.0	0.0	0.0	0.0	155.5
05/18/73	0.0	174.5	0.0	155.5	4.0	155.5	1.0	155.5	0.0	0.0	155.5	1.0	155.5	4.0	155.5	0.0	0.0	0.0	0.0	155.5
06/06/73	0.0	174.5	0.0	155.5	4.0	155.5	1.0	155.5	0.0	0.0	155.5	1.0	155.5	4.0	155.5	0.0	0.0	0.0	0.0	155.5
07/21/73	0.0	174.5	0.0	155.5	4.0	155.5	1.0	155.5	0.0	0.0	155.5	1.0	155.5	4.0	155.5	0.0	0.0	0.0	0.0	155.5
08/18/73	0.0	174.5	0.0	155.5	4.0	155.5	1.0	155.5	0.0	0.0	155.5	1.0	155.5	4.0	155.5	0.0	0.0	0.0	0.0	155.5
09/05/73	0.0	174.5	0.0	155.5	4.0	155.5	1.0	155.5	0.0	0.0	155.5	1.0	155.5	4.0	155.5	0.0	0.0	0.0	0.0	155.5
10/22/73	0.0	174.5	0.0	155.5	4.0	155.5	1.0	155.5	0.0	0.0	155.5	1.0	155.5	4.0	155.5	0.0	0.0	0.0	0.0	155.5

NUMBER PER CUBIC METER OF CTENUCALANUS AT EARLY LIFE HISTORY STATIONS

DATE	NH01		NH03		NH05		NH10		IMFS	IMFS	IMFS	IMFS	IMFS	IMFS
	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES						
06/22/69	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06/29/69	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07/10/69	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07/18/69	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07/25/69	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08/06/69	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08/20/69	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09/03/69	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09/14/69	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09/28/69	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10/08/69	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10/29/69	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12/02/69	4	34.8	3	64.2	8	98.9	7	98.9	7	77	7	77	1.6	1.6
12/29/69	1.8	16.8	1.1	30.2	3.4	48.9	3.7	48.9	3.8	53.8	4	53.8	23.4	23.4
01/29/70	1.8	16.8	1.6	14.0	2.8	27.4	2.8	27.4	3.7	73.7	4	73.7	17.5	17.5
02/25/70	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04/27/70	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05/06/70	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05/22/70	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06/04/70	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06/23/70	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07/02/70	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07/16/70	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07/29/70	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08/13/70	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08/23/70	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09/11/70	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09/25/70	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10/20/70	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12/04/70	2.1	35.3	3.7	21.0	1.6	42.0	1.6	42.0	1.6	14.1	2	14.1	28.1	28.1
01/06/71	5.7	27.7	3.0	12.0	1.0	20.0	1.0	20.0	1.0	22.0	1	22.0	22.0	22.0
03/30/71	6.4	42.3	3.0	12.0	1.0	20.0	1.0	20.0	1.0	22.0	1	22.0	22.0	22.0
05/03/71	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05/14/71	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05/29/71	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06/12/71	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06/28/71	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07/06/71	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07/21/71	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08/02/71	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08/19/71	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09/23/71	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10/11/71	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11/06/71	2.4	11.2	4.2	39.4	3.0	12.0	3.0	12.0	3.0	11.0	3	11.0	11.0	11.0
12/07/71	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04/15/72	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04/20/72	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05/22/72	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06/11/72	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06/28/72	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07/21/72	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09/05/72	0	0	0	0	0	0	0	0	0	0	0	0	0	0

NUMBER PER CUBIC METER OF O. SPINIROSTRIS AT EARLY LIFE HISTORY STATIONS

DATE	NH01		NH03		NH05		NH10		IMPS
	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES	
06/22/69	0	0	0	0	0	0	0	0	0
06/29/69	0	0	0	3.1	0	0	0	0	1.3
07/10/69	0	0	0	2.0	2.0	0	0	0	3.8
07/18/69	0	0	0	2.1	0	0	0	0	4.1
08/06/69	0	0	0	0	0	0	0	0	4.0
08/26/69	0	0	0	13.1	0	0	0	0	4.9
09/03/69	0	5.1	0	14.6	4.9	0	0	0	0
09/14/69	0	0	0	11.7	0	0	0	0	0
09/28/69	0	2.1	0	2.0	0	0	0	0	0
10/08/69	0	2.2	0	5.0	0	0	0	0	0
10/29/69	0	0	0	11.7	0	0	0	0	0
12/02/69	0	0	0	2.0	0	0	0	0	0
12/29/70	0	17.1	0	2.0	4.0	0	0	0	0
02/27/70	0	0	0	2.0	0	0	0	0	0
04/06/70	0	1.8	0	1.0	0	0	0	0	0
05/22/70	0	2.0	0	1.0	0	0	0	0	0
06/04/70	0	0	0	1.0	0	0	0	0	0
06/23/70	0	0	0	1.0	0	0	0	0	0
07/02/70	0	0	0	1.0	0	0	0	0	0
07/16/70	0	0	0	1.0	0	0	0	0	0
07/29/70	0	0	0	1.0	0	0	0	0	0
08/13/70	0	0	0	1.0	0	0	0	0	0
09/11/70	0	0	0	1.0	0	0	0	0	0
09/20/70	0	0	0	1.0	0	0	0	0	0
12/04/70	0	0	0	1.0	0	0	0	0	0
02/16/71	0	0	0	0	0	0	0	0	0
03/30/71	0	0	0	0	0	0	0	0	0
05/14/71	0	0	0	0	0	0	0	0	0
05/29/71	0	0	0	0	0	0	0	0	0
06/02/71	0	0	0	0	0	0	0	0	0
06/12/71	0	0	0	0	0	0	0	0	0
06/28/71	0	39.0	0	2.0	0	0	0	0	0
07/06/71	0	0	0	7.0	0	0	0	0	0
07/22/71	0	0	0	0	0	0	0	0	0
08/02/71	0	0	0	0	0	0	0	0	0
08/19/71	0	0	0	0	0	0	0	0	0
09/23/71	0	0	0	0	0	0	0	0	0
10/07/71	0	0	0	0	0	0	0	0	0
11/06/71	0	0	0	0	0	0	0	0	0
12/15/72	0	0	0	0	0	0	0	0	0
04/20/72	0	0	0	0	0	0	0	0	0
05/22/72	0	0	0	0	0	0	0	0	0
06/11/72	0	0	0	0	0	0	0	0	0
06/28/72	0	0	0	0	0	0	0	0	0
07/05/72	0	0	0	0	0	0	0	0	0

NUMBER PER CUBIC METER OF C. ARCUICORNIS AT EARLY LIFE HISTORY STATIONS

DATE	NH01	NH02	NH03	NH05	NH10
	MALES	MALES	MALES	MALES	MALES
	FEMALES	FEMALES	FEMALES	FEMALES	FEMALES
	IMFS	IMFS	IMFS	IMFS	IMFS
	MALES	MALES	MALES	MALES	MALES
	FEMALES	FEMALES	FEMALES	FEMALES	FEMALES
	IMFS	IMFS	IMFS	IMFS	IMFS
06/22/69	0	0	0	0	0
06/29/69	0	0	0	0	0
07/10/69	0	0	0	0	0
07/18/69	0	0	0	0	0
07/25/69	0	0	0	0	0
08/06/69	0	0	0	0	0
08/30/69	0	0	0	0	0
09/03/69	0	0	0	0	0
09/14/69	0	0	0	0	0
09/29/69	0	0	0	0	0
10/08/69	0	0	0	0	0
10/29/69	0	0	0	0	0
12/29/70	8	5	1	2	14
01/29/70	0	0	0	0	0
02/25/70	0	0	0	0	0
04/05/70	0	0	0	0	0
05/22/70	0	0	0	0	0
06/04/70	0	0	0	0	0
06/23/70	0	0	0	0	0
07/02/70	0	0	0	0	0
07/16/70	0	0	0	0	0
07/29/70	0	0	0	0	0
08/13/70	0	0	0	0	0
08/23/70	0	0	0	0	0
09/11/70	0	0	0	0	0
09/25/70	0	0	0	0	0
10/04/70	0	0	0	0	0
12/16/71	5	2	1	1	2
02/16/71	2	0	0	0	0
03/30/71	0	0	0	0	0
05/14/71	0	0	0	0	0
05/29/71	0	0	0	0	0
06/12/71	0	0	0	0	0
06/28/71	0	0	0	0	0
07/06/71	0	0	0	0	0
07/21/71	0	0	0	0	0
08/02/71	0	0	0	0	0
08/19/71	0	0	0	0	0
09/23/71	0	0	0	0	0
10/16/71	0	0	0	0	0
11/07/71	0	0	0	0	0
11/15/71	0	0	0	0	0
12/15/72	0	0	0	0	0
01/22/72	0	0	0	0	0
05/11/72	0	0	0	0	0
06/28/72	0	0	0	0	0
07/05/72	0	0	0	0	0

NUMBER PER CUBIC METER OF CLAUDE. FERGENS AT EARLY LIFE HISTORY STATIONS

DATE	NH01		NH03		NH05		NH10		IMPS	
	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES
06/23/69	0	0	0	0	0	0	0	0	0	0
06/29/69	0	0	0	0	0	0	0	0	0	0
07/10/69	0	14.7	0	0	0	0	0	0	0	0
07/18/69	0	0	0	0	0	0	0	0	0	0
07/25/69	0	0	0	0	0	0	0	0	0	0
08/06/69	0	0	0	0	0	0	0	0	0	0
08/26/69	0	0	0	0	0	0	0	0	0	0
09/03/69	0	0	0	0	0	0	0	0	0	0
09/14/69	0	0	0	0	0	0	0	0	0	0
09/28/69	0	0	0	0	0	0	0	0	0	0
10/08/69	0	0	0	0	0	0	0	0	0	0
10/29/69	0	0	0	0	0	0	0	0	0	0
12/02/69	0	3.1	0	0	0	0	0	0	0	0
12/29/69	0	3.4	0	0	0	0	0	0	0	0
01/29/70	0	17.1	0	0	0	0	0	0	0	0
02/25/70	0	0	0	0	0	0	0	0	0	0
04/27/70	0	0	0	0	0	0	0	0	0	0
05/06/70	0	2.6	0	0	0	0	0	0	0	0
05/22/70	0	0	0	0	0	0	0	0	0	0
06/04/70	0	0	0	0	0	0	0	0	0	0
06/23/70	0	0	0	0	0	0	0	0	0	0
07/02/70	0	0	0	0	0	0	0	0	0	0
07/16/70	0	0	0	0	0	0	0	0	0	0
08/13/70	0	0	0	0	0	0	0	0	0	0
08/23/70	0	0	0	0	0	0	0	0	0	0
09/11/70	0	0	0	0	0	0	0	0	0	0
09/25/70	0	0	0	0	0	0	0	0	0	0
10/20/70	0	0	0	0	0	0	0	0	0	0
12/04/71	0	5.9	0	0	0	0	0	0	0	0
01/06/71	0	10.8	0	0	0	0	0	0	0	0
02/16/71	0	1	0	0	0	0	0	0	0	0
03/30/71	0	0	0	0	0	0	0	0	0	0
05/03/71	0	0	0	0	0	0	0	0	0	0
05/14/71	0	0	0	0	0	0	0	0	0	0
05/29/71	0	0	0	0	0	0	0	0	0	0
06/02/71	0	0	0	0	0	0	0	0	0	0
06/12/71	0	0	0	0	0	0	0	0	0	0
06/28/71	0	0	0	0	0	0	0	0	0	0
07/06/71	0	0	0	0	0	0	0	0	0	0
07/21/71	0	0	0	0	0	0	0	0	0	0
08/02/71	0	0	0	0	0	0	0	0	0	0
08/19/71	0	0	0	0	0	0	0	0	0	0
09/23/71	0	0	0	0	0	0	0	0	0	0
10/11/71	0	0	0	0	0	0	0	0	0	0
11/06/71	0	0	0	0	0	0	0	0	0	0
12/07/71	0	0	0	0	0	0	0	0	0	0
01/15/72	0	0	0	0	0	0	0	0	0	0
04/20/72	0	0	0	0	0	0	0	0	0	0
05/22/72	0	0	0	0	0	0	0	0	0	0
06/11/72	0	0	0	0	0	0	0	0	0	0
06/28/72	0	0	0	0	0	0	0	0	0	0
08/05/72	0	0	0	0	0	0	0	0	0	0

NUMBER PER CUEIC METER OF IMPAURE CLAUSO AT EARLY LIFE HISTORY STATIONS

DATE	NH01	NH03	NH05	NH10
	MALES FEMALES	MALES FEMALES	MALES FEMALES	MALES FEMALES
06/22/69	0	0	0	0
06/29/69	0	0	0	0
07/10/69	0	0	0	0
07/18/69	0	0	0	0
07/25/69	0	0	0	0
08/06/69	0	0	0	0
08/26/69	0	0	0	0
09/30/69	0	0	0	0
09/14/69	0	0	0	0
09/28/69	0	0	0	0
10/08/69	0	0	0	0
10/29/69	6.3	3.1	3.3	1.7
12/02/69	1.0	4.6	3.8	1.0
12/29/69	2.6	114.2	22.3	3.7
01/29/70	199.8	30.1	25.1	45.4
02/25/70	0	0	0	0
04/27/70	0	0	0	0
05/06/70	0	0	0	0
05/22/70	0	0	0	0
06/04/70	0	0	0	0
06/23/70	0	0	0	0
07/02/70	0	0	0	0
07/16/70	0	0	0	0
07/29/70	0	0	0	0
08/13/70	0	0	0	0
08/23/70	0	0	0	0
09/11/70	0	0	0	0
09/25/70	0	0	0	0
10/20/70	0	0	0	0
12/04/70	0	0	0	0
01/06/71	3.3	2.1	5.7	25.2
03/30/71	0	0	3.1	12.2
05/03/71	0	0	0	2.2
05/29/71	0	0	0	2.2
06/02/71	0	0	0	0
06/12/71	0	0	0	0
06/28/71	0	0	0	0
07/06/71	0	0	0	0
07/21/71	0	0	0	0
08/02/71	0	0	0	0
08/19/71	0	0	0	0
09/23/71	0	0	0	0
10/11/71	0	0	0	0
11/07/71	0.5	0	0	0
12/07/71	0	0	0	0
01/15/72	0	0	0	0
04/20/72	0	0	0	0
05/22/72	0	0	0	0
06/11/72	0	0	0	0
06/29/72	0	0	0	0
07/21/72	0	0	0	0
09/05/72	0	0	0	0

NUMBER PER CUBIC METER OF ACARTIA TONSA AT EARLY LIFE HISTORY STATIONS

DATE	NH01		NH03		NH05		NH10		IPFS
	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES	
06/22/69	30.2	30.2	2.0	4.6	5.6	5.6	0	0	0
06/29/69	14.7	29.3	4.0	9.0	2.7	10.7	2.5	7.6	1.3
07/18/69	29.5	41.3	2.0	13.8	6.9	10.7	1.8	7.6	2.5
07/25/69	15.8	59.2	30.8	82.1	3.7	8.0	5.1	7.6	2.5
08/06/69	12.1	9.7	10.1	20.3	6.1	16.4	1.2	0	0
08/30/69	0	2.6	0	28.1	0	16.8	0	2.7	9.0
09/14/69	0	0	10.7	34.8	4.0	42.7	0	0	0
09/28/69	0	0	15.4	45.8	27.4	30.7	0	0	0
10/08/69	39.2	34.4	12.6	45.7	17.4	30.7	1.7	1.7	10.7
10/29/69	1.3	53.2	6.8	22.9	0	1.2	0	0	0
12/02/69	4.8	58.2	1.5	13.2	0	1.2	0	0	25.8
01/29/70	1.8	1.6	2.0	0	0	0	0	0	0
02/25/70	1.4	1.6	6.8	0	0	0	0	0	0
04/27/70	1.4	4.4	1.5	0	0	0	0	0	0
05/06/70	1.8	5.7	19.9	2.8	0	2.0	3.1	3.1	1.3
05/22/70	1.1	21.9	0	0	0	1.0	0	0	0
06/04/70	1.8	2.0	0	0	0	0	0	0	0
06/23/70	1.8	1.5	1.0	0	0	0	0	0	0
07/02/70	1.8	0	0	0	0	0	0	0	0
07/16/70	1.8	0	0	0	0	0	0	0	0
07/29/70	1.8	0	0	0	0	0	0	0	0
08/13/70	1.8	0	0	0	0	0	0	0	0
08/23/70	1.8	0	0	0	0	0	0	0	0
09/11/70	1.8	0	0	0	0	0	0	0	0
09/25/70	0	0	0	0	0	0	0	0	0
10/20/70	0	0	0	0	0	0	0	0	0
01/16/71	0	4.1	0	3.4	1.2	1.2	0	1.2	1.3
02/16/71	0	0	0	1.0	0	0	0	0	0
03/30/71	0	0	0	0	0	0	0	0	0
05/14/71	0	0	0	0	0	0	0	0	0
05/29/71	0	0	0	0	0	0	0	0	0
06/12/71	0	0	0	0	0	0	0	0	0
06/28/71	0	0	0	0	0	0	0	0	0
07/06/71	0	0	0	0	0	0	0	0	0
07/21/71	0	0	0	0	0	0	0	0	0
08/02/71	0	0	0	0	0	0	0	0	0
08/19/71	0	0	0	0	0	0	0	0	0
09/23/71	0	0	0	0	0	0	0	0	0
10/11/71	0	0	0	0	0	0	0	0	0
11/06/71	0	0	0	0	0	0	0	0	0
12/07/71	0	0	0	0	0	0	0	0	0
03/15/72	1.8	0	0	0	1.1	1.1	1.0	1.0	1.0
04/20/72	0	0	0	0	0	0	0	0	0
06/11/72	0	0	0	0	0	0	0	0	0
06/28/72	0	0	0	0	0	0	0	0	0
07/21/72	0	0	0	0	0	0	0	0	0
08/10/72	0	0	0	0	0	0	0	0	0

NUMBER PER CUBIC METER OF GAL. TENUICORNIS AT EARLY LIFE HISTORY STATIONS

DATE	NH01		NH03		NH05		NH10	
	MALES	FEMALES	IMPS	MALES	FEMALES	IMPS	MALES	FEMALES
06/22/69	0	0	0	0	0	0	0	0
06/29/69	0	0	0	0	0	0	0	0
07/10/69	0	0	0	0	0	0	0	0
07/18/69	0	0	0	0	0	0	0	0
07/25/69	0	0	0	0	0	0	0	0
08/06/69	0	0	0	0	0	0	0	0
08/26/69	0	0	0	0	0	0	0	0
09/03/69	0	0	0	0	0	0	0	0
09/14/69	0	0	0	0	0	0	0	0
09/28/69	0	0	0	0	0	0	0	0
10/08/69	0	0	0	0	0	0	0	0
10/29/69	0	0	1	0	0	0	0	0
12/29/69	0	0	1	0	0	0	0	0
01/29/70	0	0	1	0	0	0	0	0
02/25/70	0	0	0	0	0	0	0	0
04/27/70	0	0	0	0	0	0	0	0
05/06/70	0	0	0	0	0	0	0	0
05/22/70	0	0	0	0	0	0	0	0
06/04/70	0	0	0	0	0	0	0	0
06/23/70	0	0	0	0	0	0	0	0
07/02/70	0	0	0	0	0	0	0	0
07/16/70	0	0	0	0	0	0	0	0
07/29/70	0	0	0	0	0	0	0	0
08/13/70	0	0	0	0	0	0	0	0
08/23/70	0	0	0	0	0	0	0	0
09/11/70	0	0	0	0	0	0	0	0
09/25/70	0	0	0	0	0	0	0	0
10/20/70	0	0	0	0	0	0	0	0
12/04/71	0	0	0	0	0	0	0	0
01/06/71	0	0	0	0	0	0	0	0
02/16/71	0	0	0	0	0	0	0	0
03/30/71	0	0	0	0	0	0	0	0
03/03/71	0	0	0	0	0	0	0	0
05/14/71	0	0	0	0	0	0	0	0
05/29/71	0	0	0	0	0	0	0	0
06/02/71	0	0	0	0	0	0	0	0
06/12/71	0	0	0	0	0	0	0	0
06/26/71	0	0	0	0	0	0	0	0
07/06/71	0	0	0	0	0	0	0	0
07/21/71	0	0	0	0	0	0	0	0
08/02/71	0	0	0	0	0	0	0	0
08/19/71	0	0	0	0	0	0	0	0
09/23/71	0	0	0	0	0	0	0	0
10/11/71	0	0	0	0	0	0	0	0
11/06/71	0	0	0	0	0	0	0	0
12/07/71	0	0	0	0	0	0	0	0
01/15/72	0	0	0	0	0	0	0	0
03/15/72	0	0	0	0	0	0	0	0
04/22/72	0	0	0	0	0	0	0	0
05/11/72	0	0	0	0	0	0	0	0
06/11/72	0	0	0	0	0	0	0	0
07/21/72	0	0	0	0	0	0	0	0
09/20/72	0	0	0	0	0	0	0	0
08/05/72	0	0	0	0	0	0	0	0

NUMBER PER CURIC METER OF EUPHAUSIIC EGGS AT EARLY LIFE HISTORY STATIONS

DATE	NH01		NH03		NH05		NH10	
	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES
06/22/69	0	0	0	0	0	0	0	0
06/29/69	0	0	0	0	0	0	0	0
07/10/69	0	0	4	0	0	0	2	0
07/18/69	0	0	0	0	0	0	0	0
07/25/69	0	0	0	0	0	0	0	0
08/06/69	0	0	0	0	0	0	0	0
08/30/69	4	0	37	0	55	0	1	0
09/03/69	9	0	16	0	27	0	0	0
09/14/69	0	0	4	0	8	0	0	0
09/26/69	0	0	0	0	0	0	0	0
10/08/69	0	0	0	0	0	0	0	0
10/29/69	0	0	0	0	0	0	0	0
12/02/69	0	0	0	0	0	0	0	0
12/29/69	0	0	0	0	0	0	0	0
01/22/70	0	0	0	0	0	0	0	0
02/27/70	0	0	0	0	0	0	0	0
04/06/70	0	0	0	0	0	0	0	0
05/06/70	0	0	0	0	0	0	0	0
05/22/70	129	0	6	0	9	0	0	0
06/04/70	0	0	484	0	216	0	7	0
06/23/70	1443	0	77	0	340	0	59	0
07/16/70	20	0	282	0	713	0	39	0
07/19/70	0	0	0	0	35	0	1	0
08/13/70	50	0	98	0	33	0	5	0
08/13/70	14	0	12	0	47	0	3	0
09/11/70	0	0	16	0	2	0	0	0
09/11/70	17	0	66	0	351	0	30	0
10/20/70	0	0	0	0	0	0	0	0
11/06/71	0	0	0	0	0	0	0	0
02/16/71	0	0	0	0	0	0	0	0
03/30/71	393	0	263	0	355	0	61	0
05/03/71	13	0	40	0	147	0	15	0
05/14/71	16	0	95	0	8	0	1	0
05/29/71	0	0	0	0	50	0	0	0
06/02/71	278	0	0	0	0	0	0	0
06/12/71	0	0	0	0	0	0	0	0
06/26/71	0	0	0	0	0	0	0	0
07/06/71	0	0	0	0	0	0	0	0
07/21/71	0	0	5	0	48	0	0	0
08/02/71	112	0	0	0	9	0	0	0
08/19/71	1	0	0	0	0	0	0	0
09/23/71	0	0	0	0	1	0	0	0
10/11/71	0	0	0	0	0	0	0	0
11/06/71	0	0	0	0	0	0	0	0
12/07/71	0	0	0	0	0	0	0	0
01/15/72	0	0	0	0	0	0	0	0
04/20/72	0	0	0	0	0	0	0	0
05/22/72	0	0	13	0	1	0	0	0
06/11/72	0	0	20	0	0	0	0	0
06/28/72	2	6	1	0	0	0	0	0
07/21/72	1	6	0	0	0	0	0	0
08/05/72	0	0	0	0	0	0	0	0

NUMBER PER CUBIC METER OF LUFAUSIID NAUP AT EARLY LIFE HISTORY STATIONS

DATE	NH01	NH03	NH05	NH10
	MALES FEMALES	MALES FEMALES	MALES FEMALES	MALES FEMALES
05/22/69	00	0	00	000
05/29/69	37.	7.7	00	000
07/10/69	44.	00	00	000
07/25/69	00	00	00	000
08/06/69	00	2.1	00	000
08/20/69	00	00	00	000
09/03/69	00	00	00	000
09/14/69	00	00	00	000
09/28/69	00	1.6	00	000
10/08/69	00	00	00	000
10/29/69	00	00	00	000
12/02/69	00	00	00	000
12/29/70	00	25.	00	000
01/25/70	00	1.0	00	000
05/06/70	00	00	00	000
05/22/70	00	00	00	000
05/23/70	2.	00	00	000
07/02/70	00	00	00	000
07/16/70	00	9.1	00	000
08/13/70	00	216.	00	000
08/23/70	00	00	00	000
09/11/70	00	53.	00	000
10/20/70	20.	12.	00	000
10/06/71	00	46.	00	000
10/16/71	00	00	00	000
10/30/71	00	00	00	000
10/03/71	3.1	00	00	000
10/14/71	23.	14.	00	000
10/22/71	00	20.	00	000
10/28/71	137.	00	00	000
11/06/71	00	00	00	000
11/21/71	00	00	00	000
12/02/71	00	00	00	000
12/12/71	00	00	00	000
12/28/71	00	00	00	000
01/06/72	00	00	00	000
01/21/72	00	00	00	000
02/08/72	00	00	00	000
02/22/72	00	00	00	000
03/15/72	00	00	00	000
03/22/72	6.8.	00	00	000
04/11/72	00	00	00	000
04/28/72	00	00	00	000
05/21/72	00	00	00	000
06/07/72	00	00	00	000
06/21/72	00	00	00	000
07/05/72	11.	00	00	000
07/19/72	00	00	00	000
08/02/72	00	00	00	000
08/16/72	00	00	00	000
08/30/72	00	00	00	000
09/13/72	00	00	00	000
09/27/72	00	00	00	000
10/11/72	00	00	00	000
10/25/72	00	00	00	000
11/08/72	00	00	00	000
11/22/72	00	00	00	000
12/06/72	00	00	00	000
12/20/72	00	00	00	000
01/03/73	00	00	00	000
01/17/73	00	00	00	000
01/31/73	00	00	00	000
02/14/73	00	00	00	000
02/28/73	00	00	00	000
03/13/73	00	00	00	000
03/27/73	00	00	00	000
04/10/73	00	00	00	000
04/24/73	00	00	00	000
05/08/73	00	00	00	000
05/22/73	00	00	00	000
06/05/73	00	00	00	000
06/19/73	00	00	00	000
07/03/73	00	00	00	000
07/17/73	00	00	00	000
07/31/73	00	00	00	000
08/14/73	00	00	00	000
08/28/73	00	00	00	000
09/11/73	00	00	00	000
09/25/73	00	00	00	000
10/09/73	00	00	00	000
10/23/73	00	00	00	000
11/06/73	00	00	00	000
11/20/73	00	00	00	000
12/04/73	00	00	00	000
12/18/73	00	00	00	000
12/31/73	00	00	00	000
01/14/74	00	00	00	000
01/28/74	00	00	00	000
02/11/74	00	00	00	000
02/25/74	00	00	00	000
03/10/74	00	00	00	000
03/24/74	00	00	00	000
04/07/74	00	00	00	000
04/21/74	00	00	00	000
05/05/74	00	00	00	000
05/19/74	00	00	00	000
06/02/74	00	00	00	000
06/16/74	00	00	00	000
06/30/74	00	00	00	000
07/14/74	00	00	00	000
07/28/74	00	00	00	000
08/11/74	00	00	00	000
08/25/74	00	00	00	000
09/08/74	00	00	00	000
09/22/74	00	00	00	000
10/06/74	00	00	00	000
10/20/74	00	00	00	000
11/03/74	00	00	00	000
11/17/74	00	00	00	000
12/01/74	00	00	00	000
12/15/74	00	00	00	000
12/29/74	00	00	00	000
01/12/75	00	00	00	000
01/26/75	00	00	00	000
02/09/75	00	00	00	000
02/23/75	00	00	00	000
03/09/75	00	00	00	000
03/23/75	00	00	00	000
04/06/75	00	00	00	000
04/20/75	00	00	00	000
05/04/75	00	00	00	000
05/18/75	00	00	00	000
06/01/75	00	00	00	000
06/15/75	00	00	00	000
06/29/75	00	00	00	000
07/13/75	00	00	00	000
07/27/75	00	00	00	000
08/10/75	00	00	00	000
08/24/75	00	00	00	000
09/07/75	00	00	00	000
09/21/75	00	00	00	000
10/05/75	00	00	00	000
10/19/75	00	00	00	000
11/02/75	00	00	00	000
11/16/75	00	00	00	000
11/30/75	00	00	00	000
12/14/75	00	00	00	000
12/28/75	00	00	00	000
01/11/76	00	00	00	000
01/25/76	00	00	00	000
02/08/76	00	00	00	000
02/22/76	00	00	00	000
03/08/76	00	00	00	000
03/22/76	00	00	00	000
04/05/76	00	00	00	000
04/19/76	00	00	00	000
05/03/76	00	00	00	000
05/17/76	00	00	00	000
06/01/76	00	00	00	000
06/15/76	00	00	00	000
06/29/76	00	00	00	000
07/13/76	00	00	00	000
07/27/76	00	00	00	000
08/10/76	00	00	00	000
08/24/76	00	00	00	000
09/07/76	00	00	00	000
09/21/76	00	00	00	000
10/05/76	00	00	00	000
10/19/76	00	00	00	000
11/02/76	00	00	00	000
11/16/76	00	00	00	000
11/30/76	00	00	00	000
12/14/76	00	00	00	000
12/28/76	00	00	00	000
01/11/77	00	00	00	000
01/25/77	00	00	00	000
02/08/77	00	00	00	000
02/22/77	00	00	00	000
03/08/77	00	00	00	000
03/22/77	00	00	00	000
04/05/77	00	00	00	000
04/19/77	00	00	00	000
05/03/77	00	00	00	000
05/17/77	00	00	00	000
06/01/77	00	00	00	000
06/15/77	00	00	00	000
06/29/77	00	00	00	000
07/13/77	00	00	00	000
07/27/77	00	00	00	000
08/10/77	00	00	00	000
08/24/77	00	00	00	000
09/07/77	00	00	00	000
09/21/77	00	00	00	000
10/05/77	00	00	00	000
10/19/77	00	00	00	000
11/02/77	00	00	00	000
11/16/77	00	00	00	000
11/30/77	00	00	00	000
12/14/77	00	00	00	000
12/28/77	00	00	00	000
01/11/78	00	00	00	000
01/25/78	00	00	00	000
02/08/78	00	00	00	000
02/22/78	00	00	00	000
03/08/78	00	00	00	000
03/22/78	00	00	00	000
04/05/78	00	00	00	000
04/19/78	00	00	00	000
05/03/78	00	00	00	000
05/17/78	00	00	00	000
06/01/78	00	00	00	000
06/15/78	00	00	00	000
06/29/78	00	00	00	000
07/13/78	00	00	00	000
07/27/78	00	00	00	000
08/10/78	00	00	00	000
08/24/78	00	00	00	000
09/07/78	00	00	00	000
09/21/78	00	00	00	000
10/05/78	00	00	00	000
10/19/78	00	00	00	000
11/02/78	00	00	00	000
11/16/78	00	00	00	000
11/30/78	00	00	00	000
12/14/78	00	00	00	000
12/28/78	00	00	00	000
01/11/79	00	00	00	000
01/25/79	00	00	00	000
02/08/79	00	00	00	000
02/22/79	00	00	00	000
03/08/79	00	00	00	000
03/22/79	00	00	00	000
04/05/79	00	00	00	000
04/19/79	00	00	00	000
05/03/79	00	00	00	000
05/17/79	00	00	00	000
06/01/79	00	00	00	000
06/15/79	00	00	00	000
06/29/79	00	00	00	000
07/13/79	00	00	00	000
07/27/79	00	00	00	000
08/10/79	00	00	00	000
08/24/79	00	00	00	000
09/07/79	00	00	00	000
09/21/79	00	00	00	000
10/05/79	00	00	00	000
10/19/79	00	00	00	000
11/02/79	00	00	00	000
11/16/79	00	00	00	000
11/30/79	00	00	00	000
12/14/79	00	00	00	000
12/28/79	00	00	00	000
01/11/80	00	00	00	000
01/25/80	00	00	00	000
02/08/80	00	00	00	000
02/22/80	00	00	00	000
03/08/80	00	00	00	000
03/22/80	00	00	00	000
04/05/80	00	00	00	000
04/19/80	00	00	00	000
05/03/80	00	00	00	000
05/17/80	00	00	00	000
06/01/80	00	00	00	000
06/15/80	00	00	00	000
06/29/80	00	00	00	000
07/13/80	00	00	00	000
07/27/80	00	00	00	000
08/10/80	00	00	00	000
08/24/80	00	00	00	0

NUMBER PER CURIC METER OF CALYPTICPIS AT EARLY LIFE HISTORY STATIONS

DATE	NH01		NH03		NH05		NH10	
	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES
06/22/69	0	0	0	0	0	0	0	0
06/29/69	5.4	0	0	0	0	0	0	0
07/10/69	14.7	0	0	0	0	0	1.3	0
07/18/69	0	0	0	0	0	0	0	0
07/25/69	0	0	0	0	0	0	0	0
08/06/69	0	0	0	0	0	0	0	0
08/30/69	0	0	0	0	0	0	0	0
09/03/69	0	0	0	0	0	0	0	0
09/14/69	0	0	0	0	0	0	0	0
09/20/69	0	0	0	0	0	0	0	0
10/08/69	0	0	0	0	0	0	0	0
10/29/69	4.2	0	1.6	0	2.5	0	5.2	0
12/29/69	0	0	1.4	0	0	0	1.1	0
02/29/70	0	0	2.8	0	0	0	1.5	0
04/27/70	3.9	0	0	0	3.3	0	0.6	0
05/06/70	0	0	0	0	0	0	0	0
05/22/70	0	0	0	0	0	0	0	0
06/04/70	0	0	0	0	0	0	0	0
06/23/70	0	0	0	0	0	0	0	0
07/02/70	19.2	0	0	0	2.5	0	1.2	0
07/16/70	0	0	0	0	0	0	0	0
07/29/70	0	0	0	0	0	0	0	0
08/13/70	0	0	0	0	0	0	0	0
08/23/70	0	0	0	0	0	0	0	0
09/11/70	0	0	0	0	0	0	0	0
09/25/70	0	0	0	0	0	0	0	0
10/20/70	12.7	0	0	0	0	0	0	0
12/04/70	0	0	0	0	0	0	0	0
01/06/71	0	0	0	0	0	0	0	0
02/16/71	0	0	0	0	0	0	0	0
03/30/71	0	0	0	0	0	0	0	0
05/03/71	0	0	0	0	0	0	0	0
05/14/71	0	0	0	0	0	0	0	0
05/19/71	0	0	0	0	0	0	0	0
06/02/71	0	0	0	0	0	0	0	0
06/12/71	5.2	0	0	0	0	0	0	0
06/26/71	0	0	0	0	0	0	0	0
07/06/71	0	0	0	0	0	0	0	0
07/21/71	0	0	0	0	0	0	0	0
08/02/71	0	0	0	0	0	0	0	0
08/19/71	0	0	0	0	0	0	0	0
09/23/71	2.1	0	0	0	0	0	0	0
10/11/71	8.2	0	0	0	0	0	0	0
11/06/71	0	0	0	0	0	0	0	0
12/07/71	0	0	0	0	0	0	0	0
03/15/72	0	0	0	0	0	0	0	0
04/20/72	5.3	0	0	0	0	0	0	0
05/11/72	0	0	0	0	0	0	0	0
06/20/72	0	0	0	0	0	0	0	0
07/21/72	0	0	0	0	0	0	0	0
08/05/72	0	0	0	0	0	0	0	0

NUMBER PER CUBIC METER OF EVAONE AT EARLY LIFE HISTORY STATIONS

DATE	NH01		NH03		NH05		NH10	
	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES
06/22/69	0	0	0	0	0	0	0	0
06/29/69	75.4	0	0	0	0	0	3.8	0
07/10/69	58.6	0	2.1	0	40.4	0	0	0
07/18/69	11.8	0	0	0	23.1	0	1.3	0
07/25/69	0	0	0	0	4.8	0	0	0
08/06/69	0	0	0	0	1.3	0	0	0
08/30/69	0	0	50.7	0	36.8	0	0	0
09/03/69	2.6	0	1.6	0	8.2	0	0	0
09/14/69	0	0	0	0	0	0	0	0
09/28/69	0	0	1.6	0	0	0	0	0
10/08/69	4.2	0	0	0	0	0	0	0
10/29/69	0	0	0	0	0	0	0	0
12/29/69	0	0	0	0	0	0	0	0
01/29/70	0	0	0	0	0	0	0	0
02/25/70	0	0	0	0	0	0	0	0
04/27/70	0	0	0	0	0	0	0	0
05/06/70	1.5	0	0	0	0	0	0	0
06/04/70	16.8	0	57.5	0	0	0	1.2	0
06/23/70	127.8	0	4.0	0	7.5	0	0	0
07/02/70	19.2	0	33.7	0	23.3	0	0	0
07/16/70	11.0	0	1.4	0	15.4	0	0	0
07/29/70	0	0	4.0	0	1.0	0	0	0
08/13/70	0	0	23.2	0	0	0	9.8	0
08/23/70	0	0	6.0	0	0	0	15.0	0
09/11/70	0	0	0	0	0	0	0	0
09/25/70	81.9	0	0	0	0	0	0	0
10/20/70	17.9	0	0	0	0	0	0	0
12/04/70	0	0	0	0	0	0	0	0
01/06/71	0	0	0	0	0	0	0	0
02/16/71	0	0	0	0	0	0	0	0
03/30/71	0	0	0	0	0	0	0	0
05/03/71	0	0	0	0	0	0	0	0
05/14/71	0	0	0	0	0	0	0	0
05/29/71	0	0	0	0	0	0	0	0
06/02/71	0	0	0	0	0	0	0	0
06/12/71	7.0	0	0	0	2.0	0	0	0
06/28/71	0	0	0	0	0	0	0	0
07/06/71	0	0	0	0	0	0	0	0
07/21/71	0	0	0	0	0	0	0	0
08/02/71	0	0	0	0	0	0	0	0
08/19/71	0	0	0	0	0	0	0	0
09/23/71	0	0	0	0	0	0	0	0
10/11/71	0	0	0	0	0	0	0	0
11/06/71	0	0	0	0	0	0	0	0
12/07/71	1.2	0	1.2	0	1.0	0	1.4	0
01/15/72	0	0	0	0	0	0	0	0
04/20/72	0	0	0	0	0	0	0	0
05/22/72	0	0	0	0	0	0	0	0
06/11/72	0	0	0	0	0	0	0	0
06/28/72	0	0	0	0	0	0	0	0
07/21/72	0	0	0	0	0	0	0	0
08/05/72	0	0	0	0	0	0	0	0

NUMBER PER CURIC METER OF PODON AT EARLY LIFE HISTORY STATIONS

DATE	NH01	NH03	NH05	NH10
	MALES	MALES	MALES	MALES
	FEMALES	FEMALES	FEMALES	FEMALES
	IMPS	IMPS	IMPS	IMPS
06/22/69	0	0	0	0
06/29/69	0	0	0	0
07/10/69	0	1.5	0	1.3
07/18/69	0	0	0	0
07/25/69	0	0	0	0
08/06/69	0	0	0	0
08/26/69	0	0	0	0
08/30/69	0	0	0	0
09/03/69	0	0	0	0
09/14/69	0	0	0	0
09/28/69	0	0	0	0
10/08/69	63.9	11.0	48.0	3.4
10/29/69	0	0	0	0
12/02/69	0	0	0	0
12/29/69	0	0	0	0
01/22/70	0	0	0	0
04/27/70	0	0	0	0
05/06/70	0	0	0	0
05/22/70	0	0	0	0
06/04/70	0	0	0	0
06/23/70	0	2.8	0	0
07/02/70	0	4.2	1.2	0
07/16/70	0	9.6	8.2	0
07/29/70	0	0	0	0
08/13/70	0	0	0	0
08/23/70	0	33.9	4.1	2.7
09/11/70	18.8	6.6	0	0
09/25/70	181.7	0	0	0
10/20/70	20.7	0	0	0
11/04/70	0	0	0	0
12/16/71	0	0	0	0
01/30/71	0	0	0	0
03/30/71	0	0	0	0
05/03/71	0	0	0	0
05/14/71	0	0	0	0
05/29/71	0	0	0	0
06/02/71	5.2	0	0	0
06/12/71	0	0	0	0
06/26/71	0	0	0	0
07/06/71	0	0	0	0
07/21/71	0	0	0	0
08/02/71	0	0	0	0
08/19/71	0	0	0	0
09/23/71	0	0	0	0
10/11/71	0	0	0	0
11/06/71	36.4	51.8	18.1	10.1
12/07/71	0	0	0	0
10/31/72	4.4	2.7	1.0	0
04/20/72	0	0	0	0
05/22/72	0	0	0	0
06/11/72	0	0	0	0
06/28/72	0	0	0	0
07/21/72	0	0	0	0
08/05/72	0	0	0	0

NUMBER PER CUBIC METER OF PTEROCHS AT EARLY LIFE HISTORY STATIONS

DATE	NH01	NH03	NH05	NH10
	MALES	MALES	MALES	MALES
	FEMALES	FEMALES	FEMALES	FEMALES
	IMFS	IMFS	IMFS	IMFS
05/22/69	00	00	00	00
06/29/69	00	13.9	00	00
07/10/69	00	2.1	00	00
07/25/69	00	00	1.3	00
08/06/69	00	00	4.1	00
08/26/69	00	00	00	00
09/03/69	00	00	00	00
09/14/69	00	00	00	00
09/28/69	00	00	00	00
10/04/69	00	00	00	00
10/29/69	00	00	00	00
11/29/70	00	00	00	00
01/22/71	00	00	00	00
02/29/71	00	00	00	00
04/22/71	00	00	00	00
05/06/71	00	00	00	00
06/04/71	00	00	00	00
06/23/71	00	00	00	00
07/02/71	00	00	00	00
07/16/71	00	00	00	00
07/29/71	00	00	00	00
08/13/71	00	00	00	00
08/23/71	00	00	00	00
09/11/71	00	00	00	00
09/25/71	00	00	00	00
10/06/71	00	00	00	00
10/21/71	00	00	00	00
11/07/71	00	00	00	00
12/15/71	00	00	00	00
01/22/72	00	00	00	00
02/29/72	00	00	00	00
03/11/72	00	00	00	00
03/28/72	00	00	00	00
04/11/72	00	00	00	00
04/28/72	00	00	00	00
05/11/72	00	00	00	00
05/28/72	00	00	00	00
06/11/72	00	00	00	00
06/28/72	00	00	00	00
07/11/72	00	00	00	00
07/28/72	00	00	00	00
08/11/72	00	00	00	00
08/28/72	00	00	00	00
09/11/72	00	00	00	00
09/28/72	00	00	00	00
10/11/72	00	00	00	00
10/28/72	00	00	00	00
11/11/72	00	00	00	00
11/28/72	00	00	00	00
12/11/72	00	00	00	00
12/28/72	00	00	00	00
01/11/73	00	00	00	00
01/28/73	00	00	00	00
02/11/73	00	00	00	00
02/28/73	00	00	00	00
03/11/73	00	00	00	00
03/28/73	00	00	00	00
04/11/73	00	00	00	00
04/28/73	00	00	00	00
05/11/73	00	00	00	00
05/28/73	00	00	00	00
06/11/73	00	00	00	00
06/28/73	00	00	00	00
07/11/73	00	00	00	00
07/28/73	00	00	00	00
08/11/73	00	00	00	00
08/28/73	00	00	00	00
09/11/73	00	00	00	00
09/28/73	00	00	00	00
10/11/73	00	00	00	00
10/28/73	00	00	00	00
11/11/73	00	00	00	00
11/28/73	00	00	00	00
12/11/73	00	00	00	00
12/28/73	00	00	00	00
01/11/74	00	00	00	00
01/28/74	00	00	00	00
02/11/74	00	00	00	00
02/28/74	00	00	00	00
03/11/74	00	00	00	00
03/28/74	00	00	00	00
04/11/74	00	00	00	00
04/28/74	00	00	00	00
05/11/74	00	00	00	00
05/28/74	00	00	00	00
06/11/74	00	00	00	00
06/28/74	00	00	00	00
07/11/74	00	00	00	00
07/28/74	00	00	00	00
08/11/74	00	00	00	00
08/28/74	00	00	00	00
09/11/74	00	00	00	00
09/28/74	00	00	00	00
10/11/74	00	00	00	00
10/28/74	00	00	00	00
11/11/74	00	00	00	00
11/28/74	00	00	00	00
12/11/74	00	00	00	00
12/28/74	00	00	00	00
01/11/75	00	00	00	00
01/28/75	00	00	00	00
02/11/75	00	00	00	00
02/28/75	00	00	00	00
03/11/75	00	00	00	00
03/28/75	00	00	00	00
04/11/75	00	00	00	00
04/28/75	00	00	00	00
05/11/75	00	00	00	00
05/28/75	00	00	00	00
06/11/75	00	00	00	00
06/28/75	00	00	00	00
07/11/75	00	00	00	00
07/28/75	00	00	00	00
08/11/75	00	00	00	00
08/28/75	00	00	00	00
09/11/75	00	00	00	00
09/28/75	00	00	00	00
10/11/75	00	00	00	00
10/28/75	00	00	00	00
11/11/75	00	00	00	00
11/28/75	00	00	00	00
12/11/75	00	00	00	00
12/28/75	00	00	00	00
01/11/76	00	00	00	00
01/28/76	00	00	00	00
02/11/76	00	00	00	00
02/28/76	00	00	00	00
03/11/76	00	00	00	00
03/28/76	00	00	00	00
04/11/76	00	00	00	00
04/28/76	00	00	00	00
05/11/76	00	00	00	00
05/28/76	00	00	00	00
06/11/76	00	00	00	00
06/28/76	00	00	00	00
07/11/76	00	00	00	00
07/28/76	00	00	00	00
08/11/76	00	00	00	00
08/28/76	00	00	00	00
09/11/76	00	00	00	00
09/28/76	00	00	00	00
10/11/76	00	00	00	00
10/28/76	00	00	00	00
11/11/76	00	00	00	00
11/28/76	00	00	00	00
12/11/76	00	00	00	00
12/28/76	00	00	00	00
01/11/77	00	00	00	00
01/28/77	00	00	00	00
02/11/77	00	00	00	00
02/28/77	00	00	00	00
03/11/77	00	00	00	00
03/28/77	00	00	00	00
04/11/77	00	00	00	00
04/28/77	00	00	00	00
05/11/77	00	00	00	00
05/28/77	00	00	00	00
06/11/77	00	00	00	00
06/28/77	00	00	00	00
07/11/77	00	00	00	00
07/28/77	00	00	00	00
08/11/77	00	00	00	00
08/28/77	00	00	00	00
09/11/77	00	00	00	00
09/28/77	00	00	00	00
10/11/77	00	00	00	00
10/28/77	00	00	00	00
11/11/77	00	00	00	00
11/28/77	00	00	00	00
12/11/77	00	00	00	00
12/28/77	00	00	00	00
01/11/78	00	00	00	00
01/28/78	00	00	00	00
02/11/78	00	00	00	00
02/28/78	00	00	00	00
03/11/78	00	00	00	00
03/28/78	00	00	00	00
04/11/78	00	00	00	00
04/28/78	00	00	00	00
05/11/78	00	00	00	00
05/28/78	00	00	00	00
06/11/78	00	00	00	00
06/28/78	00	00	00	00
07/11/78	00	00	00	00
07/28/78	00	00	00	00
08/11/78	00	00	00	00
08/28/78	00	00	00	00
09/11/78	00	00	00	00
09/28/78	00	00	00	00
10/11/78	00	00	00	00
10/28/78	00	00	00	00
11/11/78	00	00	00	00
11/28/78	00	00	00	00
12/11/78	00	00	00	00
12/28/78	00	00	00	00
01/11/79	00	00	00	00
01/28/79	00	00	00	00
02/11/79	00	00	00	00
02/28/79	00	00	00	00
03/11/79	00	00	00	00
03/28/79	00	00	00	00
04/11/79	00	00	00	00
04/28/79	00	00	00	00
05/11/79	00	00	00	00
05/28/79	00	00	00	00
06/11/79	00	00	00	00
06/28/79	00	00	00	00
07/11/79	00	00	00	00
07/28/79	00	00	00	00
08/11/79	00	00	00	00
08/28/79	00	00	00	00
09/11/79	00	00	00	00
09/28/79	00	00	00	00
10/11/79	00	00	00	00
10/28/79	00	00	00	00
11/11/79	00	00	00	00
11/28/79	00	00	00	00
12/11/79	00	00	00	00
12/28/79	00	00	00	00
01/11/80	00	00	00	00
01/28/80	00	00	00	00
02/11/80	00	00	00	00
02/28/80	00	00	00	00
03/11/80	00	00	00	00
03/28/80	00	00	00	00
04/11/80	00	00	00	00
04/28/80	00	00	00	00
05/11/80	00	00	00	00
05/28/80	00	00	00	00
06/11/80	00	00	00	00
06/28/80	00	00	00	00
07/11/80	00	00	00	00
07/28/80	00	00	00	00
08/11/80	00	00	00	00
08/28/80	00	00	00	00
09/11/80	00	00	00	00
09/28/80	00	00	00	00
10/11/80	00	00	00	00
10/28/80	00	00	00	00
11/11/80	00	00	00	00
11/28/80	00	00	00	00
12/11/80	00	00	00	00
12/28/80	00	00	00	00
01/11/81	00	00	00	00
01/28/81	00	00	00	00
02/11/81	00	00	00	00
02/28/81	00	00	00	00
03/11/81	00	00	00	00
03/28/81	00	00	00	00
04/11/81	00	00	00	00
04/28/81	00	00	00	00
05/11/81	00	00	00	00
05/28/81	00	00	00	00
06/11/81	00	00	00	00
06/28/81	00	00	00	00
07/11/81	00	00	00	00
07/28/81	00	00	00	00
08/11/81	00	00	00	00
08/28/81	00	00	00	00
09/11/81	00	00	00	00
09/28/81	00	00	00	00
10/11/81	00	00	00	00
10/28/81	00	00	00	00

NUMBER PER CUBIC METER OF CHAETOGNATHS AT EARLY LIFE HISTORY STATIONS

DATE	NH01			NH03			NH05			NH10		
	MALES	FEMALES	IMPS	MALES	FEMALES	IMPS	MALES	FEMALES	IMPS	MALES	FEMALES	IMPS
06/22/69	54.4	23.9	0	57.0	0	0	8.5	0	0	3.8	0	0
07/10/69	48.5	47.4	0	47.4	0	0	24.2	0	0	14.0	0	0
07/18/69	105.6	12.3	0	12.3	0	0	26.4	0	0	3.6	0	0
08/06/69	5.0	0	0	0	0	0	5.0	0	0	1.0	0	0
08/26/69	0	0	0	0	0	0	0	0	0	0	0	0
08/30/69	0	0	0	0	0	0	0	0	0	0	0	0
09/03/69	0	0	0	0	0	0	0	0	0	0	0	0
09/14/69	0	0	0	0	0	0	0	0	0	0	0	0
09/28/69	0	0	0	0	0	0	0	0	0	0	0	0
10/08/69	0	0	0	0	0	0	0	0	0	0	0	0
10/29/69	1.7	16.3	0	16.3	0	0	1.7	0	0	2.5	0	0
12/02/69	2.2	11.4	0	11.4	0	0	2.2	0	0	4.5	0	0
12/29/69	2.4	11.4	0	11.4	0	0	2.4	0	0	5.1	0	0
01/25/70	1.1	17.4	0	17.4	0	0	1.1	0	0	2.3	0	0
05/06/70	1.0	5.8	0	5.8	0	0	1.0	0	0	3.5	0	0
05/22/70	0	15.3	0	15.3	0	0	0	0	0	0	0	0
06/04/70	0	2.0	0	2.0	0	0	0	0	0	0	0	0
06/23/70	0	8.5	0	8.5	0	0	0	0	0	0	0	0
07/02/70	0	1.2	0	1.2	0	0	0	0	0	0	0	0
07/16/70	0	6.2	0	6.2	0	0	0	0	0	0	0	0
07/29/70	0	0	0	0	0	0	0	0	0	0	0	0
08/13/70	1.6	0	0	0	0	0	1.6	0	0	1.7	0	0
09/15/70	7.8	0	0	0	0	0	7.8	0	0	2.1	0	0
09/20/70	4.4	0	0	0	0	0	4.4	0	0	2.4	0	0
10/20/70	1.2	0	0	0	0	0	1.2	0	0	0	0	0
12/06/71	2.2	0	0	0	0	0	2.2	0	0	0	0	0
03/30/71	1.7	0	0	0	0	0	1.7	0	0	0	0	0
05/03/71	0	0	0	0	0	0	0	0	0	0	0	0
05/14/71	0	0	0	0	0	0	0	0	0	0	0	0
05/29/71	0	0	0	0	0	0	0	0	0	0	0	0
06/02/71	0	0	0	0	0	0	0	0	0	0	0	0
06/12/71	7.0	0	0	0	0	0	7.0	0	0	0	0	0
06/28/71	1.6	0	0	0	0	0	1.6	0	0	0	0	0
07/06/71	0	0	0	0	0	0	0	0	0	0	0	0
07/21/71	0	0	0	0	0	0	0	0	0	0	0	0
08/02/71	1.0	0	0	0	0	0	1.0	0	0	0	0	0
08/19/71	0	0	0	0	0	0	0	0	0	0	0	0
09/27/71	2.0	0	0	0	0	0	2.0	0	0	0	0	0
11/06/71	0	0	0	0	0	0	0	0	0	0	0	0
12/07/71	0	0	0	0	0	0	0	0	0	0	0	0
03/15/72	0	0	0	0	0	0	0	0	0	0	0	0
04/22/72	0	0	0	0	0	0	0	0	0	0	0	0
05/11/72	0	0	0	0	0	0	0	0	0	0	0	0
06/18/72	0	0	0	0	0	0	0	0	0	0	0	0
07/21/72	0	0	0	0	0	0	0	0	0	0	0	0
08/10/72	0	0	0	0	0	0	0	0	0	0	0	0

NUMBER PER CUBIC METER OF CIKOPLEURA AT EARLY LIFE HISTORY STATIONS

DATE	NH01		NH03		NH05		NH10	
	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES
05/22/69	0	0	2	0	2	0	2	0
05/29/69	21	0	6	0	21	0	2	0
07/10/69	14	0	0	0	13	0	0	0
07/25/69	0	0	0	0	0	0	0	0
08/06/69	0	0	0	0	0	0	0	0
08/26/69	0	0	0	0	0	0	0	0
09/30/69	0	0	0	0	0	0	0	0
09/14/69	0	0	0	0	0	0	0	0
09/28/69	0	0	0	0	0	0	0	0
10/08/69	87	1	59	0	1	0	0	0
10/20/69	1	0	187	0	386	0	170	0
12/22/69	0	0	15	0	10	0	15	0
01/29/70	3	4	1	0	2	0	1	0
02/25/70	87	5	2	0	4	0	2	0
03/06/70	1	10	40	0	108	0	16	0
05/22/70	0	0	5	0	34	0	0	0
06/04/70	0	0	0	0	0	0	0	0
06/23/70	0	0	0	0	0	0	0	0
07/02/70	0	0	0	0	0	0	0	0
07/16/70	0	0	0	0	0	0	0	0
07/29/70	0	0	4	0	0	0	0	0
08/13/70	0	0	0	0	0	0	0	0
08/23/70	0	0	0	0	0	0	0	0
09/15/70	1	0	0	0	0	0	0	0
10/04/70	16	4	11	0	10	0	1	0
10/16/71	4	0	17	0	3	0	1	0
03/16/71	25	7	14	0	20	0	1	0
03/30/71	40	0	7	0	3	0	0	0
05/03/71	1	0	14	0	14	0	14	0
05/14/71	0	0	6	0	6	0	5	0
06/02/71	0	0	0	0	0	0	0	0
06/12/71	0	0	0	0	0	0	0	0
07/06/71	31	0	5	0	20	0	0	0
07/21/71	0	0	0	0	0	0	0	0
09/02/71	0	0	0	0	0	0	0	0
09/19/71	0	0	0	0	0	0	0	0
09/23/71	0	0	0	0	0	0	0	0
10/11/71	0	0	0	0	0	0	0	0
11/07/71	0	0	0	0	0	0	0	0
01/15/72	22	0	5	0	27	0	1	0
03/22/72	0	0	0	0	0	0	0	0
06/18/72	0	0	0	0	0	0	0	0
07/21/72	0	0	0	0	0	0	0	0
09/05/72	0	0	0	0	0	0	0	0

NUMBER PER CUEIC PLTER OF CTENOPHORES AT EARLY LIFE HISTORY STATIONS

DATE	NH01		NH03		NH05		NH10	
	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES
06/22/69	0	0	4.0	0	0	0	1.6	0
06/29/69	0	0	1.5	0	0	0	1.3	0
07/10/69	0	0	2.1	0	2.7	0	0	0
07/18/69	0	0	0	0	0	0	0	0
08/06/69	0	0	0	0	0	0	0	0
08/26/69	0	0	0	0	0	0	0	0
08/30/69	0	0	0	0	0	0	0	0
09/03/69	0	0	0	0	0	0	0	0
09/14/69	0	0	0	0	0	0	0	0
09/28/69	0	0	0	0	0	0	0	0
10/08/69	0	0	0	0	0	0	0	0
12/02/69	0	0	0	0	0	0	0	0
12/29/69	0	0	0	0	0	0	0	0
01/29/70	0	0	6.0	0	0	0	0	0
02/25/70	0	0	0	0	0	0	0	0
04/22/70	0	0	0	0	0	0	0	0
05/06/70	0	0	0	0	0	0	0	0
05/20/70	0	0	0	0	0	0	0	0
07/02/70	0	0	0	0	0	0	0	0
07/15/70	0	0	0	0	0	0	0	0
07/29/70	0	0	0	0	0	0	0	0
08/13/70	0	0	0	0	0	0	0	0
09/23/70	0	0	0	0	0	0	0	0
09/31/70	0	0	0	0	0	0	0	0
10/20/70	0	0	0	0	0	0	0	0
12/04/70	0	0	0	0	0	0	0	0
01/06/71	0	0	0	0	0	0	0	0
02/16/71	0	0	3.6	0	1.5	0	0	0
03/30/71	0	0	1.8	0	2.7	0	0	0
05/03/71	0	0	19.8	0	26.7	0	2.7	0
05/14/71	0	0	17.6	0	22.7	0	3.4	0
06/02/71	0	0	22.8	0	8.9	0	0	0
06/12/71	0	0	0	0	1.9	0	0	0
06/28/71	0	0	0	0	1.1	0	0	0
07/06/71	0	0	0	0	0	0	0	0
07/22/71	0	0	0	0	0	0	0	0
09/02/71	0	0	0	0	0	0	0	0
08/19/71	0	0	2.5	0	0	0	0	0
09/23/71	0	0	1.6	0	0	0	0	0
10/11/71	0	0	0	0	0	0	0	0
11/07/71	0	0	0	0	0	0	0	0
03/15/72	0	0	0	0	0	0	0	0
04/22/72	0	0	16.4	0	0	0	0	0
05/22/72	0	0	14.5	0	0	0	0	0
06/11/72	0	0	0	0	0	0	0	0
06/28/72	0	0	0	0	0	0	0	0
07/21/72	0	0	0	0	0	0	0	0
08/30/72	0	0	0	0	0	0	0	0

NUMBER PER CUBIC METER OF SCYPHOMEDUSAE AT EARLY LIFE HISTORY STATIONS

DATE	NH01		NH03		NH05		NH10	
	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES
06/22/69	12.1	0	8.0	0	1.4	0	3.0	0
06/29/69	10.8	0	1.5	0	0	0	0	0
07/10/69	11.0	0	13.0	0	1.3	0	0	0
07/25/69	0	0	2.0	0	0	0	0	0
08/06/69	0	0	4.9	0	0	0	0	0
08/26/69	0	0	10.2	0	2.0	0	0	0
09/30/69	0	0	0	0	0	0	0	0
09/14/69	0	0	2.0	0	0	0	0	0
09/28/69	0	0	0	0	0	0	0	0
10/08/69	0	0	0	0	0	0	0	0
10/20/69	0	0	0	0	0	0	0	0
12/02/69	0	0	0	0	0	0	0	0
12/29/70	0	0	0	0	0	0	0	0
01/22/70	0	0	0	0	0	0	0	0
04/27/70	0	0	0	0	0	0	0	0
05/06/70	0	0	0	0	0	0	0	0
05/22/70	5.0	0	14.1	0	0	0	0	0
06/02/70	3.8	0	15.7	0	0	0	0	0
06/23/70	3.7	0	8.2	0	2.0	0	0	0
07/02/70	0	0	1.0	0	0	0	0	0
07/16/70	0	0	0	0	0	0	0	0
08/13/70	15.1	0	1.4	0	0	0	0	0
08/27/70	19.0	0	3.1	0	0	0	0	0
09/11/70	2.4	0	17.2	0	0	0	0	0
09/25/70	0	0	0	0	0	0	0	0
10/20/70	0	0	0	0	0	0	0	0
12/06/71	1.1	0	0	0	0	0	0	0
01/16/71	0	0	0	0	0	0	0	0
03/30/71	5.2	0	1.0	0	0	0	0	0
05/03/71	1.0	0	0	0	0	0	0	0
05/19/71	0	0	0	0	0	0	0	0
05/22/71	0	0	0	0	0	0	0	0
05/28/71	12.0	0	1.0	0	0	0	0	0
07/06/71	18.1	0	3.0	0	0	0	0	0
07/21/71	12.7	0	0	0	0	0	0	0
08/02/71	0	0	0	0	0	0	0	0
08/19/71	0	0	0	0	0	0	0	0
09/11/71	0	0	0	0	0	0	0	0
10/07/71	12.0	0	10.2	0	0	0	0	0
11/05/71	0	0	0	0	0	0	0	0
03/15/72	13.0	0	21.0	0	0	0	0	0
05/22/72	0	0	0	0	0	0	0	0
06/11/72	0	0	0	0	0	0	0	0
06/21/72	0	0	0	0	0	0	0	0
08/05/72	0	0	0	0	0	0	0	0

NUMBER PER CURIC METER OF DECAPOD MYXIS AT EARLY LIFE HISTORY STATIONS

DATE	NH01			NH03			NH05			NH12		
	MALES	FEMALES	IMPS	MALES	FEMALES	IMPS	MALES	FEMALES	IMPS	MALES	FEMALES	IMPS
06/22/69	48.4	0	0	2.3	0	0	2.8	0	0	0	0	0
06/29/69	5.7	0	0	2.0	0	0	2.7	0	0	0	0	0
07/10/69	14.8	0	0	620.5	0	0	0	0	0	0	0	0
07/25/69	17.9	0	0	121.1	0	0	0	0	0	0	0	0
08/06/69	2.4	0	0	6.8	0	0	2.0	0	0	0	0	0
08/26/69	2.6	0	0	2.0	0	0	0	0	0	0	0	0
09/03/69	0	0	0	0	0	0	0	0	0	0	0	0
09/14/69	0	0	0	0	0	0	0	0	0	0	0	0
09/28/69	0	0	0	0	0	0	0	0	0	0	0	0
10/08/69	0	0	0	0	0	0	0	0	0	0	0	0
10/29/69	0	0	0	0	0	0	0	0	0	0	0	0
12/02/69	0	0	0	0	0	0	0	0	0	0	0	0
12/29/69	0	0	0	0	0	0	0	0	0	0	0	0
01/29/70	1.7	0	0	0	0	0	0	0	0	0	0	0
02/25/70	5.4	0	0	0	0	0	0	0	0	0	0	0
04/27/70	5.7	0	0	4.3	0	0	0	0	0	0	0	0
05/06/70	10.2	0	0	13.7	0	0	0	0	0	0	0	0
05/22/70	15.5	0	0	43.2	0	0	0	0	0	0	0	0
06/04/70	192.5	0	0	12.4	0	0	6.0	0	0	0	0	0
07/02/70	16.4	0	0	0	0	0	0	0	0	0	0	0
07/16/70	15.1	0	0	0	0	0	0	0	0	0	0	0
07/29/70	18.3	0	0	0	0	0	0	0	0	0	0	0
08/13/70	12.7	0	0	0	0	0	0	0	0	0	0	0
08/23/70	3.2	0	0	0	0	0	0	0	0	0	0	0
09/11/70	0.5	0	0	0	0	0	0	0	0	0	0	0
09/25/70	46.5	0	0	0	0	0	0	0	0	0	0	0
10/20/70	8.3	0	0	0	0	0	0	0	0	0	0	0
12/04/70	6.3	0	0	0	0	0	0	0	0	0	0	0
01/16/71	72.5	0	0	0	0	0	0	0	0	0	0	0
03/30/71	28.6	0	0	0	0	0	0	0	0	0	0	0
05/14/71	0	0	0	0	0	0	0	0	0	0	0	0
05/29/71	0	0	0	0	0	0	0	0	0	0	0	0
06/02/71	0	0	0	0	0	0	0	0	0	0	0	0
06/12/71	0	0	0	0	0	0	0	0	0	0	0	0
06/28/71	0	0	0	0	0	0	0	0	0	0	0	0
07/06/71	44.8	0	0	0	0	0	0	0	0	0	0	0
07/21/71	69.9	0	0	0	0	0	0	0	0	0	0	0
08/02/71	21.4	0	0	0	0	0	0	0	0	0	0	0
08/19/71	0	0	0	0	0	0	0	0	0	0	0	0
09/23/71	1.6	0	0	0	0	0	0	0	0	0	0	0
10/11/71	5.5	0	0	0	0	0	0	0	0	0	0	0
11/06/71	0	0	0	0	0	0	0	0	0	0	0	0
12/07/71	0	0	0	0	0	0	0	0	0	0	0	0
03/15/72	0	0	0	0	0	0	0	0	0	0	0	0
04/20/72	0	0	0	0	0	0	0	0	0	0	0	0
05/22/72	12.6	0	0	0	0	0	0	0	0	0	0	0
06/11/72	14.3	0	0	0	0	0	0	0	0	0	0	0
06/28/72	10.2	0	0	0	0	0	0	0	0	0	0	0
08/05/72	199.1	0	0	0	0	0	0	0	0	0	0	0

NUMBER PER CUBIC METER OF BARNACLE NAUP AT EARLY LIFE HISTORY STATIONS

DATE	NH01		NH03		NH05		NH10	
	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES
06/22/69	0	0	2	0	2	0	2	0
06/28/69	70	0	32	0	18	0	2	0
07/10/69	14	0	0	0	0	0	0	0
07/18/69	0	0	0	0	0	0	0	0
07/25/69	0	0	0	0	0	0	0	0
08/06/69	0	0	0	0	0	0	0	0
08/26/69	0	0	0	0	0	0	0	0
08/30/69	1	0	0	0	0	0	0	0
09/14/69	0	0	0	0	0	0	0	0
09/28/69	0	0	0	0	0	0	0	0
10/08/69	20	4	5	7	17	7	0	0
10/29/69	0	2	4	0	0	0	0	0
12/29/69	0	0	8	0	0	0	0	0
01/22/70	592	5	257	1	87	5	13	8
04/27/70	2	6	5	0	9	0	0	0
05/06/70	0	0	0	0	0	0	0	0
05/22/70	130	7	3	1	5	5	0	4
06/04/70	22	3	45	2	6	8	4	4
06/23/70	259	5	4	0	8	0	1	8
07/02/70	51	1	16	6	5	2	0	0
07/16/70	0	0	0	0	0	0	0	0
07/19/70	55	3	0	0	0	0	0	0
08/13/70	0	0	0	0	0	0	0	0
08/23/70	62	8	296	1	10	4	45	0
09/15/70	140	4	14	3	19	4	0	0
09/20/70	0	0	21	0	0	0	0	0
10/04/70	0	0	0	0	0	0	0	0
11/06/71	5	6	0	0	0	0	0	0
02/16/71	14	6	1	0	4	3	0	0
03/30/71	11	1	8	0	5	3	0	0
05/14/71	0	0	1	0	4	0	0	0
05/29/71	0	0	1	0	0	0	0	0
06/02/71	1105	3	120	0	85	0	2	7
06/12/71	53	0	0	0	0	0	0	0
07/06/71	0	0	0	0	0	0	0	0
07/21/71	106	2	1	0	0	0	0	0
08/02/71	154	0	47	0	1	0	0	0
08/19/71	127	0	14	0	7	8	0	0
09/23/71	229	4	68	0	35	2	3	0
10/07/71	0	0	1	5	0	4	0	0
10/15/72	1	0	1	0	0	0	0	0
04/22/72	60	7	95	0	5	4	0	0
05/11/72	46	7	0	0	6	9	0	0
06/11/72	10	7	9	0	0	0	8	0
06/20/72	36	7	0	0	4	0	0	0
07/21/72	146	7	0	0	0	6	0	0
08/05/72	0	7	0	0	0	0	0	0

NUMBER PER CUBIC METER OF GASTRO VELIGERS AT EARLY LIFE HISTORY STATIONS

DATE	NH01			NH03			NH05			NH10		
	MALES	FEMALES	IMPS	MALES	FEMALES	IMPS	MALES	FEMALES	IMPS	MALES	FEMALES	IMPS
06/22/69	0	0	0	4	0	0	2	8	0	0	0	0
06/29/69	32	0	0	0	0	0	5	4	0	0	0	0
07/10/69	0	0	0	0	0	0	3	0	0	0	0	0
07/18/69	0	0	0	2	1	0	1	3	0	0	0	0
08/06/69	0	0	0	3	4	0	6	1	0	0	0	0
08/26/69	9	7	0	3	0	0	2	7	0	0	0	0
09/03/69	7	0	0	14	5	0	35	6	0	0	0	0
09/14/69	0	0	0	2	0	0	12	6	0	0	0	0
09/28/69	7	9	0	2	0	0	3	4	0	0	0	0
10/08/69	5	2	0	10	7	0	1	2	0	0	0	0
10/29/69	2	0	0	1	0	0	1	2	0	0	0	0
12/29/70	22	0	0	10	7	0	1	2	0	0	0	0
01/25/70	7	0	0	10	2	0	1	7	0	0	0	0
04/27/70	0	0	0	4	0	0	0	0	0	0	0	0
05/06/70	4	4	0	4	0	0	1	0	0	0	0	0
05/22/70	33	2	0	4	2	0	5	1	2	0	0	0
06/10/70	17	3	0	12	0	0	1	2	0	0	0	0
07/02/70	0	0	0	1	0	0	1	2	0	0	0	0
07/16/70	7	0	0	1	0	0	1	2	0	0	0	0
08/13/70	0	0	0	1	0	0	4	0	0	0	0	0
08/27/70	21	0	0	1	0	0	5	1	2	0	0	0
09/11/70	17	5	0	2	0	0	1	2	0	0	0	0
09/25/70	1	5	0	4	0	0	1	4	0	0	0	0
10/20/70	4	9	0	4	0	0	16	4	0	0	0	0
10/06/71	0	0	0	4	0	0	1	4	0	0	0	0
10/30/71	3	3	0	10	0	0	1	4	0	0	0	0
05/03/71	30	2	0	2	0	0	2	7	0	0	0	0
05/19/71	4	2	0	2	0	0	1	0	0	0	0	0
05/22/71	0	0	0	1	0	0	1	2	0	0	0	0
06/02/71	5	4	0	1	0	0	1	4	0	0	0	0
06/12/71	30	4	0	1	0	0	1	4	0	0	0	0
06/28/71	0	0	0	1	0	0	1	4	0	0	0	0
07/06/71	0	0	0	1	0	0	2	0	0	0	0	0
07/21/71	0	0	0	0	0	0	2	0	0	0	0	0
08/02/71	1	0	0	0	0	0	2	0	0	0	0	0
08/19/71	2	2	0	0	0	0	0	0	0	0	0	0
09/03/71	3	5	0	2	0	0	5	1	0	0	0	0
10/16/71	5	0	0	2	0	0	1	4	0	0	0	0
11/07/71	0	6	0	1	2	0	5	1	0	0	0	0
03/15/72	0	6	0	1	2	0	5	1	0	0	0	0
04/20/72	1	5	0	5	0	0	1	1	0	0	0	0
05/11/72	1	5	0	1	0	0	1	1	0	0	0	0
06/28/72	4	1	0	1	0	0	1	1	0	0	0	0
07/25/72	4	1	0	1	0	0	1	1	0	0	0	0

NUMBER PER CUBIC METER OF PLUTEUS AT EARLY LIFE HISTORY STATIONS

DATE	NH01		NH03		NH05		NH10	
	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES
06/22/69	0	0	0	0	0	0	0	0
06/29/69	0	0	0	0	0	0	0	0
07/10/69	0	0	0	0	0	0	0	0
07/18/69	0	0	0	0	0	0	0	0
07/25/69	0	0	0	0	0	0	0	0
08/06/69	0	0	0	0	0	0	0	0
08/26/69	0	0	0	0	0	0	0	0
09/03/69	0	0	0	0	0	0	0	0
09/14/69	0	0	0	0	0	0	0	0
09/28/69	0	0	0	0	0	0	0	0
10/08/69	0	0	0	0	0	0	0	0
10/29/69	0	0	0	0	0	0	0	0
12/02/69	0	0	0	0	0	0	0	0
12/29/69	0	0	0	0	0	0	0	0
01/25/70	22.6	22.0	2.0	2.0	7.4	7.4	4.9	4.9
04/06/70	0	0	0	0	0	0	0	0
05/22/70	0	0	0	0	0	0	0	0
06/04/70	0	0	0	0	0	0	0	0
06/23/70	0	0	0	0	0	0	0	0
07/02/70	0	0	0	0	0	0	0	0
07/16/70	0	0	0	0	0	0	0	0
07/29/70	0	0	0	0	0	0	0	0
08/13/70	0	0	4.0	4.0	2.3	2.3	1.0	1.0
08/23/70	0	0	0	0	0	0	0	0
09/11/70	0	0	0	0	0	0	0	0
09/25/70	0	0	23.0	23.0	1.5	1.5	0.0	0.0
10/20/70	0	0	0	0	0	0	0	0
12/04/70	0	0	0	0	0	0	0	0
01/06/71	0	0	0	0	0	0	0	0
03/10/71	0	0	0	0	0	0	0	0
05/03/71	0	0	0	0	0	0	0	0
05/14/71	0	0	0	0	0	0	0	0
05/29/71	0	0	0	0	0	0	0	0
06/02/71	0	0	0	0	0	0	0	0
06/12/71	0	0	0	0	0	0	0	0
06/28/71	0	0	130.4	130.4	10.4	10.4	1.3	1.3
07/06/71	0	0	0	0	0	0	0	0
07/21/71	0	0	0	0	0	0	0	0
08/02/71	0	0	0	0	0	0	0	0
08/19/71	0	0	0	0	0	0	0	0
09/23/71	40.3	42.7	4.2	4.2	5.4	5.4	6.5	6.5
10/11/71	1.1	2.2	2.0	2.0	12.3	12.3	0.0	0.0
12/07/71	0	0	0	0	0	0	0	0
03/15/72	0	0	0	0	0	0	0	0
04/20/72	0	0	0	0	0	0	0	0
05/22/72	0	0	0	0	0	0	0	0
06/11/72	0	0	0	0	0	0	0	0
06/28/72	0	0	0	0	0	0	0	0
07/21/72	0	0	0	0	0	0	0	0
08/05/72	0	0	0	0	0	0	0	0

NUMBER PER CUBIC METER OF MISC FISH EGGS AT EARLY LIFE HISTORY STATIONS

DATE	NH01 MALES FEMALE	IMPS	NH03 MALES FEMALE	IMPS	NH05 MALES FEMALE	IMPS	NH10 MALES FEMALE	IMPS
05/29/69								
05/29/69								
07/10/69								
07/18/69								
08/06/69	2.		2.					
08/26/69								
09/03/69	7.		3.		2.		3.	
09/14/69			4.		5.		1.	
09/28/69								
10/08/69								
10/29/69								
11/29/70								
02/25/70								
04/27/70								
05/06/70								
05/22/70	53.		5.		3.		1.	
06/23/70								
07/02/70	12.		5.		18.		1.	
07/16/70			2.		1.		1.	
08/13/70	12.		7.		3.		2.	
08/23/70								
09/11/70	2.							
09/25/70								
10/20/70								
12/04/70								
01/06/71								
02/16/71								
03/30/71								
05/14/71								
05/20/71	12.		1.		1.		1.	
06/12/71			3.		4.		3.	
06/28/71			4.		1.		1.	
07/06/71	5.		1.		3.		1.	
07/21/71	6.		1.		1.		1.	
08/19/71								
09/23/71								
10/11/71								
11/06/71								
12/07/71								
03/15/72								
04/28/72								
05/11/72								
05/21/72	1.		2.					
07/21/72	1.							
08/05/72								

NUMBER PER CUBIC METER OF COPEPOD NAUPLII AT EARLY LIFE HISTORY STATIONS

DATE	NH01	NH03	NH05	NH10
	MALES FEMALES	MALES FEMALES	MALES FEMALES	MALES FEMALES
05/22/69	32.0	10.8	0	0
06/29/69	0	0	0	0
07/10/69	49.3	2.1	5.4	3.8
07/18/69	0	0	0	0
08/05/69	0	0	0	0
08/26/69	0	0	0	0
09/13/69	2.6	0	0	0
09/14/69	0	0	0	0
10/08/69	0	0	0	0
10/29/69	2.2	7.0	1.2	4.7
12/02/69	0	0	0	0
12/29/69	0	0	0	0
02/29/70	0	2.1	1.5	0.1
04/27/70	0	0	4.1	0.4
05/06/70	0	0	0	0
05/22/70	14.4	0	0	0
06/04/70	11.0	24.1	1.0	6.0
06/23/70	0	0	0	0
07/02/70	0	0	0	0
07/16/70	0	16.0	0	0
07/29/70	0	0	0	0
08/13/70	7.2	1.4	0	0
09/13/70	0	0	0	0
09/15/70	0	0	0	0
09/25/70	6.9	18.7	1.0	2.2
10/20/70	0	0	0	0
10/24/70	6.4	1.7	0	0
10/30/70	1.0	0	0	0
11/06/70	0	0	0	0
11/16/70	0	0	0	0
12/03/70	0	0	0	0
12/10/70	0	0	0	0
12/16/70	0	0	0	0
12/23/70	0	0	0	0
01/06/71	0	0	0	0
01/13/71	0	0	0	0
01/20/71	0	0	0	0
01/27/71	0	0	0	0
02/03/71	0	0	0	0
02/10/71	0	0	0	0
02/17/71	0	0	0	0
02/24/71	0	0	0	0
03/03/71	0	0	0	0
03/10/71	0	0	0	0
03/17/71	0	0	0	0
03/24/71	0	0	0	0
04/07/71	0	0	0	0
04/14/71	0	0	0	0
04/21/71	0	0	0	0
04/28/71	0	0	0	0
05/05/71	0	0	0	0
05/12/71	0	0	0	0
05/19/71	0	0	0	0
05/26/71	0	0	0	0
06/02/71	41.5	31.1	10.1	3.8
06/09/71	12.5	1.0	1.7	0
06/16/71	0	0	0	0
06/23/71	0	0	0	0
07/07/71	0	0	0	0
07/14/71	0	0	0	0
07/21/71	0	0	0	0
07/28/71	0	0	0	0
08/04/71	0	0	0	0
08/11/71	0	0	0	0
08/18/71	0	0	0	0
08/25/71	0	0	0	0
09/01/71	0	0	0	0
09/08/71	0	0	0	0
09/15/71	0	0	0	0
09/22/71	0	0	0	0
10/06/71	0	0	0	0
10/13/71	0	0	0	0
10/20/71	0	0	0	0
10/27/71	0	0	0	0
11/03/71	0	0	0	0
11/10/71	0	0	0	0
11/17/71	0	0	0	0
11/24/71	0	0	0	0
12/01/71	0	0	0	0
12/08/71	0	0	0	0
12/15/71	0	0	0	0
12/22/71	0	0	0	0
12/29/71	0	0	0	0
01/05/72	0	0	0	0
01/12/72	0	0	0	0
01/19/72	0	0	0	0
01/26/72	0	0	0	0
02/02/72	0	0	0	0
02/09/72	0	0	0	0
02/16/72	0	0	0	0
02/23/72	0	0	0	0
03/02/72	0	0	0	0
03/09/72	0	0	0	0
03/16/72	0	0	0	0
03/23/72	0	0	0	0
04/06/72	0	0	0	0
04/13/72	0	0	0	0
04/20/72	0	0	0	0
04/27/72	0	0	0	0
05/04/72	0	0	0	0
05/11/72	0	0	0	0
05/18/72	0	0	0	0
05/25/72	0	0	0	0
06/01/72	0	0	0	0
06/08/72	0	0	0	0
06/15/72	0	0	0	0
06/22/72	0	0	0	0
06/29/72	0	0	0	0
07/06/72	0	0	0	0
07/13/72	0	0	0	0
07/20/72	0	0	0	0
07/27/72	0	0	0	0
08/03/72	0	0	0	0
08/10/72	0	0	0	0
08/17/72	0	0	0	0
08/24/72	0	0	0	0
09/07/72	0	0	0	0
09/14/72	0	0	0	0
09/21/72	0	0	0	0
09/28/72	0	0	0	0
10/05/72	0	0	0	0
10/12/72	0	0	0	0
10/19/72	0	0	0	0
10/26/72	0	0	0	0
11/02/72	0	0	0	0
11/09/72	0	0	0	0
11/16/72	0	0	0	0
11/23/72	0	0	0	0
11/30/72	0	0	0	0
12/07/72	0	0	0	0
12/14/72	0	0	0	0
12/21/72	0	0	0	0
12/28/72	0	0	0	0
01/04/73	0	0	0	0
01/11/73	0	0	0	0
01/18/73	0	0	0	0
01/25/73	0	0	0	0
02/01/73	0	0	0	0
02/08/73	0	0	0	0
02/15/73	0	0	0	0
02/22/73	0	0	0	0
02/29/73	0	0	0	0
03/06/73	0	0	0	0
03/13/73	0	0	0	0
03/20/73	0	0	0	0
03/27/73	0	0	0	0
04/03/73	0	0	0	0
04/10/73	0	0	0	0
04/17/73	0	0	0	0
04/24/73	0	0	0	0
05/01/73	0	0	0	0
05/08/73	0	0	0	0
05/15/73	0	0	0	0
05/22/73	0	0	0	0
05/29/73	0	0	0	0
06/05/73	0	0	0	0
06/12/73	0	0	0	0
06/19/73	0	0	0	0
06/26/73	0	0	0	0
07/03/73	0	0	0	0
07/10/73	0	0	0	0
07/17/73	0	0	0	0
07/24/73	0	0	0	0
08/01/73	0	0	0	0
08/08/73	0	0	0	0
08/15/73	0	0	0	0
08/22/73	0	0	0	0
08/29/73	0	0	0	0
09/05/73	0	0	0	0
09/12/73	0	0	0	0
09/19/73	0	0	0	0
09/26/73	0	0	0	0
10/03/73	0	0	0	0
10/10/73	0	0	0	0
10/17/73	0	0	0	0
10/24/73	0	0	0	0
10/31/73	0	0	0	0
11/07/73	0	0	0	0
11/14/73	0	0	0	0
11/21/73	0	0	0	0
11/28/73	0	0	0	0
12/05/73	0	0	0	0
12/12/73	0	0	0	0
12/19/73	0	0	0	0
12/26/73	0	0	0	0
01/02/74	0	0	0	0
01/09/74	0	0	0	0
01/16/74	0	0	0	0
01/23/74	0	0	0	0
01/30/74	0	0	0	0
02/06/74	0	0	0	0
02/13/74	0	0	0	0
02/20/74	0	0	0	0
02/27/74	0	0	0	0
03/06/74	0	0	0	0
03/13/74	0	0	0	0
03/20/74	0	0	0	0
03/27/74	0	0	0	0
04/03/74	0	0	0	0
04/10/74	0	0	0	0
04/17/74	0	0	0	0
04/24/74	0	0	0	0
05/01/74	0	0	0	0
05/08/74	0	0	0	0
05/15/74	0	0	0	0
05/22/74	0	0	0	0
05/29/74	0	0	0	0
06/05/74	0	0	0	0
06/12/74	0	0	0	0
06/19/74	0	0	0	0
06/26/74	0	0	0	0
07/03/74	0	0	0	0
07/10/74	0	0	0	0
07/17/74	0	0	0	0
07/24/74	0	0	0	0
08/01/74	0	0	0	0
08/08/74	0	0	0	0
08/15/74	0	0	0	0
08/22/74	0	0	0	0
08/29/74	0	0	0	0
09/05/74	0	0	0	0
09/12/74	0	0	0	0
09/19/74	0	0	0	0
09/26/74	0	0	0	0
10/03/74	0	0	0	0
10/10/74	0	0	0	0
10/17/74	0	0	0	0
10/24/74	0	0	0	0
10/31/74	0	0	0	0
11/07/74	0	0	0	0
11/14/74	0	0	0	0
11/21/74	0	0	0	0
11/28/74	0	0	0	0
12/05/74	0	0	0	0
12/12/74	0	0	0	0
12/19/74	0	0	0	0
12/26/74	0	0	0	0
01/02/75	0	0	0	0
01/09/75	0	0	0	0
01/16/75	0	0	0	0
01/23/75	0	0	0	0
01/30/75	0	0	0	0
02/06/75	0	0	0	0
02/13/75	0	0	0	0
02/20/75	0	0	0	0
02/27/75	0	0	0	0
03/06/75	0	0	0	0
03/13/75	0	0	0	0
03/20/75	0	0	0	0
03/27/75	0	0	0	0
04/03/75	0	0	0	0
04/10/75	0	0	0	0
04/17/75	0	0	0	0
04/24/75	0	0	0	0
05/01/75	0	0	0	0
05/08/75	0	0	0	0
05/15/75	0	0	0	0
05/22/75	0	0	0	0
05/29/75	0	0	0	0
06/05/75	0	0	0	0
06/12/75	0	0	0	0
06/19/75	0	0	0	0
06/26/75	0	0	0	0
07/03/75	0	0	0	0
07/10/75	0	0	0	0
07/17/75	0	0	0	0
07/24/75	0	0	0	0
08/01/75	0	0	0	0
08/08/75	0	0	0	0
08/15/75	0	0	0	0
08/22/75	0	0	0	0
08/29/75	0	0	0	0
09/05/75	0	0	0	0
09/12/75	0	0	0	0
09/19/75	0	0	0	0
09/26/75	0	0	0	0
10/03/75	0	0	0	0
10/10/75	0	0	0	0
10/17/75	0	0	0	0
10/24/75	0	0	0	0
10/31/75	0	0	0	0
11/07/75	0	0	0	0
11/14/75	0	0	0	0
11/21/75	0	0	0	0
11/28/75	0	0	0	0
12/05/75	0	0	0	0
12/12/75	0	0	0	0
12/19/75	0	0	0	

STATIONS ON, 05/14/71

	NH15			NH20		
	MALES	FEMALES	IMPS	MALES	FEMALES	IMPS
CAL. MARSHALLAE	1.1	.8	23.6	1.3	.4	10.0
CAL. TENUICORNIS	4.5	12.0	22.1	.4	6.3	15.4
EUCAL. BUNGII BU	0	0	.4	.4	.3	1.3
PARACAL. PARVUS	0	2.3	1.1	.4	1.7	1.7
PSEUDOCAL. SP.	101.3	182.0	136.9	26.3	343.4	260.4
CLAUSO. ARCUICOR	3.0	5.6	.4	0	2.5	0
CLAUSO. PERGENS	.4	10.1	3.8	0	5.0	.4
CLAUSO IMMATURE	0	0	5.6	0	0	2.9
CTENOCAL. VANUS	3.8	19.5	10.1	1.3	17.5	4.6
AETIODEUS PACIFIC	0	0	0	0	0	.4
EUCHIRELLA-ROSTR	0	.4	0	0	0	0
SCOLE. MINOR	.4	1.5	1.9	0	3.3	3.8
METRIDIA LUCENS	3.0	1.9	21.8	3.8	.8	15.8
METRIDIA PACIFIC	0	1.1	0	0	.4	0
LUCICUTIA FLAVIC	1.5	0	.4	0	0	0
HYPERORHAB. TANN	0	0	0	0	.4	0
ACARTIA LONGIREM	0	2.6	.4	.4	.8	0
ACARTIA DANAE	0	.4	0	0	0	0
COPEPOD NAUPLII	.4	.4	0	0	0	0
CALANUS NAUPLII	6.4	0	0	2.1	0	0
OITHONA SIMILIS	7.5	185.7	29.3	2.5	125.0	27.1
OITH. SPINIROSTR	0	7.1	1.1	0	4.6	1.3
ALL AMPHIPODS	0	0	0	.4	0	0
EUPHAUSIID NAUPL	8.3	0	0	.8	0	0
EUPHAUSIID CALYP	1.1	0	0	0	0	0
LIMACINA HELICIN	45.4	0	0	15.4	0	0
CHAETOGNATHS	.4	0	0	0	0	0
SCYPHOMEDUSAE	0	0	0	.4	0	0
CRAB ZOEAE	0	0	0	.4	0	0
POLYCHAETE OLDER	.4	0	0	0	0	0
CLAM VELIGER	.8	0	0	0	0	0
GASTROPOD VELIGE	.4	0	0	.8	0	0
YOUNG LITTORINA	.4	0	0	0	0	0
LARGE ROUND EGGS	1.5	0	0	.4	0	0
CALANUS EGGS	0	0	0	.4	0	0
INTERM. RND. EGG	22.9	0	0	.4	0	0
EGG CAPSULE	.4	0	0	0	0	0

STATIONS ON, 06/01/71

	NH15			NH20		
	MALES	FEMALES	IMPS	MALES	FEMALES	IMPS
CAL. MARSHALLAE	2.3	0	568.7	0	0	50.3
CAL. TENUICORNIS	1.1	1.1	0	1.1	1.1	1.1
CAL. CRISTATUS	0	0	1.1	0	0	0
EUCAL. BUNGII BU	0	1.1	2.3	0	1.1	2.2
PARACAL. PARVUS	0	0	0	0	1.1	.3
PSEUDOCAL. SP.	175.8	861.6	1907.0	20.1	637.0	1720.9
CLAUSO. ARCUICOR	0	0	0	0	1.1	1.1
CLAUSO. PERGENS	0	5.7	0	0	4.5	0
CLAUSO IMMATURE	0	0	1.1	0	0	0
CTENOCAL. VANUS	1.1	5.7	3.4	1.1	5.6	0
SCOLE. MINOR	0	4.6	11.5	2.2	1.1	2.2
METRIDIA LUCENS	3.4	2.3	13.8	1.1	4.5	26.8
LUCICUTIA FLAVIC	0	1.1	0	1.1	0	0
ACARTIA CLAUSII	0	1.1	1.1	0	1.1	0
ACARTIA LONGIREM	56.3	47.1	5.7	2.2	10.1	8.9
OITHONA SIMILIS	1.1	24.1	3.4	0	14.5	4.5
OITH. SPINIROSTR	0	9.2	3.4	0	4.5	0
EUPHAUSIID CALYP	1.1	0	0	0	0	0
EUPHAUSIID FURCI	5.7	0	0	2.2	0	0
ISOPODS	1.1	0	0	0	0	0
LIMACINA HELICIN	44.8	0	0	12.3	0	0
CHAETOGNATHS	1.1	0	0	0	0	0
TOMOPTERIS	1.1	0	0	0	0	0
OIKOPLEURA SPP.	0	0	0	1.1	0	0
CLAM VELIGER	1.1	0	0	0	0	0
GASTROPOD VELIGE	1.1	0	0	0	0	0
LARGE ROUND EGGS	1.1	0	0	0	0	0
CALANUS EGGS	2.3	0	0	1.1	0	0
GREEN EGG MASS	2.3	0	0	0	0	0
INTERM. RND. EGG	20.7	0	0	2.2	0	0

	NH35	NH40	NH50	NH50	NH50	NH50	NH50
	MALE	MALE	MALE	MALE	MALE	MALE	MALE
	FEMALE	FEMALE	FEMALE	FEMALE	FEMALE	FEMALE	FEMALE
	IMM	IMM	IMM	IMM	IMM	IMM	IMM
ALL AMPHIPODS	.6	0	0	0	0	0	0
EUPHAUSIID NAUPL	0	0	0	0	0	0	0
EUPHAUSIID CALYP	0	0	0	0	0	0	0
EUPH. PACIFIC	0	1.5	0	0	0	0	0
THYSANOCSSA SPIN	0	0	0	0	0	0	0
NEMATODS. FLEXIPE	0	0	0	0	0	0	0
ISOPODOSS	0	0	0	0	0	0	0
OSIRACID	0	0	0	0	0	0	0
IMACINA HELICIN	9.3	13.7	0	0	0	0	0
CHAETOGNATHS	0	0	0	0	0	0	0
SCYPHOMEDUSAE	0	0	0	0	0	0	0
CRAB MEALOPA	0	0	0	0	0	0	0
POLYCHAETE OLDER	0	0	0	0	0	0	0
CLAM VELIGER	0	0	0	0	0	0	0
LARGE ROUND EGGS	0	0	0	0	0	0	0
LALANUS EGGS	0	0	0	0	0	0	0
GREEN EGG MASS	0	0	0	0	0	0	0
SHRIMP EGGS	0	2.2	0	0	0	0	0
INTERM. PVD. EGG	1.9	0	0	0	0	0	0
0.5MM FORAMS	0	0	0	0	0	0	0
NEW RAD	0	0	0	0	0	0	0
SQUID LARVA	0	0	0	0	0	0	0

STATIONS ON 08/02/71

	NH35	NH40	NH50	NH50	NH50	NH50	NH50
	MALE	MALE	MALE	MALE	MALE	MALE	MALE
	FEMALE	FEMALE	FEMALE	FEMALE	FEMALE	FEMALE	FEMALE
	IMM	IMM	IMM	IMM	IMM	IMM	IMM
CAL. MARSHALLAE	.2	16.4	0	0	0	0	0
CAL. TENUCORMIS	0	1.6	0	0	0	0	0
EUCAL. BUNGIIBU	0	.8	0	0	0	0	0
PSEUDOCAL. ARCEI	6.3	32.2	97.8	141.2	104.6	133.1	0
CCLAUSO. JOBERTI	0	0	1.1	1.1	1.1	1.1	0
CCLAUSO. PARAPURE	0	0	0	0	0	0	0
CCLAUSO. IMMATURE	0	0	0	0	0	0	0
CCTENOCAL. PACIFIC	0	0	0	0	0	0	0
AETIDEUCH. JAPONI	0	1.2	0	0	0	0	0
PARACOVI. JANTARC	0	1.0	1.1	7.6	3.8	1.5	0
SCOLE. OVAYA	.6	4.0	0	0	0	0	0
METRIDIA LUCENS	0	8.0	0	12.0	0	0	0
METRIDIA PACIFIC	0	0	0	0	0	0	0
LUCICURTHIA FLATANN	0	1.0	0	1.1	0	0	0
HETERORHIA OLIMBI	0	1.2	0	0	0	0	0
CANDACIA CYPINNA	0	0	0	0	0	0	0
CANDACIA BONGIREM	0	1.6	172.9	2.1	0	0	0
UNIDENTIFIED COP	1.0	.8	0	0	0	0	0
CALANUS IZAZI	0	2.0	0	0	0	0	0
COPEPOD NAUPLII	0	0	0	0	0	0	0
CALANUS NAUPLII	0	0	0	0	0	0	0
MALOPTILLUS	0	0	0	0	0	0	0
METEORHABDUS SP	0	0	0	0	0	0	0
A. NEGLIGENS....	0	0	0	0	0	0	0
UNID COPEPOD	0	0	0	0	0	0	0
MICROSETELLA	0	0	0	0	0	0	0
OLITHONA SIMILIS	3.3	53.7	33.5	10.4	4.2	1.5	0
OLITH. SPINIROSTR	.3	2.0	14.1	1.1	0	0	0

STATIONS ON, 08/19/71

	NH15		IMPS	NH20		IMPS
	MALES	FEMALES		MALES	FEMALES	
CAL. MARSHALLAE	1.9	7.8	25.4	0	1.8	36.8
CAL. TENUICORNIS	0	.3	0	0	0	0
PSEUDOCAL. SP.	.3	1.3	.9	0	.5	.4
PARAFUCH. JAPONI	0	0	0	0	0	.1
SCOLE. MINOR	0	0	.3	0	.1	0
ACARTIA LONGIREM	13.5	94.9	11.0	.1	5.7	0
COPEPOD NAUPLII	.3	0	0	0	0	0
CALANUS NAUPLII	0	0	0	.1	0	0
OITHONA SIMILIS	.9	18.2	5.0	.1	1.0	.2
OITH. SPINIROSTR	0	9.1	0	0	.9	0
EUPH. PACIFICA	0	0	0	.1	0	0
YESSARAB. OCULAT	.3	0	0	0	0	0
NEMATOD. FLEXIPE	.3	0	0	0	0	0
LINACINA HELICIN	1.9	0	0	.6	0	0
CHAETOGNATHS	15.0	0	0	.6	0	0
CLAM VELIGER	1.3	0	0	.9	0	0
YOUNG LITTORINA	.3	0	0	0	0	0
WORM EGGS	0	0	0	.1	0	0
INTERM. RND. EGG	0	0	0	.1	0	0

STATIONS ON, 09/23/71

	NH15		IMPS	NH20		IMPS
	MALES	FEMALES		MALES	FEMALES	
CAL. MARSHALLAE	0	0	9.1	0	0	6.3
CAL. TENUICORNIS	0	0	2.8	0	.3	.5
EUCAL. BUNGII BU	0	0	.6	0	0	.3
PARACAL. PARVUS	.9	2.8	.9	.5	2.2	.8
PSEUDOCAL. SP.	14.4	35.5	58.1	17.7	35.3	92.4
CLAUSO. ARCUICOR	0	0	.3	0	0	0
CTENOAL. VANUS	0	.3	0	0	0	0
AETIDEUS PACIFIC	0	0	.3	0	0	0
SCOLE. MINOR	0	0	.6	0	0	.8
METRIDIA LUCENS	0	0	6.3	0	0	4.6
CENTROPAGES DOMI	.3	0	0	.9	1.1	1.4
ACARTIA CLAUSSII	0	0	0	0	.5	0
ACARTIA LONGIREM	76.3	112.3	55.9	72.0	153.6	165.8
COPEPOD NAUPLII	.6	0	0	0	0	0
MICROSETELLA	0	0	0	0	0	.3
OITHONA SIMILIS	9.4	122.4	53.3	2.4	69.3	25.0
OITH. SPINIROSTR	0	10.4	12.9	0	1.6	4.6
ALL AMPHIPODS	.3	0	0	0	0	0
LARVAL AMPHIPOD	0	0	0	.5	0	0
EUPHAUSIID NAUPL	3.1	0	0	0	0	0
EUPHAUSIID CALYP	.9	0	0	0	0	0
EUPHAUSIID FURCI	.3	0	0	0	0	0
OSTRACODS	.3	0	0	0	0	0
LINACINA HELICIN	3.5	0	0	1.1	0	0
CHAETOGNATHS	1.6	0	0	0	0	0
OIKOPLEURA SPP.	.9	0	0	0	0	0
CTENOPHORES	0	0	0	.3	0	0
CLAM VELIGER	.3	0	0	.3	0	0
GASTROPOD VELIGE	1.3	0	0	.5	0	0
LARGE ROUND EGGS	.9	0	0	7.0	0	0
CALANUS EGGS	.3	0	0	0	0	0
GREEN EGG MASS	0	0	0	.3	0	0
SHRIMP EGGS	.9	0	0	.3	0	0
INTERM. RND. EGG	.6	0	0	0	0	0
0.5MM FOPANS	.3	0	0	0	0	0
0000000000000000	7.5	0	0	1.6	0	0
JAPAN LAMP SHADE	.7	0	0	.3	0	0

STATIONS ON, 06/11/72

	NH15		IMPS	NH20		IMPS
	MALES	FEMALES		MALES	FEMALES	
CAL. MARSHALLAE	.6	1.2	129.2	1.5	2.2	193.3
CAL. TENUICORNIS	0	0	.6	0	.7	0
EUCAL. BUNGII BU	0	0	.6	0	0	.5
PSEUDOCAL. SP.	26.1	156.4	744.3	71.2	292.2	625.7
CLAUSO. PERGENS	0	0	0	0	0	.7
CTENOAL. VANUS	0	1.2	1.2	0	.7	.7
AETIDEUS PACIFIC	0	0	0	0	0	.7
SCOLE. MINOR	0	0	2.9	0	1.5	1.5
METRIDIA LUCENS	0	0	5.8	2.2	0	18.0
CENTROPAGES DOMI	0	.6	0	.7	0	0

ACARTIA LONGIREM	39.4	74.1	14.5	29.2	42.7	31.5
CALANUS NAUPLII	0	0	0	3.0	0	0
OITHONA SIMILIS	5.2	162.2	37.6	2.2	99.7	20.6
OITH. SPINIROSTR	0	4.1	.6	0	9.0	.7
ONCAEA BOREALIS	0	.6	0	0	0	0
EUPHAUSIID NAUPL	0	0	0	1.5	0	0
EUPHAUSIID FURCI	1.2	0	0	.7	0	0
EUPH. PACIFICA	0	0	0	4.5	0	0
THYSANOESSA SPIN	.6	0	0	0	0	0
LIMACINA HELICIN	4.6	0	0	21.7	0	0
CHAETOGNATHS	0	0	0	.7	0	0
OIKOPLEURA SPP.	0	0	0	.7	0	0
CTENOPHORES	.6	0	0	0	0	0
LARGE ROUND EGGS	.6	0	0	0	0	0
CALANUS EGGS	2.9	0	0	0	0	0
LARVAL FISH	0	0	0	.7	0	0
SHRIMP EGGS	0	0	0	.7	0	0
INTERM. RND. EGG	84.0	0	0	13.5	0	0

STATIONS ON, 06/28/72

	NH15			NH20		
	MALES	FEMALES	IMPS	MALES	FEMALES	IMPS
CAL. MARSHALLAE	0	0	167.1	0	1.7	90.9
CAL. TENUICORNIS	0	0	0	0	3.4	2.3
EUCAL. BUNGIUS	0	0	.6	0	0	1.1
PARACAL. PARVUS	0	0	0	0	1.1	.6
PSEUDOCAL. SP.	83.6	279.6	989.9	22.1	411.7	883.1
MICROCAL. PUSTILL	0	.6	.6	0	2.3	0
CLAUSO. ARCUICOR	0	.6	1.3	0	0	0
CLAUSO. PERGENS	0	0	1.3	0	1.1	0
CTENOCAL. VANUS	0	.6	.6	0	2.8	.6
SCOLE. MINOR	.6	.6	1.9	0	.6	.6
METRIDIA LUCENS	0	0	6.4	0	.6	4.0
CENTROPAGES DOMI	1.3	0	9.6	0	.6	0
LUCICUTIA FLAVIC	.6	0	.6	0	0	0
ACARTIA CLAUSSII	0	0	.6	0	0	0
ACARTIA LONGIREM	120.2	143.3	39.9	9.1	28.4	13.6
ACARTIA DANAE	0	0	.6	0	0	0
COPEPOD NAUPLII	.6	0	0	0	0	0
CALANUS NAUPLII	1.3	0	0	0	0	0
OITHONA SIMILIS	5.8	44.4	16.7	4.3	31.2	27.3
OITH. SPINIROSTR	0	10.3	1.9	0	9.7	2.3
EUPHAUSIID NAUPL	0	0	0	.6	0	0
EUPHAUSIID FURCI	.6	0	0	1.7	0	0
EUPH. PACIFICA	0	0	0	.6	0	0
NEMATOR. FLEXIPE	0	0	0	.6	0	0
LIMACINA HELICIN	39.9	0	0	9.7	0	0
CHAETOGNATHS	0	0	0	2.3	0	0
CTENOPHORES	1.4	0	0	0	0	0
SHRIMP MYSES	.6	0	0	0	0	0
CLAM VELIGER	.6	0	0	.6	0	0
WORM	1.3	0	0	0	0	0
GREEN EGG MASS	4.5	0	0	0	0	0
INTERM. RND. EGG	.6	0	0	.6	0	0

STATIONS ON, 07/21/72

	NH15			IMPS		
	MALES	FEMALES	IMPS	MALES	FEMALES	IMPS
CAL. MARSHALLAE	0	1.2	70.0	0	0	0
CAL. TENUICORNIS	1.2	0	0	0	0	0
PARACAL. PARVUS	0	1.2	0	0	0	0
PSEUDOCAL. SP.	3.7	207.7	439.9	0	0	0
SCOLE. MINOR	0	1.2	2.5	0	0	0
METRIDIA LUCENS	0	0	3.7	0	0	0
ACARTIA LONGIREM	79.9	323.2	61.4	0	0	0
OITHONA SIMILIS	1.2	110.6	44.2	0	0	0
OITH. SPINIROSTR	0	2.5	0	0	0	0
THYSANOESSA SPIN	33.2	0	0	0	0	0
LIMACINA HELICIN	50.4	0	0	0	0	0
CHAETOGNATHS	2.5	0	0	0	0	0
CLAM VELIGER	1.2	0	0	0	0	0
CALANUS EGGS	1.2	0	0	0	0	0

STATIONS ON, 08/05/72

	NH15		IMPS			IMPS
	MALES	FEMALES		MALES	FEMALES	
CAL. MARSHALLAE	0	.4	28.1			
EUCAL. BUNGII BU	0	.4	.4			
PSEUDOCAL. SP.	7.1	85.5	231.5			
SCOLE. MINOR	0	.4	.4			
METRIDIA LUCENS	0	0	2.1			
CENTROPAGES DOMI	1.1	.4	0			
LUCICUTIA FLAVIC	0	0	.4			
ACARTIA LONGIREM	32.8	123.9	11.4			
COPEPOD NAUPLII	.4	0	0			
OITHONA SIMILIS	2.8	42.7	18.9			
OITH. SPINIROSTR	0	.4	2.1			
EUPHAUSIID FURCI	.7	0	0			
LIMACINA HELICIN	4.6	0	0			
CHAETOGNATHS	.7	0	0			
CTENOPHORES	.4	0	0			
CLAM VELIGER	.4	0	0			
GASTROPOD VELIGE	1.1	0	0			
CALANUS EGGS	1.1	0	0			
INTERM. RNO. EGG	19.9	0	0			

