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Daily Variations in the Abundance of Zooplankton in the Coastal Waters of Queen Maud Land, Antarctica During Summer 1983-'84

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ABSTRACT

The Antarctic summer which lasts for a short period brings in cyclical changes n the sea with regard to production at the various levels. The initial change in this dynamic environment is triggered off by the primary producers with the onset of long and bright sunny days. The next in series is the zooplankton which owing to the availability of large quantities of food materials multiply and grow in this season. During the Third Indian Scientific Expedition to Antarctica some efforts were made to understand the variations taking place among the zooplankters during the summer months of January and February 1984 by taking everyday samples from a polynya in the coastal waters of Queen Maud Land Antarctica.

The zooplankton in general was observed to make a phenomenal increase from a minimum of 30 37 cc per 1000 m^8 of water in the first week of observation to 101 08 cc per 1000 m^8 of water in the sixth week registering a more than three fold increase in s x weeks time. There was considerable difference in the volumetric and numerical increase of plankton in the different weeks and this gave clear indications about the recruitment and growth among the secondary producers. The rate of increase in both ways was estimated. As in the case of general plankton the major groups also showed regular trends of numerical increase as summer advanced. Thus it was found that the zooplankton underwent a phase of multiplication followed by a period of growth and these two life processes surpassed grazing by the higher ups and this continued until very late in the summer after which a decline in the popula tions was indicated. The major groups of zooplankters studied for their increase over time were eu-phausnds copepods chaetognaths appendicularians ostracods polychaetes and siphonophores.

INTRODUCTION

The Antarctic Ocean presents unique features in several aspects of its environment. The circum polar currents the upwelling and the consequent enrichment of the surface waters the cold climate, the ice cover for the sea etc influence the living organisms to a great extent. Above all, the contin-uous days and nights play no less a major role in the occurrence and abundance of green matter and animals in this ecosystem. The bright sunlight for almost 24 hrs a day during the summer months results in the large scale production at the primary level. Normally an increase in the rale of phytoplan-kton production may lead to a multiplication and increase of the first level grazers, the zooplankton

During the Third Indian Scientific Expedition to Antarctica which spent the summer months of 1983-84 in Antarctica an attempt was made to investigate the rate of growth and multiplication of zooplankton consequent on the increase in the primary production as a result of increased sunlight *

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* The fast multiplication and blooming of phytoplankton was evident when they clogged the zooplankton net and formed a thick coating of green matter on the netting during the early part of the summer. The coating when dried formed itself into a powdery matter and dropped down. As summer advanced and terminated into the winter and with the multiplication or zooplankton the phytoplankton showed a decline (personal experience and personal communication by Dr Aditl Pant)

The paper embodies the results of these studies carried out for about one and a half months in the coastal waters of Queen Maud Land from mid summer to the beginning of the winter

MATERIAL AND METHODS

The Third Indian Scientific Expedition to Antarctica spent 65 days in the continent from 27th December 1983 to 1 st March 1984. During this period the ship *Finnpolaris* from which the samp ling for zooplankton was carried out was either moored on to the ice shelf or was cruising in the nearby polynya (Fig 1). Daily sampling for zooplankton was done from 12th January 1984 to 25th February 1984 (from mid summer to the beginning of winter) with a few gaps when sampling was not possible because of storms and bad weather. Vertical sampling was carried out around 1800 hrs every day. Two types of nets were made use of (1) a Bongo net of 60 cm mouth diameter having a mesh size of 0 4 mm for the collection of normal zooplankton including the larval forms and (2) a modified Indian Ocean Standard Net (IOS Net) with a mesh size of 2 mm for the collection of macroplankton composed mainly of adults. The sampling were done as open hauls from 150 m to the surface for the Bongo net and 200m to the surface for the IOS Net whenever the depths to the bottom exceeded these depths but otherwise from permissible depths. The details of daily collection of zooplankton are given in table 1. The quantification of plankton both volumetrically and numerically was done in terms of m^3 of water. In case of Bongo net a TSK flow meter was used while for the IOS Net the

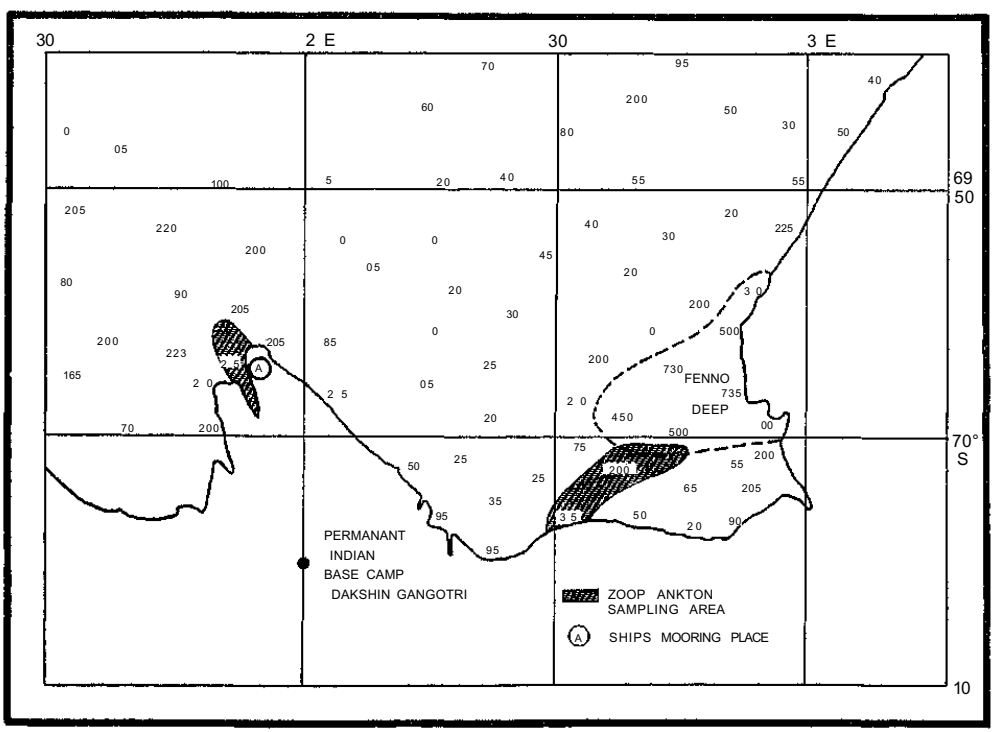

Fig 1 Area sounded during the expedition for the ba hymet y n the coastal waters of Antarctica Places of zooplankton collect on for the present study are shaded.

quantity of water filtered was calculated based on the formula r^2h. The volume of the plankton was estimated by displacement method. A bathymetric chart of the polynya from where the samples were collected and the nearby areas sounded during the Expedition is given in Fig 1.

TABLE 1

Details of zooplankton samples collected from the coastal waters of Antarctica

Gear: Bongo-60 net		*Mesh size : 0.4 mm*			*Type of haul: Vertical*	
Sample No.	*Date*	*Time (hrs.)*	*Position lat. °S*	*long. °E*	*Depth at stn.(m)*	*Depth of haul (m)*
1.	12-1-1984	1600	70° 01'	12° 44'	165	150-0
2.	13-1-1984	1730	70° 03'	12° 33'	148	130-0
3.	14-1-1984	1730	70° 03'	12° 32'	140	130-0
4.	15-1-1984	1730	70° 03'	12° 31'	140	130-0
5.	16-1-1984	1800	70° 02'	12° 36'	150	140-0
6.	17-1-1984	1745	69° 56'	11° 49'	195	150-0
7.	18-1-1984	1830	70° 02'	12° 42'	165	150-0
8.	19-1-1984	1835	69° 57'	11° 52'	215	150-0
9.	20-1-1984	1830	69° 56'	11° 56'	205	150-0
10.	22-1-1984	1830	69° 57'	11° 54'	210	150-0
11.	24-1-1984	1800	69° 57'	11° 54'	210	150-0
12.	25-1-1984	1815	69° 57'	11° 54'	210	150-0
13.	26-1-1984	1830	69° 57'	11° 54'	210	150-0
14.	27-1-1984	1800	69° 57'	11° 54'	210	150-0
15.	29-1-1984	1830	69° 57'	11° 54'	210	150-0
16.	30-1-1984	1800	69° 57'	11° 54'	210	150-0
17.	31-1-1984	1730	69° 57'	11° 54'	210	150-0
18.	1-2-1984	1800	69° 57'	11° 54'	210	150-0
19.	2-2-1984	1830	69° 57'	11° 54'	210	150-0
20.	3-2-1984	1800	69° 57'	11° 54'	210	150-0
21.	4-2-1984	1830	69° 57'	11° 54'	210	150-0
22.	5-2-1984	1800	69° 57'	11° 54'	210	150-0
23.	6-2-1984	1830	69° 57'	11° 54'	210	150-0
24.	7-2-1984	1745	66° 58'	12° 05'	115	110-0
25.	8-2-1984	1830	69° 59'	11° 54'	210	150-0
26.	11-2-1984	2000	69° 59'	11° 54'	210	150-0
27.	12-2-1984	1830	69° 59'	11° 54'	210	150-0
28.	13-2-1984	1830	69° 59'	11° 54'	210	150-0
29.	14-2-1984	1930	69° 59'	11° 54'	210	150-0
30.	15-2-1984	1830	69° 59'	11° 54'	210	150-0
31.	16-2-1984	1830	69° 59'	11° 54'	210	150-0
32.	17-2-1984	1800	69° 59'	11° 54'	210	150-0
33.	18-2-1984	1800	69° 59'	11° 54'	210	150-0
34.	25-2-1984	1800	69° 59'	11° 54'	210	150-0

RESULTS AND DISCUSSION

Zooplankton biomass

The data obtained on the volume of zooplankton was made use of for understanding the day to day addition to the existing population. Eventhough variations were noticed in the day to day abundance in volume the general trend was towards a gradual increase from the beginning to the end of the period of investigations. This was more evident with the Bongo net samples.

In the case of the Bongo net samples the zooplankton biomass fluctuated between 14 18 cc per 1000 m^3 of water on 17th January and 130 40 cc per 1000 m^3 of water on 16th February. The plankton colle with the IOS Net varied between 1 00 cc per 1000 m^3 of water on 14th January and 35 00 cc per 1000 m^3 of water on 16th February (On 15th January a large swarm of euphausiids were caught with the IOS Net and their volume was measured as 514 cc per 1000m^3 of water. However this odd value which cannot be reckoned as part of the general abundance in the biomass has not been considered for the present estimates). The daily fluctuations in the abundance of zooplankton was smoothened out by calculating three point moving average and the values thus obtained for both type of nets are given in Fig 2 along with some values of chlorophyll *a* as communicated by Dr Aditi Pant.

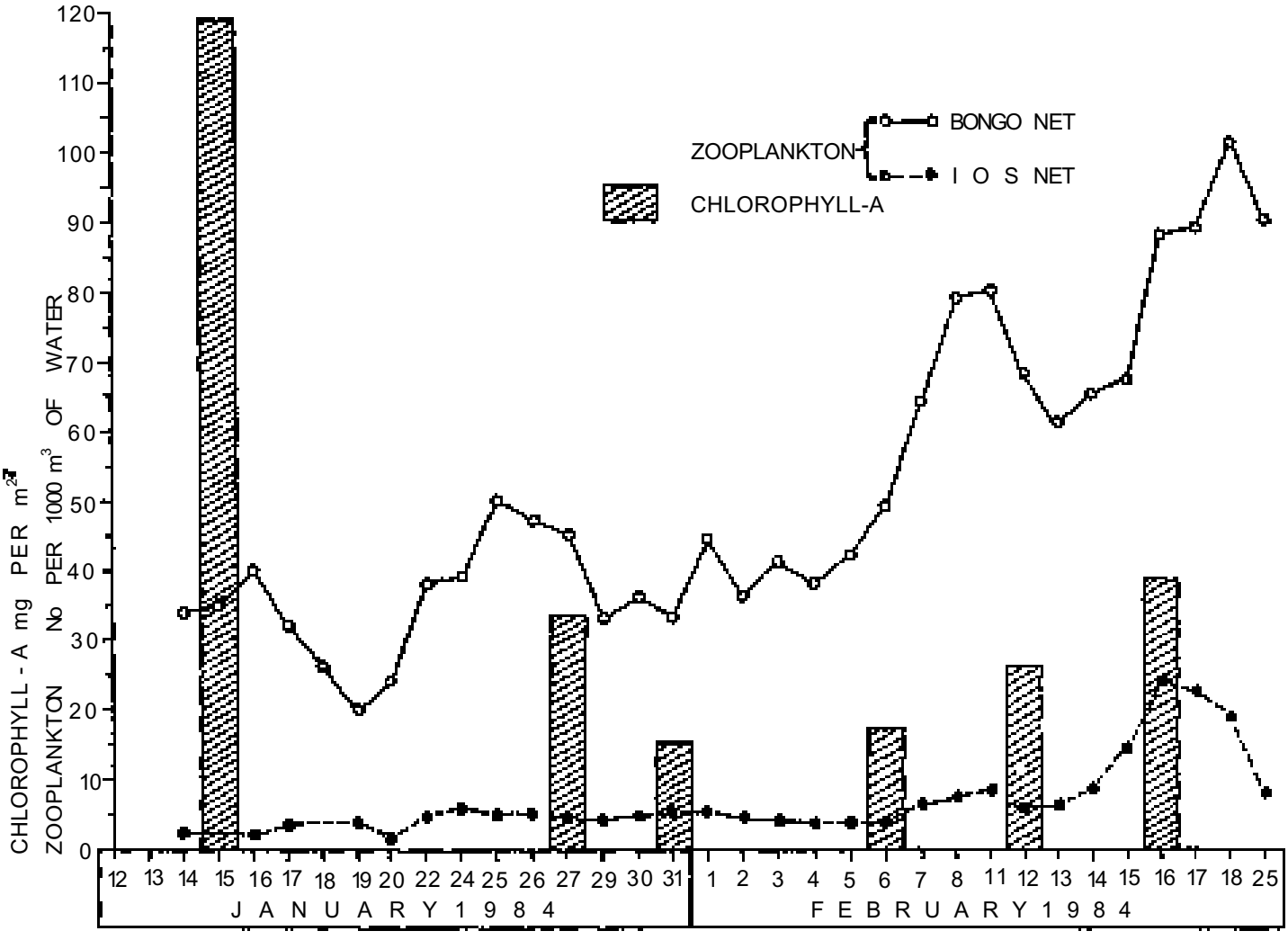

Fig 2 Daily variations in the volumetric abundance of zooplankton sampled with Bongo net and modified IOS Net (three point moving average values) along with values for chlorophyll-*a*

From Fig 2 it is seen that till the end of January eventhough fluctuations were noticed in the day to day abundance remarkable increase in volume was not noticed with the Bongo net samples. In the case of the IOS Net samples the same was the condition until 6th February. However from these dates onwards there was a spectacular increase in the volumetric abundance. The fact that the IOS Net samples constituted by larger and adult specimens showed an increase at a relatively later stage is quite significant. The zooplankton which were in the actual multiplication stage being composed mainly of larvae and young ones were collected by the Bongo net alone. Therefore the increase in zooplankton biomass in relation to phytoplankton production was reflected initially in the samples collected with this net. Later when the young ones and larvae attained the size that could be retained by the 2 mm mesh size net and got added to the macroplankton their abundance was very well seen.

As far as the zooplankton collected with the Bongo net was concerned the period of study could be divided into three a first period of very slow production with a trend of decrease lasting upto 18th January a second period of moderate increase with great fluctuations in values lasting until 16th February and a third period of fast multiplication and growth. During the first second and third periods the biomass averaged to 30 37 cc 40 81 cc and 81 39 cc per 1000 m^3 of water respectively. The first period may be considered as the period of grazing for the zooplankton population survived through the previous winter the second the period of multiplication giving rise to larval populations and the third the period of growth of the already produced young ones and also their multiplication.

In the case of the large meshed net the first two periods were not very distinguishable the period of multiplication being not reflected in the collection or otherwise saying the young ones produced during the second period were not collected by the net. However the third stage was very well reflected which suggested that the individuals produced during the second period were quite fattened enough to be taken by the large meshed net.

A study was made to protect the variations in the abundance of zooplankton on a weekly basis irrespective of the groups (table 2). Thus it was seen that as time passed on there was an overall increase in the standing crop of biomass of zooplankton with of course slight reduction in the weekly mean values in the third and the last weeks.

TABLE 2

Weekly mean values and the percentage of increase or decrease of zooplankton biomass (volumetric and numerical) in the different weeks

Weeks	*Weekly mean value in volume (CC/ 1000m^3 of water)*	*Percentage of increase/decrease in volume over previous week's stock*	*Weekly mean value in volume (ccl1000 m^3 of water)*	*Percentage of increasel decrease in number over previous week's stock*
First	30.37	..	8,108	..
Second	41 .75	+ 31.47	8,715	+ 7.49
Third	38.58	- 08.23	15,197	+ 74.38
Fourth	57.35	+ 48.65	37,971	+149.38
Fifth	63.38	+ 10.51	65,732	+ 73.11
Sixth	101.08	+ 59.48	1,18,284	+ 99.95
Seventh	96.47	- 04.78	1,31,530	+ 11.20

When the percentage of increase or decrease of volume of the zooplankton collected in the Bongo net in the ensuing week over the past week was estimated it was found that there was increase by 31.47% in the second week over the abundance of the first week. However in the third week a decrease by 8.23% was indicated over the second week abundance. The situation in the fourth week was significant when an increase by 48.65% was noticed over the third week value. Again in the fifth week of observation it was on the increase though of a low magnitude of 10.51%. The increase in the sixth week was quite spectacular. However in the last week of study eventhough an increase was indicated it was of the order of 4.78% only.

A similar study was undertaken for understand ng the rate at which multiplication in number took place in course of time irrespective of the zooplankton groups Thus it was found that while the number showed almost a steady trend in the first two weeks (average for the first two weeks being 8 108 and 8 715 respectively per 1000 m^3 of water) there was considerable increase in the third (ave rage 15197) fourth (average 37 971) fifth (average 65 732) sixth (average 118 284) and seventh weeks (average 1 31 530) per 1000 m^3 of water

A percentage wise consideration of the increase or decrease in the numerical abundance showed that there was an increase by 7 49% in the second week over the number at the beginning of the study In the third week there was an increase in number of individuals by 74 38% The rate increased further in the fourth week and peaked at 149 88% In the fifth week of study the increase was indicated by 73 11% over that of the preceding week The rate of increase in the sixth week was 79 95% but in the last week the increase was considerably reduced to reach 11 20%

From the foregoing account based on table 2 it is evident that the zooplankton from an initial minimum passed through a period of multiplication followed by a period of fattening The great dif ference in volume was noticed between the third fourth fifth and the sixth weeks of observation when the biomass increased by about 50% The fattening continued through the seventh week also though at a relatively low rate

In order to understand whether the increase n volume or fattening of zooplankton occurred in tune with the multiplication in number a general comparison was made between the volume and the number irrespective of the groups (Fig 3)

During the second week of observation it was the volume that dominated over the number indi eating that there was no considerable multiplication in number of individuals Th s was because with the high phytoplankton production the grazers hav ng less competition among themselves consumed more food and fattened In the third week a rather reversal in the above trend was noticed in that while the volume showed a slight decrease (probably due to the death of adult individuals after breeding) there was an increase in number by 74 38% over that of the previous week This could be an indica t on of intense breeding and multiplication In the fourth week the picture obtained was more interes ting There was a substantial increase in number as well as volume the former surpassing the latter This could be an indication of further multiplication and also fattening of the animals produced in the preceeding three weeks In the fifth week of observat on compared to the preceeding week there was a substantial reduction in volume but only a slight reduction was noticed with the number (10 51%) However in this week again it was the number (73 11%) that dominated over the volume Thissitua tion must be an indication of moderating the fast growth rate while the adults continued to breed and add to the populations

It was probably in the sixth week of observation (in the second half of February) that the popu lations attained the maximum growth and number suggesting that recruitment and growth were at the peaks In the last week of the study both volume and number showed a fast declining trend In this

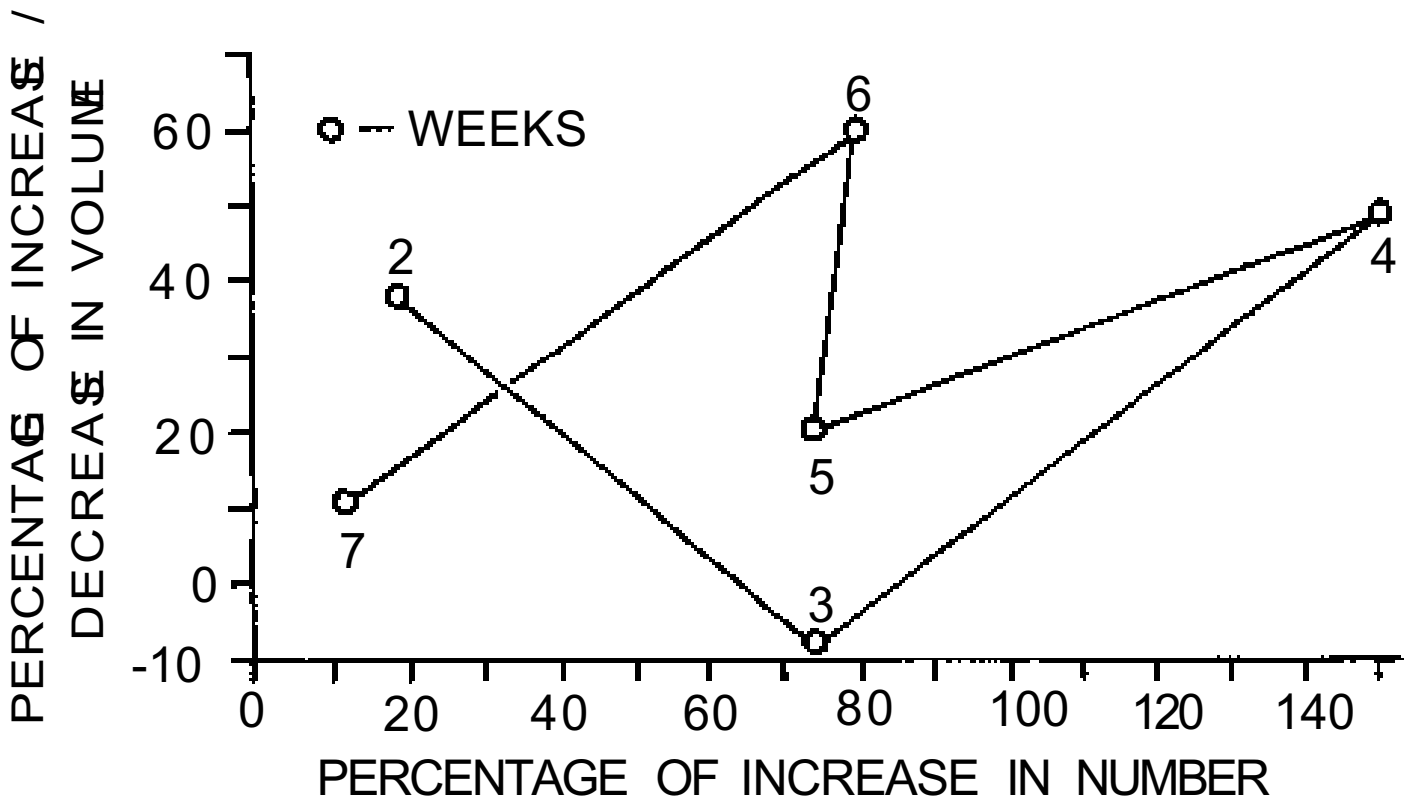

Fig 3 Relationship of volume of zooplankton to number in the different weeks (based on Bongo net samples)

week while the volume showed a downward trend by - 4 78% over the volume of the 6th week the number registered a minimal increase by 11 20%. This clearly shows that after a summer maximum of zooplankton its population started showing a decrease in their rate of multiplication as well as growth. This was a time when there was darkness for several hours a day and this would have caused in a dip in the phytoplanaton production. Also the grazing effect of the zooplankton would have left a little quantity of plant matter in the sea. This situation has affected further fattening and multiplication of the zooplankton organisms. Moreover the primary predators the second level consumers in the food chain that followed the zooplankton must have been making active feeding on them.

A few values of chlorophyll-*a* integrated for the euphotic zone (mg/m^2) were also available for the period of study (Aditi personal communication) which helped to understand the direct relation ship between the zooplankton and the phytoplankton (Fig 2). Towards the beginning of the investi gations the chlorophyll values obtained was 118 8 mg/m^2. This was the period when the sunlight was maximum ensuring high production at the primary level and the zooplankton was at the mini- mum In the absence of enough grazers it was not surprising to see that the phytoplankton survived to the maximum. Unfortunately the data obtained for the chlorophyll was not as regular as zooplank ton and hence a proper correlation became rather difficult. The next value obtained for chlorophyll was after about a fortnight. However this itself showed a tremendous decrease in the standing crop of phytoplankton.

Having obtained a rather clear picture of the rate of multiplication and growth of zooplankton in general through summer to the beginning of winter a further study was made to understand the popu- lation pattern of major groups of zooplankton. Following is a discussion based on the results thus obtained.

1 Euphausiids

The euphausiids constituted mainly by the krill *(Euphausia superba)* were caught in more numbers during the earlier days of the period of study. Their number per 1000 m^3 of water ranged between nil in the third week and 830 in the first week. The relative abundance among euphausiids (Fig 4) was found to be more in the first and last weeks being represented by 30 70% and 15 32% respectively. In the other weeks they were almost uniform in occurrence ranging from 8 47 and 12 91%. Most of the individuals were represented as larvae which showed that breeding was on during the period of investigation. As time passed a progressive trend in production was not noticed with this group.

Addition or deletion in the population of euphausiids was not always regular (table 3) and hence it is rather difficult to say anything definite about the multiplication or growth in the stock during the summer months. Probably such a pattern is to be expected when their predators are higher animals like penguins, whales etc.

2 Copepods

Numerically this was the major group represented in the zooplankton. Their multiplication during the summer months was quite rhythmic. From a minimum mean value of 9 537 individuals per 1000 m^3 of water in the first week the copepods made a regular increase to reach 1 21 694 individuals per 1000 m^3 of water in the last week of observation suggesting that the summer conditions were quite congenial for their multiplication and growth.

The relative abundance of copepods in the different weeks is given in Fig 4. The percentage was found to be almost double from the second to the third third to the fourth fourth to the fifth and from fifth to the sixth weeks. Thus from a minimum of 2 04% in the second week the copepods made an amazing increase of 30 90% in the sixth week. In the seventh week towards the beginning of the winter the rapid increase in population was arrested and the increase was by a little over 3% only during this week.

A correct picture of the rate of multiplication and growth was obtained when the percentage of increase or decrease in population over the previous weeks was worked out (table 3). Thus it was found that except in the second week when there was a decreasing trend in the population in all the other weeks heavy recruitment was indicated with peak in the fourth week and the minimum in the last week of observation. The reduction in the population in the second week over the population of the first week may be due to the result of increased rate of predation over breeding. The addition to the population was minimum in the last week towards the beginning of the winter by which time a stability might have occurred in the population.

3 Chaetognaths

This group was only moderately represented throughout the period of investigation. The weekly mean number ranged from 26 in the second week to 236 in the sixth week per 1000 m^3 of water. A steady increase from the second to the sixth week was observed. The percentage com position among chaetognaths in the different weeks is presented in Fig 3. In the first week they had a share of 5 26%. In the next week this was reduced to 2 74% showing a reduction in the population. But there was a substantial increase from the third to the seventh week which was of the order of 10 53% and 24 84% in the third and sixth weeks respectively.

The percentage wise oscillations in the the standing stock of chaetognaths in the different weeks when worked out was found that after an initial decline in the second week over that of the first week s population the condition improved and a substantial increase by 80 90% was noticed in the third week.

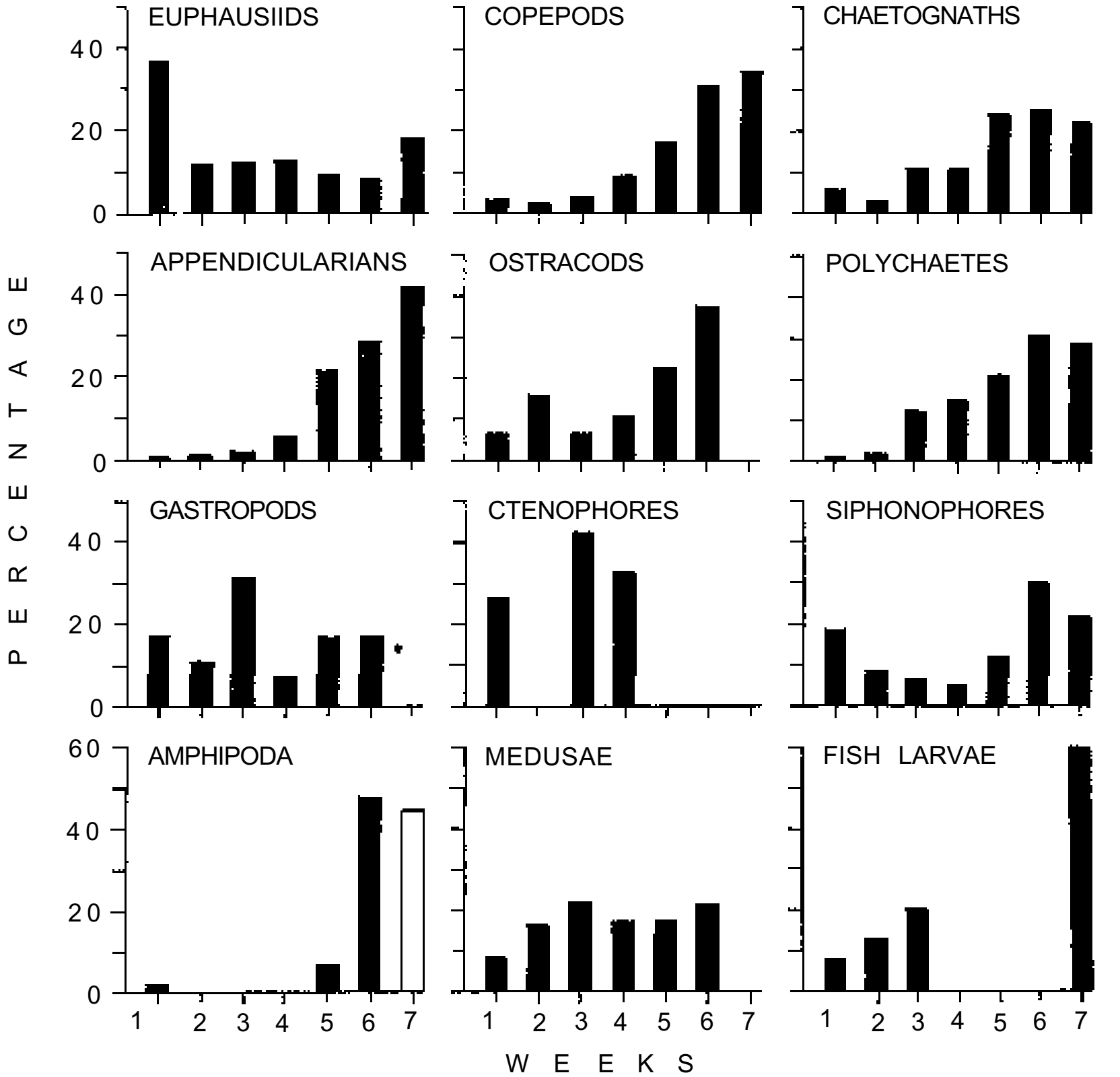

Fig 4 Relative abundance of major zooplankton groups in the different weeks (based on Bongo net samples)

While the status quo was maintained in the fourth week an increase by 119 00% was seen in the fifth week but no substantial increase was indicated in the last two weeks (table 3).

TABLE 3

Percentage of increase or decrease in the weekly mean numerical abundance of various groups of zooplankters during the summer months

Zooplankton groups	*Weeks*					
	2nd	3rd	4th	5th	6th	7th
Euphausiids	- 173 84	+ 6 98	+ 7 61	- 37 50	- 10 77	+ 80 77
Copepods	- 31 45	+ 80 90	+ 163 45	+ 73 44	+ 83 53	+ 10 57
Chaetognaths	- 92 31	+ 284 62	0	+119 00	+ 7 76	- 11 32
Appendicularians	+ 11 63	+ 268 75	+ 234 46	+306 59	+ 21 41	+ 49 57
Ostracods	+150 00	- 105 88	+ 44 12	+118 37	+ 64 49	
Polychaetes	+109 62	- 2 83	+ 619 34	+ 38 16	+ 47 60	- 5 75
Siphonophores	- 125 93	- 42 11	- 11 76	+123 53	+160 53	- 39 44
Amphipods				+233 33	+660 00	- 7 04
Gastropods	- 53 33	+ 186 67	- 330 00	+130 00	0	
Ctenophores		+ 56 82	- 28 57			
Medusae	+100 00	- 35 71	- 31 03	+ 3 45	+ 20 00	
Fish larvae	+ 66 67	+ 60 00	-			+200 00
Echinoderm larvae	+120 00					

4 Appendicularians

This was a group which always showed an increasing trend throughout the period of study. From a minimum of 43 specimens per 1000 m^3 of water in the first week they peaked with a weekly mean value of 4 659 specimens per 1000 m^3 of water in the seventh week. Their multiplication took momentum in the first two weeks and got accelerated in the following weeks.

Regarding the relative abundance of this group in the different weeks (Fig 4) their share in the first week was just 0 3% only which was almost maintained in the second week also after which it improved a little in the next two weeks. Major portion of the material collected were in the next three weeks. Thus from a minimum size of the population in the beginning the appendicularians gradually increased in number to reach the climax in the seventh week of observation.

A study of the rate of increase in population in each week revealed the following facts. Among the zooplankton collected the appendicularians were the only group which registered regular increase from the beginning to the end of the period of study. From an 11 63% of increase in the second week there was a significant increase by 268 75% in the third week 234 46% in the fourth week and 306 59% in the fifth week (table 3). From then onwards the percentage of increase was considerably lessened to 21 41 % and 49 57% in the sixth and seventh weeks respectively. The spectacular growth in population during the summer months must have been an indication in successful breeding and minimum predation by other animals until the fifth week.

5 Ostracods

This group of zooplankton was very poorly represented and therefore any conclusions on the population size relative abundance and percentage of addition to or removal from the population may be far from true. Their average weekly abundance ranged from 28 in the first week to 176 in the last week per 1000 m^3 of water. Their percentage abundance in the various weeks showed a gradual increase from the first week (6 03%) to the sixth week (37 93%) with a little higher value in the second week (Fig 4). Surprisingly this group was not collected in the last week of observation.

The rate of increase or decrease in population in due course of time when worked out (table 3) it was found that there was an increase by 150% in the second week over the first week population. But in the third week there was a reduction by 105 88% which appears to be significant. From this week onwards the rate was on the ascent.

6 Polychaetes

The polychaetes were another group of zooplankton which showed a steady increase as summer advanced. They were at the minimum towards the beginning of the studies with a mean weekly value of 104 specimens per 1000 m^3 of water. The trends of increase continued until the sixth week when there was a mean number of 3 110 individuals per 1000 m^3 of water.

When the relationship of populationship of the populations of polychaetes in the different weeks was worked out it was observed that of the total material only 1 02% was present in the first week followed by 2 13% in the second 2 07% in the third 14 93% in the fourth 20 62% in the fifth 30 44% in the sixth and 28 79% in the last week (Fig 4). Thus it is seen that about one third of the total material obtained was in the sixth week which suggests that the maximum multiplication with least mortality occuired in this week.

The actual contribution of polychaetes to the stock by way of recruitment was also worked out (table 3). It was seen that the population of the first week was more than doubled in the second week indicating a fast multiplication. A slight decrease by 2 83% was noticed in the third week over the population of the second week which however, is not much and have happened due to sampling errors. This is more evidenced by the fourth week value which showed an increase by 619 34%. This high value is because the estimate was made based on the low value of the third week. For the next two weeks there was reasonable increase by 38 16% and 47 60% respectively. In the seventh week a reduction in the population by 5 75% was seen which may account for heavy predation coupled with lack of recruitment towards the early part of the winter. As in the case with all other major zooplankton the rhythmic rise and fall of the populations of polychaetes are also strongly indicated from the mid summer to the beginning of the winter.

7 Siphonophores

Though not present in large numbers the pattern of abundance presented by siphonophores was interesting. Unlike the other zooplankters this group showed a declining trend as summer advanced only to show an improvement towards the close of the summer period. To begin with they were present at an average weekly rate of 61 specimens per 1000 m^3 of water. From this level there was a gradual reduction week after week until the number came down to mere 17 per 1000 m^3 of water in the fourth week. For the next two weeks an increase in the population was noticed with the maximum of 99 specimens per 1000 m^3 of water in the sixth week. Again there was a reduction in the last week.

The relative abundance in the different weeks (Fig 4) revealed that the fourth week had a share of 5 12% only while 29 82% was claimed by the sixth week. This shows that breeding has taken place in this group quite late in the summer.

The rate of addition to or deletion from the population was also considered for this group (table 3). From the original stock of the first week 125 93% was reduced in fhe second week. The rates of depletion in the following weeks were by 42 11% in the third week and by 11 76% in the fourth week. From the level of the fourth week there was a sudden increase by 123 53% in the next week. However in the last week again there was a reduction by 39 44% on the population of the sixth week. The data clearly shows that either the mortality surpassed the breeding upto the fifth week or there was no reproduction to compensate the loss of siphonophores by mortality.

There were six more groups represented in the zooplankton collected namely amphipods plank tonic gastropods ctenophores fish larvae medusae and echinoderm larvae. However as seen from table 3 they were not represented regularly so that any inference on the rate of recruitment or growth of these zooplankters is not possible in any way.

GENERAL CONSIDERATIONS

A second week reduction in population was indicated for at least five major groups namely euphausiids copepods chaetognaths gastropods and siphonophores. This may be because the adult populations which were in the early stages of breeding in the early part of the summer were heavily pre dated over by the first level carnivores. But later the increased breeding would have compensated or even surpassed the loss in the population by predation or natural mortality. A reduction of the popula-tion in the third week over that of the second week was found with ostracods polychaetes and siphono phores of which only polychaetes were represented with large number of organisms. In the fourth week the gastropods ctenophores siphonophores and medusae were on the decrease. However in the fifth and sixth weeks all the planktonic groups except the euphausuds showed remarkable increase in number with some groups like chaetognaths appendicularians ostracods amphipods gastropods and siphono phores registering an increase of more than 100% over the preceding weeks population. In the last week of observation with the exception of chaetognaths polychaetes and siphonophores and amphi pods all others showed an increase but relatively of a low magnitude indicating a depletion in the stand-ing crop towards the beginning of the winter.

The foregoing account throws some light into the structure and development of zooplankton populations as a whole and some of the major groups in independently in the Antarctic waters from the mid summer to the beginning of the winter. In most of the cases the increase effected was quite regular and more or less reflected the rate of multiplication and growth of populations overtime.

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