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ON THE COMPOSITION AND THE ABUNDANCE DISTRIBUTION OF ZOOPLANKTON IN THE YELLOW SEA IN APRIL, 1981

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ABSTRACT

In order to clarify the species composition and abundance distribution of zooplankton, quantitative samples collected in the Yellow Sea in April 1981 were analyzed. Ranges of temperatures and salinities of the study area were 4.55~9.80°C and 32.02~32.88‰, respectively. Total 33 taxa were identified from all samples collected. Species composition along the stations showed no remarkable variations. Copepods were the most important components of zooplankton community in the study area. Dominant species of copepods were *Oithona similis*, *Acartia clausi* and *Centropages mcmurrichi*. Appendicularia, Chaetognatha, Amphipod, and Euphausiid were distributed with minor abundance. Average biomass(wet weight) of zooplankton was 107mg/m^3, and the biomasses of zooplankton at offshore stations were greater than those of inshore stations in the study area. Average individual number of zooplankton was 1,915 indiv./m^3, and the variations along stations showed the same trend as in biomass. From the result of clustering with correlation coefficients calculated with the individual numbers per cubic meter for 20 zooplankton constituents at each station it was suggested that temperature had far-reaching effect on the distribution of zooplankton in the study area.

INTRODUCTION

Even though the open ocean environment is relatively uniform, there are many physical, chemical, and biological factors especially in local conditions which limit the distribution of most zooplankton. Thus, the accumulated data on zooplankton, which plays an important role as primary consumer in marine ecosystem, are crucial in better understanding marine environments.

Though several studies on the distribution of zooplankton had been reported in the nearshore and coastal waters of Korea, they were restricted to certain taxanomic groups such as Copepod(Lee, 1972), Cladocera(Yoo and Kim, 1978), Amphipod(Yoo, 1972) and Chaetognatha(Park; 1967, 1970, 1973) or to narrow areas(Park, 1956; Hue, 1967; Park *et al.*, 1973; Shim and Ro, 1982). The only study on the distribution covering overall zooplankton group in wide area of Korean waters has been done by Park in 1973.

This study was carried out to clarify the species composition and abundance distribution of zooplankton in the Yellow Sea in April 1981.

MATERIALS AND METHODS

Zooplankton samples were obtained from

18 stations in the Yellow Sea during the period of time from 12 to 16, April 1981 (Fig. 1). In collecting zooplankton Clarke-Bumpus plankton samplers(with 160μm mesh size net) were used and the samplers were towed horizontally at the speed of 1.5~2.0 knots for 5 minutes in 0, 5, and 10m layers, respectively.

Samples were fixed with neutralized formalin at a final concentration of 5% on board.

Temperature and salinity data of the study area were obtained from the observations which had been done by Fisheries Research and Development Agency at the same time (Anon., in preparation).

Zooplankton biomass was measured with wet weight in mg/m^3 and Bogorov's counting tray was used in counting zooplankton numbers.

RESULTS AND DISCUSSIONS

Temperature and Salinity

Surface temperature of the study area ranged from 4.55°C to 9.80°C with a mean of 6.89°C, values being lowest at station 1 and highest at station 15. According to Han(1978), isothermal lines of the surface in this study area are almost perpendicular to coast lines in winter and parallel in summer. Figure 2 shows the distribution of surface temperature during the period of this study.

Salinity of the study area varied from 32.05‰ to 32.88‰ with a mean of 32.53‰ at surface and from 32.02‰ to 32.88‰ with a mean of 32.53‰ at the depth of 10m. Distribution of surface salinity is shown in Fig.3. Salinities at inshore stations showed lower values than those at offshore stations. But these horizontal differences were less than 0.86‰.

Biomass

Biomasses of zooplankton in the study area

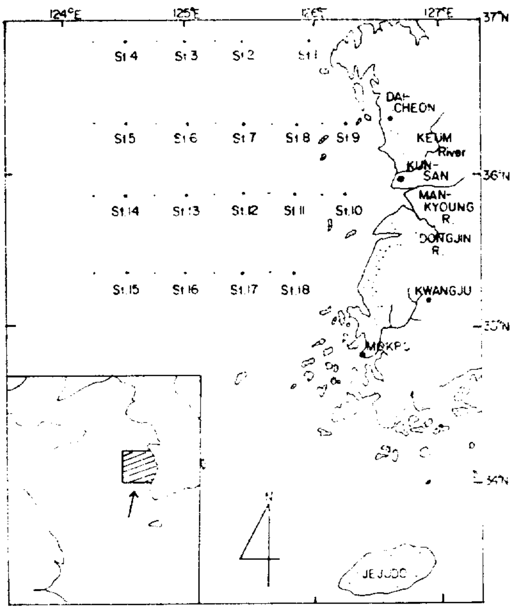

Fig. 1. A map showing plankton sampling stations of the study area, April 1981. (Small dots indicate hydrographic stations.)

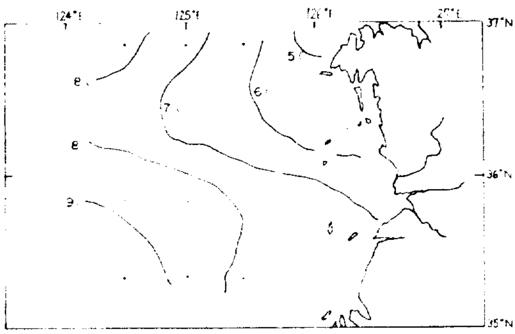

Fig. 2. Distribution of surface temperature in the study area, April 1981.

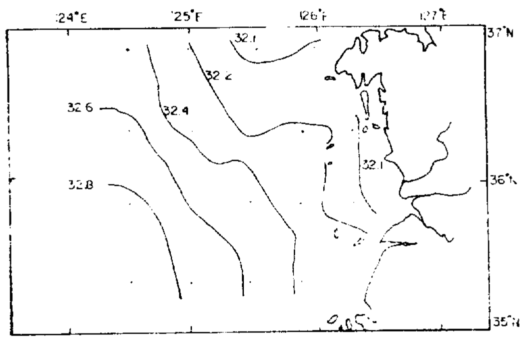

Fig. 3. Distribution of surface salinity in the study area, April 1981.

ranged from 3mg/m³(station 2, surface) to 523mg/m³(station 14, 10m layer) with a mean of 107mg/m³. This value is greater than those reported previously in the same area(Park, 1970, 1973). It seems to be due to the difference of mesh size of the net used. On the other hand, Lee(1982) reported 130mg/m³ of zooplankton biomass in the vicinity of Kunsan where stations 9 and 10 were included. This higher value may be resulted from high productive estuarine environment near Kunsan.

Figure 4 shows the distribution of zooplankton biomass in the upper 10m depth at each station. This distributional pattern is similar to Park's result(1970, 1973). The higher values at station 12, 13 and 14 of which samples were collected at night, could be caused by the amplified effect of vertical migration.

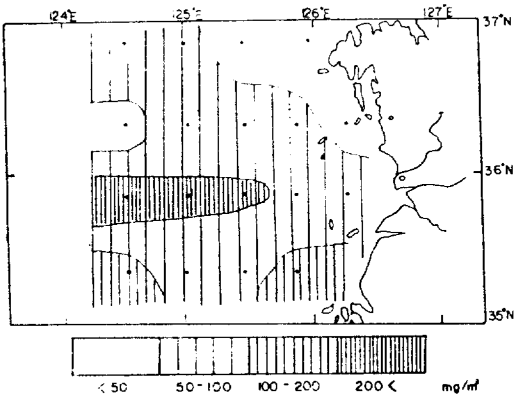

Fig. 4. Distribution of zooplankton biomass (wet weight, mg/m³) in the upper 10m, April 1981.

Species Composition and Abundance Distribution

Total 33 taxa were identified from all samples collected, and the list of them is given in Table 1. Tintinnids were observed only in qualitative observations. *Noctiluca*, which is classified as Dinoflagellate, was excluded from the study. Average individual number of zooplankton was 1,915 individuals/m³, which is greater than the value of Park's (1973) by about one order. It seems to be mainly due to the same reason as in biomass. Lee (1982) reported 1,354 individuals/m³ of zooplankton in inshore waters of the study area, while the biomass was high. This is probably due to his

Table 1. List of zooplankton observed in the study area. (Asterisks indicate the species or groups of which data were used in cluster analysis.)

CHAETOGNATHA	*Sagitta crassa* Tokioka	} *
	S. bedoti Beraneck	
ARTHROPODA	*S. sp.*	
Copepod	*Calanus sinicus* Brodsky	*
	Paracalanus parvus (Claus)	*
	Centropages mcmurrichi Willey	} *
	C. tenuiremis Thompsen et Scott	
	C. sp.	
	Acartia clausi Giesbrecht	*
	Oithona similis Claus	*
	O. plumifera Baird	*
	O. nana Giesbrecht	
	Oncaea venusta Philippi	} *
	O. conifera Giesbrecht	
	Corycaeus affinis McMurrichi	} *
	C. andrewsi Farren	
	Microsetella norvegica Boeck	*
Amphipod	*Parathemisto gracilipes* (Norman)	*
Euphausiacea	*Euphausia pacifica* Hansen	*
PROTOCHORDATA		
Appendicularia	*Oikopleura dioica* (Fol)	} *
	O. sp.	
LARVAL GROUP	Copepod nauplius	} *
	Copepodite	
	Polychaete trochophore	} *
	P. Loven's larvae	
	Cirripedia nauplius	} *
	C. cypris	
	Brachiuran larvae	*
	Caridean larvae	*
	Lamellibranch larvae	} *
	Pluteus larvae	
	Fish larvae	
	Eggs	*

samples collected early in March.

Figure 5 shows the distribution of zooplankton abundance. The distributional trend was similar to that of biomass. Copepods were the most important components of zooplankton community like other studies carried out in the coastal waters of Korea (Park, 1956; Hue, 1967; Bang, 1967; Choe, 1972; Park, 1973; Park *et al.*, 1975; Shim and Ro, 1982; Lee, 1982). The most dominant species of copepods were *Oithona similis*, *Acartia clausi* and *Centropages mcmurrichi*. *Oncaea* observed only at station 14, 15, 16 where the temperatures were relatively high showed low abundance. *Parathemisto gracilipes* and *Euphausia pacifica* were the only representatives of Amphipod and Euphausiid, respectively.

Table 2 gives the individual number of eight zooplankton groups, and abundance distribution of major groups of zooplankton is shown in Figure 6. The patterns of abundance distribution of Copepod and Copepod larvae showed nearly same trend of total abundance as expected, because Copepod was predomiating group of zooplankton community. Euphnausiid appeared only at offshore stations, while Amphipod was almost equally distributed along the stations. Appendicularia and Chaetognatha

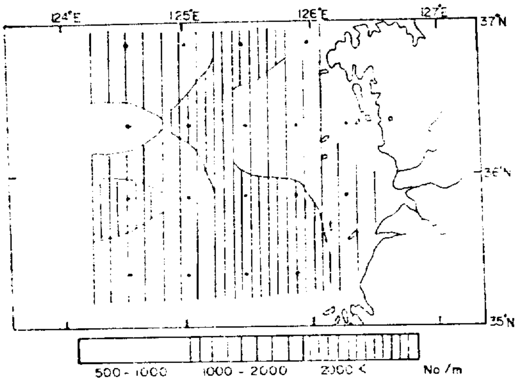

Fig. 5. Distribution of zooplankton abundance (individual numbers/m³) in the stuey area, April 1981.

Table 2. The individual numbers of the eight groups of zooplankton communites in the study area and the abundant species of each group.

Group	individuals/m³	Abundant species
Copepod	986	*Oithona similis*
		Acartia clausi
		Centropages mcmurrichi
Copepod larvae	713	
Appendicularia	69	*Oikopleura dioica*
Cheatognatha	18	*Sigitta crassa*
		S. bedoti
Amphipod	3	*Parathemisto grasilipes*
Euphausiid	1	*Euphausia pacifica*
Larvae	35	Polychaete larvae
		Cirripedia larvae
		Brachiuran larvae
		Caridean larvae
Egg	90	Fish egg

were negatively correlated in terms of horizontal distribution. Larval groups and eggs were appeared more abundantly in stations of which temperatures were below 7°C, indicating that these groups prefer low temperature.

The result of clustering with correlation coefficients calculated with the individual numbers per cubic meter for 20 zooplankton constituents (Table 1) at each station, showed high similarity in terms of species distribution. The cluster analysis (Fig. 7) indicates that the study area could be divided into two areas, A and B, along the isothermal line of 7°C (Fig. 2). Together with the facts that larval groups and eggs were appeared with more abundunce at stations where temperature was below 7°C and salinity range of the study area was narrow (Fig. 3), this result of cluster analysis suggested that temperature had an effect on the distribtion of some zooplankton groups in the study area.

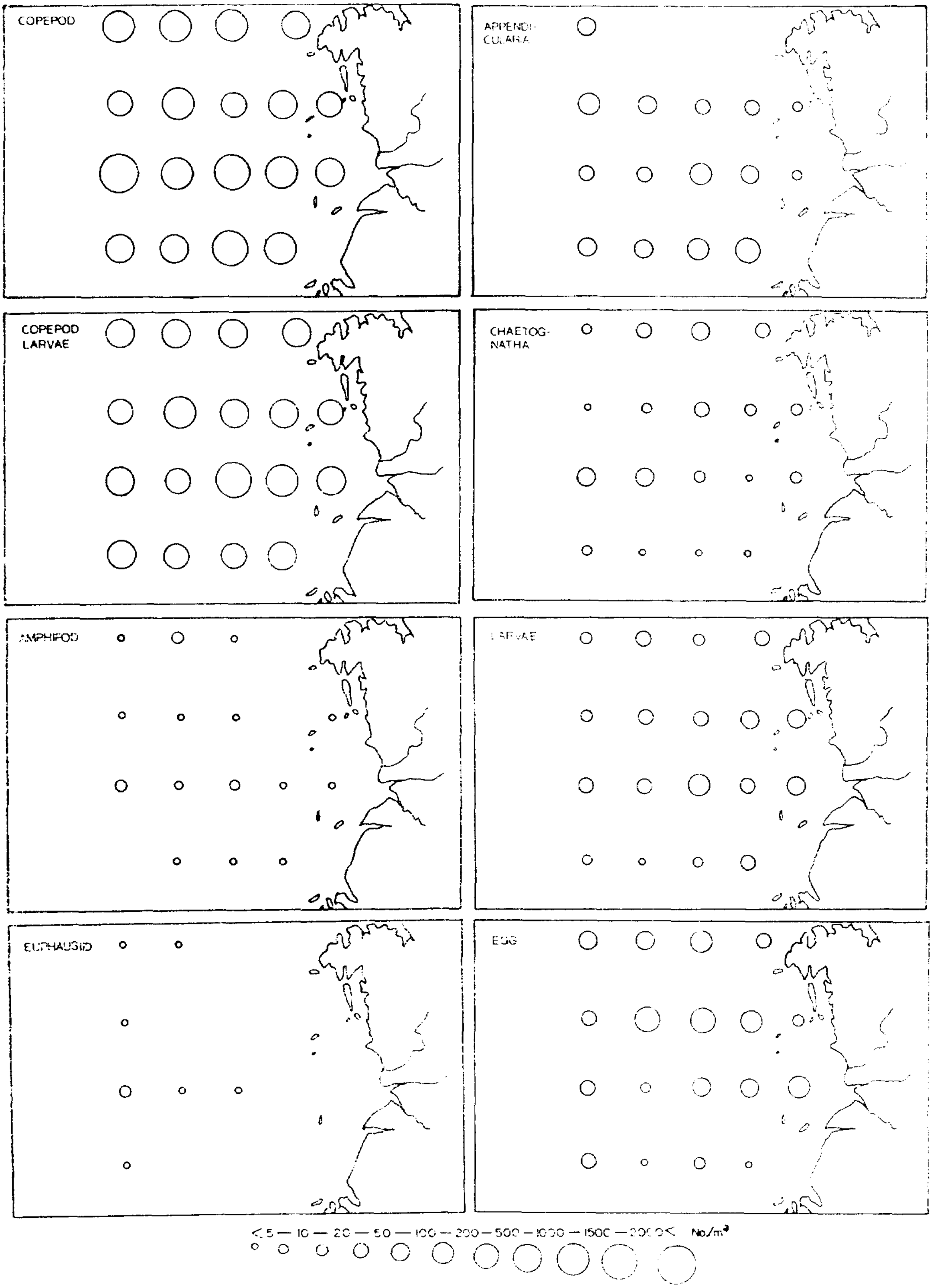

Fig. 6. Abundance distribution of major groups of zooplankton in the study area, April 1981.

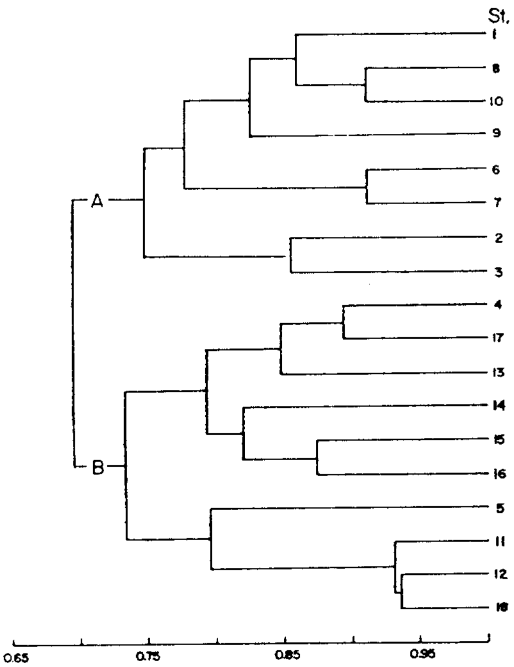

Fig. 7. Dendrogram showing the association of each station by clustering with correlation coefficients calculated with the individual numbers per cubic meter of zoolplankton constituents at each station.

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春季 한국 西海域에서의 動物플랑크톤의 種組成 및 量的 分布에 관한여

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要約：春季 한국 서해역에서의 동물플랑크톤 군집의 種組成 및 量的分布를 把握하기 위하여 1981年 4月에 정량채집한 시료를 分析하였다. 수온 및 염분의 범위는 각각 4.45°C~9.80°C와 32.02‰~32.88‰였다. 총 33개 분류군이 分類 동정되었으며, 정점간 종조성상의 차이는 두드러진 바 없었다. 橈脚類는 가장 우점하는 群으로서 우점종은 *Oithona similis,' Acartia clausi, Centropages mcmurrichi* 등이었다. 尾虫類, 毛顎類, 端脚類, Euphausiid類 등은 소량으로 분포하고 있었다. 동물플랑크톤의 現存量(습중량)은 평균 107mg/m³였으며, 대상지역內에서는 육지쪽 정점에서 보다 낮은 값을 보였다. 평균 개체수는 1915개체/m³로서, 정점별 분포양상은 현존량의 분포양상과 비슷하였다 각정점별, 분류군별 개체수를 통한 상관계수를 구하고 이를 토대로 Cluster analysis를 해본 결과는 이 지역에서 수온은 동물플랑크톤의 분포에 상당한 영향을 미치고 있을 것으로 사료되었다.