

## Zooplankton community of Patraikos Gulf of Greece

Zajednica zooplanktona zaljeva Patraikos u Grčkoj

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### INTRODUCTION

Detailed studies on zooplankton specific to Patraikos Gulf are practically nonexistent. Very limited data concerning the copepods of Ionian Sea and Korinthiakos Gulf, adjoined seas to Patraikos Gulf, have been reported by Moraitou-Apostolopoulou (1978). A preliminary study of surface zooplankton of Patraikos Gulf as recently performed (November 1980) by Siokou (personal communication), which is mainly focused on group composition.

Since 1981 we started a broad ecological study of the zooplankton community of Patraikos Gulf, a sea region with increasing pollution due to industrial effluents and domestic wastes. In the present paper we are presenting some of the results of our study. The sampling period is March 1981 — February 1982. We are giving a general outline of the major groups of zooplankton and their annual fluctuations, a list of copepods fauna of Patraikos Gulf and some seasonal features of the most common copepods. The list of copepod fauna might be completed by additional collections of more rare or sporadic species in future samplings.

### MATERIALS AND METHODS

A total of 49 zooplankton samples were collected with a net of 0.60 meters of mouth diameter and a mesh aperture of  $300 \mu$ , from a 31 station network (Fig. 1). All samples were collected by oblique hauls. Samples were fixed with

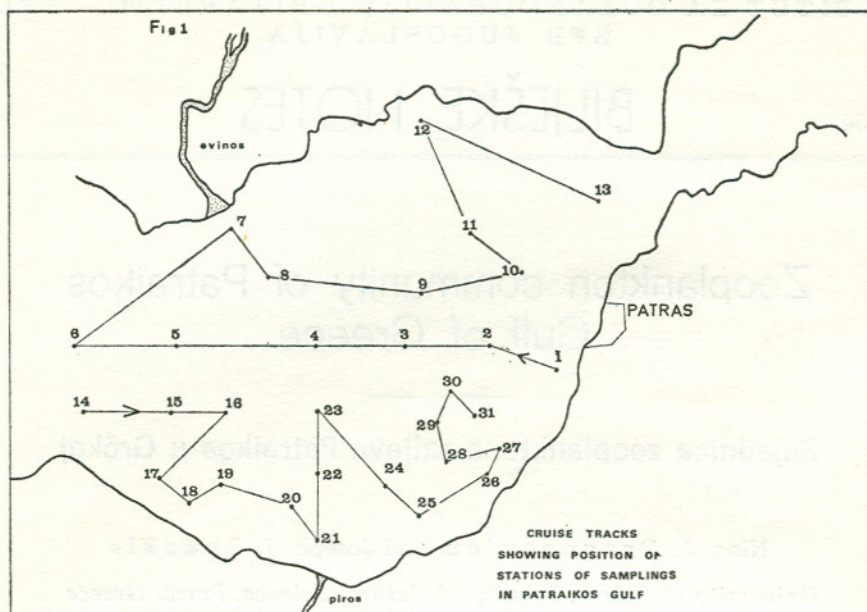


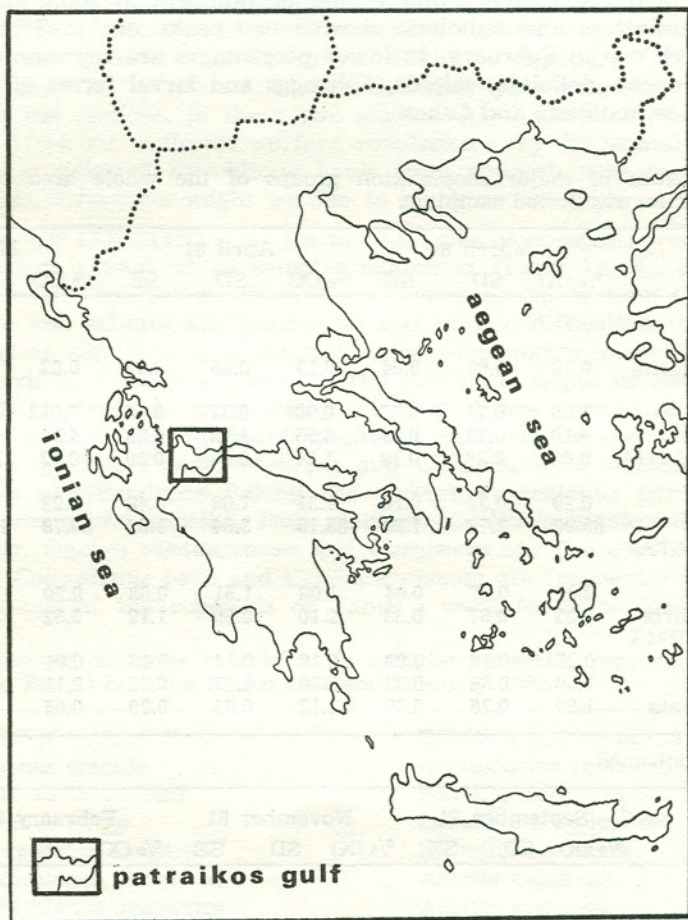
Table 1. Total number of samples and counted animals. Samples were collected between March 1981 and February 1982.

Period of sampling	Stations of sampling	Samples per period	Total animals counted
March 1981	2 3 4 5	4	7.002
April 1981	4 7 8 25 29	5	7.758
May 1981	2 3 4 5 7 11 12 25 29		18.662
September 1981	1 3 6 7 8 9 10 13 16 17		
	19 20 21 22 24 25 26 27 28	19	16.992
November 1981	4 14 15 23	4	2.455
February 1982	1 2 20 25 27 28 30 31	8	5.991
TOTAL NUMBER OF SAMBLES		49	

NOTE: The numbers in the last column indicate the counted animals in the sample portion, which was examined each time. Station are refered in Fig. 1.

neutralized 40% formalin, immediately after their collection. A Folsom splitter was used to subdivide samples into fractions for further examination. The results which are presented below concern samplings of the period March 1981 — February 1982. The sampling schedule is shown in the Table 1. Temperatures and salinities were measured with appropriate probes for these factors (YSI S-C Meter Model 33). The identification of copepod species and other taxa was based on keys and descriptions, such as those in Rose (1933), Tregouboff and Rose (1978) and Moraitou-Apostolopoulou

(1971). Some specimens were cross-identified by Dr. G. A. Boxshall (British Museum, Natural History). Group percentages were statistically treated by applying the H test (Atchley et al. 1976).



## RESULTS AND DISCUSSION

**MAJOR GROUPS** — If the whole Patraikos Gulf is considered as one uniform region, the seasonal variation of the major groups of zooplankton were found to be statistically significant as it is shown on Table 2 (H-test,  $p < 0.05$ ). The copepods are the most important group and among them, the Calanoidae predominate. Paired H-testing revealed the followings: the copepod abundance showed two statistically significant peaks in March-April 1981 and February 1982. On an annual basis the copepod fluctuation presented a single peak on spring which was followed by a decreased abundance during the summer and autumn. Cladocera increased in May, especially in the region of

Evinos river mouth, and their lowest level was recorded in February. Siphonophora reached their abundance peak in November. Chaetognatha were characterized by small seasonal variations and they were found in higher densities in the central region of Patraikos Gulf. Appendicularia followed small seasonal fluctuations and they were found in higher numbers in some stations near shores. Foraminifera and radiolaria showed two peaks, one in September and another lower one in February. In lower percentages are represented euphausiacea, mycidacea, doliolida, salpida, fish eggs and larval forms of crustacean, echinodermata, mollusca and fishes.

Table 2. Statistics of major zooplankton groups of the whole area of Patraikos Gulf for six period sampling.

	March 81			April 81			May 81		
	% ( $\bar{X}$ )	SD	SE	% ( $\bar{X}$ )	SD	SE	% ( $\bar{X}$ )	SD	SE
PROTOZOA									
Foraminifera and Radiolaria	0.39	0.08	0.04	0.13	0.05	0.02	0.02	0.04	0.01
CNIDARIA									
Medusae	1.06	0.78	0.39	0.93	0.37	0.16	0.012	0.10	0.03
Siphonophora	4.19	0.78	0.39	3.55	1.98	0.89	4.14	4.12	1.37
CHAETOGNATHA	0.62	0.38	0.19	1.24	0.64	0.29	0.72	0.65	0.22
CRUSTACEA									
Cladocera	0.29	0.32	0.16	1.31	1.08	0.48	5.93	7.31	2.44
Copepoda	85.99	2.78	1.39	85.15	3.64	1.63	83.78	16.56	5.52
UROCHORDATA									
Doliolida and Salpida	0.04	0.07	0.04	1.08	1.51	0.68	0.20	0.31	0.10
Appendicularia	2.22	0.67	0.33	2.10	2.50	1.12	2.52	4.18	1.39
LARVAL FORMS									
Polychaeta	0.27	0.18	0.09	0.18	0.14	0.06	0.01	0.02	0.01
Crustacea	2.00	0.66	0.33	2.38	1.17	0.52	2.11	0.97	0.32
Echinodermata	1.50	0.76	0.38	1.12	0.65	0.29	0.05	0.09	0.03

Table 2. — continued

	September 81			November 81			February 82			H-test value
	% ( $\bar{X}$ )	SD	SE	% ( $\bar{X}$ )	SD	SE	% ( $\bar{X}$ )	SE	SE	
PROTOZOA										
Foraminifera and Radiolaria	7.28	5.43	1.25	0.47	0.48	0.24	5.2	4.34	1.53	33.04
CNIDARIA										
Medusae	0.62	0.59	0.14	0.36	0.20	0.10	0.35	0.42	0.15	16.91
Siphonophora	4.26	2.73	0.63	12.96	4.29	2.14	3.50	3.07	1.08	11.10
CHAETOGNATHA	1.54	0.93	0.21	1.39	0.35	0.18	0.21	0.20	0.07	21.83
CRUSTACEA										
Cladocera	3.21	2.09	0.48	0.76	0.71	0.35	0.09	0.26	0.09	26.74
Copepoda	74.97	8.63	1.98	76.99	5.52	2.76	87.30	7.42	2.62	16.29
UROCHORDATA										
Doliolida and Salpida	1.71	4.74	1.09	0.00	0.00	0.00	0.00	0.00	0.00	14.31
Appendicularia	7.28	5.43	1.25	3.91	1.74	0.87	1.25	0.73	0.26	15.41
LARVAL FORMS										
Polychaeta	0.02	0.04	0.01	0.12	0.16	0.08	0.21	0.20	0.07	18.36
Crustacea	1.72	1.42	0.33	2.11	0.80	0.40	0.49	0.34	0.12	15.35
Echinodermata	0.20	0.39	0.09	0.34	0.30	0.15	0.31	0.34	0.12	20.80

Our findings as far as the mean percentages of the major zooplankton groups of Patraikos Gulf is concerned, are in some respect different from those reported by Siokou (unpublished data) for the same sea region. In her study she reported higher percentages for copepods (85.36) and cladocera (3.56) but lower ones for appendicularia (1.18), siphonophora (3.28) and crustacean larval from (0.38). The above comparisons concern samples of November 1980 (Siokou's data) and November 1981 (our findings, Table 2). These differences may be attributed to the different year-samples, number and locations of net stations, in these two studies. Also, sampling techniques are different. Siokou collected surface zooplankton by horizontal hauls. Our samples were collected by oblique hauls from a depth near to the bottom. Finally, some differences might be due to plankton net types.

FAUNA OF COPEPODA. — Up to 37 species of copepods were identified (Table 3) from a total of 49 samples examined (Table 1). No attempt was done to correlate species distribution to environmental factors. Our data on temperature and salinity are incomplete and impose difficulties in explaining their ecological, significance to distribution of zooplankton members. However, most copepods of Table 3 are neritic. The maximum depth of Patraikos Gulf is about 120 meters but most stations of Fig. 1 are located at depths less than 60—70 meters. The dominant species of copepods are *Oithona plumifera*, *Centropages typicus*, *Temora stylifera* and *Clausocalanus arcuicornis*. In the second rank of abundance belong the species *Paracalanus parvus*, *Acartia clausi*, *Pleuromamma gracilis*, *Isias clavipes*, *Lucicutia flavicornis*, *Candacia longimana*, *Oncaea mediterranea* and *Corycaeus* sp. The copepods *Mecynocera clausi*, *Calocalanus pavo* and *Candacia armata* are frequently encountered. The remainings of the copepods of Table 3 were found in lower numbers.

Table 3. A list of copepods identified in samples collected from various stations (see Fig. 1) between March 1981 and February 1982.

<i>Calanus helgolandicus</i>	<i>Candacia longimana</i> (a)
<i>Calanus gracilis</i>	<i>Anomalocera patersoni</i>
<i>Calanus tenuicornis</i>	<i>Pontella mediterranea</i>
<i>Calanus minor</i>	<i>Labidocera wollastroni</i>
<i>Mecynocera clausi</i> (f)	<i>Pontellina pulmata</i>
<i>Paracalanus parvus</i> (a)	<i>Acartia clausi</i> (a)
<i>Paracalanus denudatus</i>	<i>Acartia negligens</i>
<i>Calocalanus pavo</i> (f)	<i>Oithona setigera</i>
<i>Calocalanus styliremis</i>	<i>Oithona pulmifera</i> (d)
<i>Clausocalanus arcuicornis</i> (d)	<i>Oithona nana</i>
<i>Clausocalanus furcatus</i>	<i>Clytemnestra rostrata</i>
<i>Temora stylifera</i> (d)	<i>Clytemnestra scutellata</i>
<i>Pleuromamma gracilis</i> (a)	<i>Euterpina acutifrons</i>
<i>Centropages typicus</i> (d)	<i>Oncaea mediterranea</i> (a)
<i>Centropages kroyeri</i>	<i>Copilia quadrata</i>
<i>Centropages violaceus</i>	<i>Sapphirina</i> sp.
<i>Isias clavipes</i> (a)	<i>Corycaeus latus</i>
<i>Lucicutia flavicornis</i> (a)	<i>Corycaeus ovalis</i>
<i>Candacia armata</i> (f)	

NOTE: d = dominant, a = abundant, f = frequent

Densities of *Acartia clausi* were found increased in the river mouths of Evinos and Piros, as well as in the harbor of Patras. Its high densities in these regions is explained by the increased levels of nutrients, which were recorded in the same areas by Chalkides (unpublished data). This finding indicates the advanced state of pollution in some stations of Patraikos Gulf. The density of *Acartia clausi* is nearly doubled in all stations of the studied sea region during spring and autumn in comparison to other seasons.

From the point of view of seasonal variation we may classify the copepods of Patraikos Gulf into the following groups: 1) a year-round group in which belong *Clausocalanus arcuicornis*, *Paracalanus parvus*, *Oithona setigera*, *Acartia clausi* and *Corycaeus* sp., 2) a spring-group in which belong *Centropages typicus* and *Isias clavipes* and 3) a winter-group of copepods which are more abundant during the winter comparing to other seasons. In the third group belong *Temora stylifera*, *Pleuromamma gracilis*, *Calocalanus pavo*, *Mecynocera clausi*, *Lucicutia flavicornis*, *Candacia longimamma* and *Oncaea* sp.

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## KRATAK SADRŽAJ

U radu su proučeni razni aspekti zooplanktonske zajednice zaljeva Patraikos (Grčka). Nađeno je da je procentualna zastupljenost glavnih zooplanktonskih skupina: 74,97—87,30% za kopepode, a 0,09—5,93% za kladocere, 3,50—12,96% za sifonofore, 0,21—1,54% za hetognate i 1,25—7,28% za kopelate. Ove vrijednosti dobivene su sa mreže od 31 istraživane postaje.

U sakupljenim uzorcima determinirano je ukupno 37 vrsta kopepoda. Najbogatije zastupljene vrste bile su: *Oithona plumifera*, *Centropages typicus*, *Temora stylifera* i *Clausocalanus arcuicornis*. Neke vrste najbrojnije su u proljeće, neke kroz zimu, a druge kroz čitavu godinu.