The Structure of Zooplankton Population in the Jabuka Pit Area (Eastern Mediterranean)

Struktura populacije zooplanktona Jabučke kotline (Istočni Mediteran)

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Summary

The paper presents data on the structure of total zooplankton according to comparison of microfraction and mesofraction of quantitatively important zooplankton groups in the Jabuka Pit region. Research work was carried out during six cruises from 1986 to 1992 in the framework of the Adriatic Scientific Coordinating Programme (ASCOP). The samples were collected by vertical tows in three layers (50 to 0 meters, 100 to 50 meters and bottom to 100 meters). The microzooplankton was sampled with a 53 µm Nansen net equipped with a closing device and mesozooplankton with a Juday-Bogorov 250 µm net. There was no significant difference in zooplankton abundances between the eastern and western part of Jabuka Pit. The differences in the vertical distribution pattern, precisely between the surface and near the bottom samples were significant. Qualitative composition of some of the zooplankton groups differ between the western and eastern part of the Pit primarily due to the appearance of oceanic species in its eastern part, carried with mediterranean and south Adriatic water masses. This influence was most pronounced in December 1986 and August 1992. It should be noted that in September 1987 and in August 1992, small *Oithona* and *Oncaea* genera's copepods prevailed, whereas in December 1986, May 1987 and August 1990, the calanoids were the dominant group.

KEY WORDS
Population Structure
Mesozooplankton
Microzooplankton
Eastern Mediterranean
Adriatic Sea

Sažetak

U radu se donose podatci o strukturi ukupnog zooplanktona na temelju usporedbe mikrofrakcije i mezofrakcije kvantitativno važnih skupina zooplanktona u Jabučkoj kotlini. Istraživanja su obavljena tijekom šest krstarenja od 1986. do 1992. u sklopu programa ASCOP (Adriatic Scientific Coordinating Programme). Uzorci su prikupljeni okomitim potezima u tri sloja (50-0 m, 100-50 m i dno-100 m) Nansen mrežom na zatvaranje finoće tkanja 53 µm (mikrozooplankton) i Juday-Bogorov mrežom na zatvaranje finoće tkanja 250 µm (mezozooplankton). Nije zabilježena značajna kvantitativna razlika između istočnih i zapadnih postaja, već unutar vertikalne raspodjele, posebice između površinskih i pridnenih uzoraka. Razlika u kvalitativnom sastavu nekih zooplanktonskih skupina u istočnom i zapadnom dijelu istraživanog područja prvenstveno je posljedica pojave oceanskih vrsta u istočnom Jadranu iz istočnomediteranskih i južnojadranskih vodenih masa. Ovaj utjecaj je naizraženiji u prosincu 1986. i kolovozu 1992. U rujnu 1987. i kolovozu 1992. u ukupnom zooplanktonu dominiraju vrste rodova Oithona i Oncaea, dok su u prosincu 1986., svibnju 1987. i kolovozu 1990. dominantna skupina kalanoidni kopepodi.

KLJUČNE RIJEČI
struktura populacije
mezozooplankton
mirkozooplankton
istočni Mediteran
Jadransko more

INTRODUCTION / *Uvod*

An intensified research work of the Adriatic on the eve of the First World War resulted in first valuable data on the central Adriatic and the Jabuka Pit zooplankton. The rich plankton material collected from aboard the German zoological station RV "R. Virchow" during the 1909 and 1911 cruises contain valuable data on many plankton groups (Früchtl, 1920; Laackmann, 1913; Neppi, 1912; Steuer, 1910). Important scientific expeditions, namely the Austro-Hungarian "Najade" (1912-1914) and the

Italian "Ciclope" (1911-1914) carried out research in the Jabuka Pit region. The collected plankton material was only partially analysed due to the outbreak of the First World War (Leder, 1917; Steuer, 1913). In between the two wars, the plankton research in the Jabuka Pit was almost entirely neglected. Investigations were carried out mostly in the coastal areas of northern and middle Adriatic. More detailed plankton investigations in the Jabuka Pit region were continued within the framework of the fisheries-biological expedition "Hvar" (1948-1949) (Gamulin, 1954; Hönigman, 1955; Vučetić, 1963). Oceanographic and fisheries-biological issues were dealt within the research work carried out by some international teams that only partially covered plankton (Shmeleva, 1964, 1965, 1969; Shmeleva and Kovalev, 1974; Shmeleva and Zaika, 1973). Investigations carried out from 1974 to 1976 aboard the RV "Andrija Mohorovičić" of the State Hydrographic Institute, as well as investigations in 1990's and 2000's rendered data that markedly contributed to the knowledge of the spatial and temporal variations in population densities, horizontal and vertical distribution, seasonal and dial migrations as well as biomass of important zooplankton groups in the Jabuka Pit area (Batistić, 1994, Benović, 1977; Bojanić, 2011; Gamulin and Ghirardelli, 1983; Hure, 1980; Hure *et al.*, 1980, Katavić, 1976).

However, due to different sampling methods in previous studies, it lacks a complete overview of the importance of all the zooplankton groups, regardless their quantitative contribution. Therefore, the study of both, microfraction and mesofraction of zooplankton, was necessary in order to get the more complete results. Adriatic Scientific Co-ordinating Programme (ASCOP) was an international cooperation project on the protection of the Adriatic Sea and its coastal area from pollution. Project started in 1979 in the northern, and in 1986 in the central Adriatic, thus given the opportunity of the first comparisons between microfraction and mesofraction of zooplankton according to groups.

MATERIALS AND METHODS / *Materijali i metode*

The zooplankton material was collected during six cruises (December 1986, May 1987, September 1987, May 1988, August 1990 and August 1992) aboard the RV "Bios" at four stations located along the Pescara - Šibenik profile (Figure 1).

Microzooplankton was sampled using a 53 µm Nansen net and mesozooplankton using a modified 250 µm mesh-size Juday-Bogorov net, both nets with a closing device. The samples were collected by vertical hauls in three different layers: from 50 m to the surface, from 100 to 50 m and from the bottom to 100 meters, depending on the depth of the sampling station. The material was preserved in 2.5 neutralised formaldehyde. Microzooplankton samples were filtered through a 200 µm silk in order to remove all large organisms and then analysed.

Subsamples of 1/8 to 1/32 of the original samples volume were analysed by means of binocular microscope. Microsoft Office Excel 2003 programme was used for statistical analysis (arithmetic means and standard deviations). Pearson's correlation coefficient and Student's *t*-test were done according to SYSTAT 5.0 software package (Wilkinson, 1986).

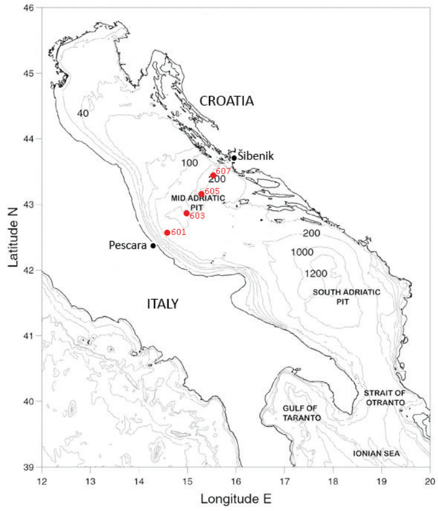
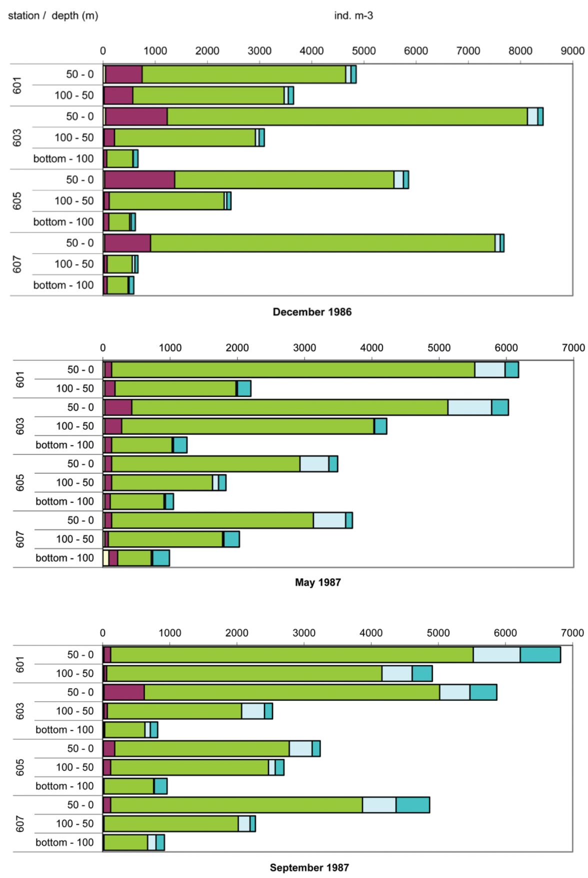


Figure 1 Study area with sampling stations
Slika 1. Raspored postaja na istraživanom području

RESULTS AND DISCUSSION / *Rezultati i rasprava*

Zooplankton abundances were always 10 to 15 times higher in microfraction than in mesofraction, with the exceptions in August 1990 and August 1992 (Figure 2 and 3). The August 1990 catch had minimum mean microzooplankton value of 630.5 ± 333.5 ind. m^{-3}, that almost equalled the mesozooplankton mean population density values of 458.7 ± 270.5 ind. m^{-3}. High microzooplankton values (3551.0 ± 2549.0 ind. m^{-3}) and lowest mesozooplankton values (88.6 ± 72.1 ind. m^{-3}) was recorded in August 1992. The highest densities of total microzooplankton and mesozooplankton was found in the surface layer (up to 50 m depth).



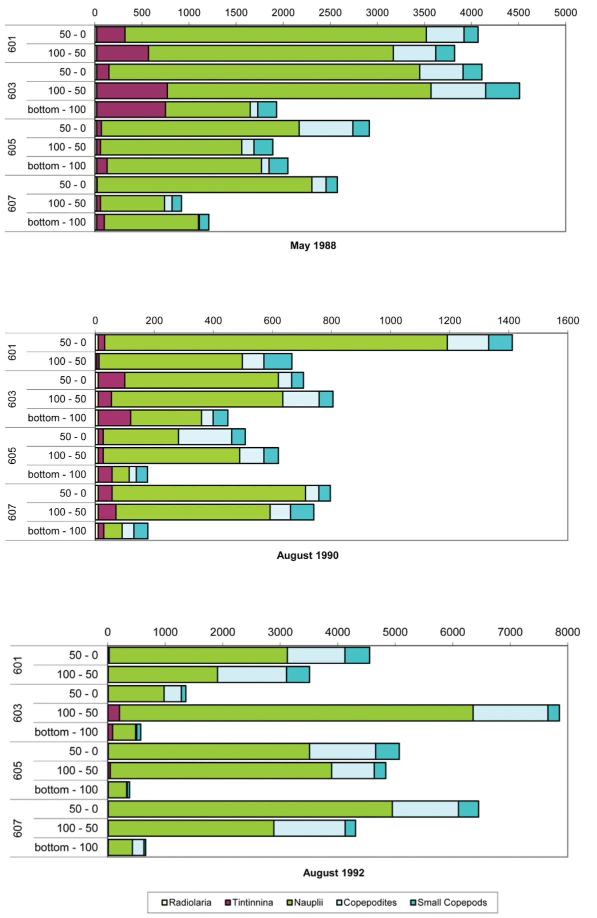


Figure 2 Composition and abundance (ind. m^{-3}) of microzooplankton in the Jabuka Pit area during investigated period

Slika 2. Sastav i gustoća (jed. m^{-3}) mikrozooplanktona u Jabučkoj kotlini tijekom istraživanog razdoblja

Dominant group of microzooplankton was nauplii with a highest abundance in December 1986 in the surface layer at Station 603 (6880 ind. m^{-3}) (Figure 2). The lowest naupliar values were registered in near the bottom layer at Station 605 (81 ind. m^{-3}) in August 1990. Copepodites occurred in highest numbers in August 1992 with a maximum value of 1320 ind. m^{-3} in the surface layer at Station 605. Oncaeidae copepodites dominated the catch (61.8 %), whereas the adult small copepods (mainly *Oithona nana*, *Oncaea zernovi* and *Monothula subtilis*) were most abundant in September 1987 in the surface layer at Station 601 (560 ind. m^{-3}).

Like nauplii, tintinnines were most abundant in December 1986 (1344 ind. m^{-3} in the surface layer at Station 605), whereas in other seasons, their density values did not exceed 756 ind. m^{-3}. Number of tintinnine species in the eastern part of the study area was higher than that in the western, due to the migration of the species from the South Adriatic along the eastern coast to the Jabuka Pit (Kršinić, 1995). A decrease in species number of this group was related to a qualitative impoverishment of the oceanic tintinnines fauna in the South Adriatic Pit and Otranto that started in 1987.

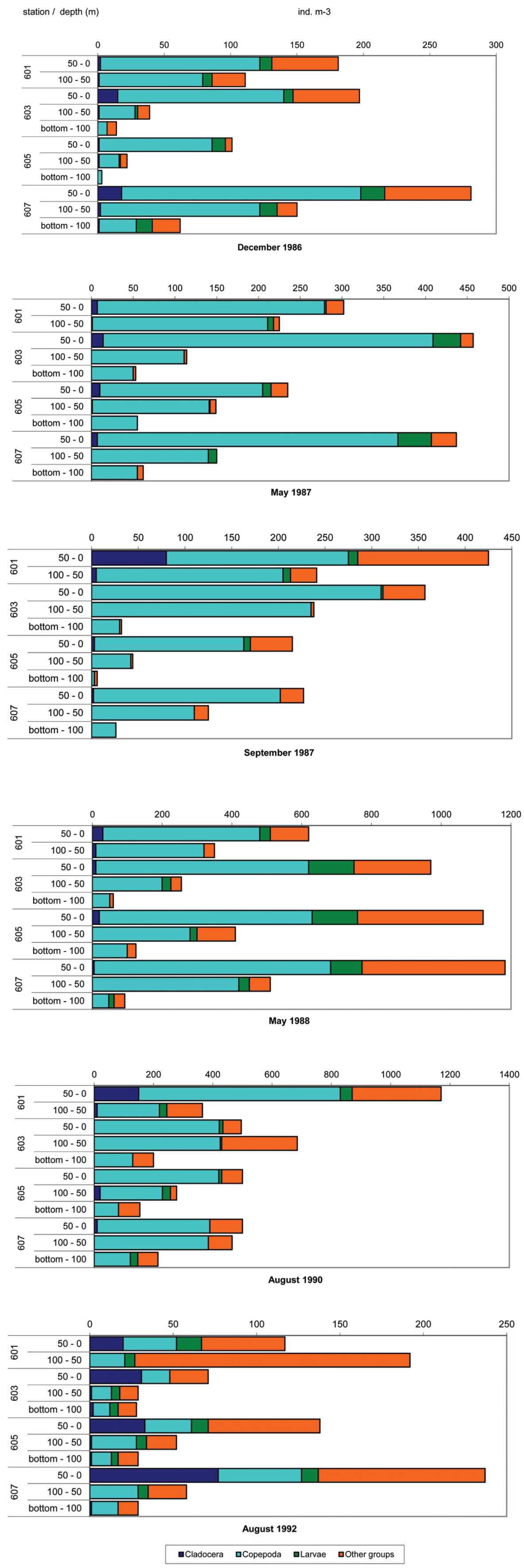


Figure 3 Composition and abundance (ind. m^{-3}) of mesozooplankton in the Jabuka Pit area during investigated period

Slika 3. Sastav i gustoća (jed. m^{-3}) mezozooplanktona u Jabučkoj kotlini tijekom istraživanog razdoblja

Copepods markedly dominated the mesozooplankton throughout the investigation period, except in August 1992, when Thaliacea occurred in high numbers in some of the samples, especially the species from the genus *Doliolum* (Figure 3). Significant cladoceran contribution of 17.8 to 47.8 % to total mesozooplankton was recorded in August 1992 in the surface samples. This species had a maximum density of 152 ind. m^{-3} in August 1990 at the Station 601 in the surface layer. Highest copepod density (678 ind. m^{-3}) was recorded in May 1988 in the surface layer at the Station 607, while the lowest one was in near the bottom layer at Station 605 (2 ind. m^{-3}, respectively) in December 1986. Surface (epipelagic) species of a vast horizontal distribution dominated the copepod populations in all the seasons (Table 2). These were the following species: *Paracalanus parvus*, *Clausocalanus arcuicornis*, *Clausocalanus jobei*, *Ctenocalanus vanus*, *Centropages typicus*, *Temora stylifera* and *Oithona plumifera*. These results corroborate the results obtained in previous investigations in the Jabuka Pit region (Gamulin 1948, 1979; Hure, 1982; Bojanić, 2011). Moreover, this coincide with the findings in the open Alboran, Tyrrhenian and Levantine waters (Delalo, 1966; Pasteur et al., 1976; Scotto di Carlo *et al.*, 1975; Shmeleva, 1964; Vives, 1967; Vives et al., 1975). Highest diversity of copepod species was in May 1987 (71 species) and in August 1990 (62 species) (Table 2). Besides the already mentioned coastal species, the following species were also numerous in upper 100 meters: poecilostomatoid *Oncaea media*; of the open sea epipelagic species: *Mesocalanus tenuicornis*, *Clausocalanus paululus* and *Clausocalanus pergens*. The following subsurface (intermediary) community representatives were found below 50 meters depth: *Eucalanus monachus*, *Chiridius poppei*, *Heterorhabdus papiliger* and *Haloptilus longicornis*. This indicates the summer migration of the open-water surface and subsurface species from the South Adriatic Pit. The spreading of these species from the South towards the Central Adriatic and further to the shallow Northern Adriatic mostly occurred in winter (Hure, 1980; Hure *et al.*, 1980) and it is evident in the eastern part of the investigated area (Bojanić Varezić, 2011). This coincides with the intrusion of the Mediterranean water that consists of the surface Ionian and modified Levantine intermediary waters in deeper layers (200 to 300 m) (Artegiani *et al.*, 1993;, Shmeleva, 1964; Vilibić and Orlić, 2001; Zore-Armanda, 1963). Moreover, it is confirmed that populations of radiolarians were renewed by the incoming Eastern Adriatic current from the Ionian Sea, especially during winter period, as well as by the ingression of Levantine intermediate waters during ingression years (Kršinić and Kršinić, 2012).

As opposed to the August 1990 samples, only 34 copepod species were recorded in the August 1992 mesozooplankton samples (Table 2) with markedly law surface species density values. In addition, the majority of subsurface (intermediary) calanoid copepods were lacking. Simultaneously, cyclopoids (*Oithona* copepodites) and poecilostomatoids (Oncaeidae copepodites and *Monothulla subtilis*) dominated the microfraction (Table 1). The quantitative and qualitative impoverishment of the calanoid copepod species on one hand and evidently high naupliar, cyclopoid and poecilostomatoid copepodite numbers recorded in August 1992 on the other hand, may be due to the influence of the Northern Adriatic waters. The increased eutrophication and mass occurrence of aggregations ("sea-blooms") occurred in the Northern Adriatic in summer period and lasted three years (from 1988 through 1990). During this period, markedly low total microzooplankton values were recorded. In August 1991 and 1992, microzooplankton occurred in increased densities, especially nauplii. Summer maxima were recorded at the stations along the western coast of the Northern Adriatic, thus indicating the tendency of the ecosystem of the Northern Adriatic to restore "normal conditions" (Kršinić, 1995). Recent investigations in circulation patterns indicate that the Northern Adriatic waters moves along the western coast and changes its direction toward the middle part of the Mid Adriatic due to the influence exerted by the circular currents in the area (Orlić *et al.*, 1992, Šturm *et al.*, 1992). Owing to this circulation pattern, there occur conditions favouring the development of the microzooplankton population, especially quantitatively important *Oncaea* species.

No significant differences were found between the eastern and the western stations (*t*-test, $p = 0.06$) in zooplankton abundances, although according to the results obtained in previous investigations, the eastern Adriatic was generally thought to be quantitatively poorer than the western (Hure *et al.*, 1980). The differences in the vertical distribution pattern, precisely between the surface and near the bottom samples were significant. Analysis of the qualitative composition indicates the difference between the western and the eastern Adriatic (Tables 1 and 2). Differences in species composition of some zooplankton groups, and the occurrence of the oceanic species in the eastern Adriatic indicate the influence of the Mediterranean and South Adriatic waters. This influence was pronounced in December 1986 when the open sea tintinnines were recorded in the open Adriatic waters. In addition, the first record of the radiolarian species *Challengeron willemoesii* was noted below the 100 meters depth in the Jabuka Pit area in August 1992.

The comparison between the microfraction and mesofraction groups indicated that in September 1987 and August 1992 a significant correlation existed between nauplii and copepodites, nauplii and small copepods as well as between copepodites and small copepods. This was due to the mass occurrence of small Oithonidae and Oncaeidae copepods among nauplii and copepodites. On the other hand, a significant correlation between nauplii and copepodites and between nauplii and calanoid copepods as well as between copepodites and calanoid copepods, noted in December 1986, May 1987 and August 1990 indicate the dominance of the calanoid group among the developing copepod stages (Table 3). Moreover, it should be noted that during the cyclopoid and poecilostomatoid copepods' domination in the microfraction, calanoid copepods were found in low densities in mesofraction (September 1987 and August 1992). In addition, quantitative and qualitative calanoid domination in the mesofraction in August 1990 was accompanied by lower presence of cyclopoids and poecilostomatoids in the microfraction.

CONCLUSION / *Zaključak*

The comparison between microfraction and mesofraction of zooplankton according to groups, carried out for the first time in the central Adriatic, pointed out no significant quantitative differences between the eastern and the western stations. But in the same time, significant differences in qualitative composition between the eastern and the western Adriatic were recorded.

Differences in species composition of some zooplankton groups, and the occurrence of the oceanic species in the eastern Adriatic indicate the influence of the Mediterranean and South Adriatic waters.

Further investigations of zooplankton populations in the study area are highly recommended due to economical importance, especially in fisheries, as well as contribution to knowledge of physical, chemical and biological processes in the Adriatic Sea. Combination of sampling methods is highly recommended, as well.

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Table 1 List of microzooplankton taxa found in the Jabuka Pit
Tablica 1. Taksonomski sastav mikrozooplanktona u Jabučkoj kotlini

	XII 1986	V 1987	IX 1987	V 1988	VIII 1990	VIII 1992
HELIOZOA						
Sticholonche zanclea	+	+				
RADIOLARIA						
Protocystis xiphodon		+				+
Challengeron diodon	+				+	+
Challengeron willernoesii					+	+
Euphysetta lucani		+				
Euphysetta pussila	+					
Lirella sp.					+	+
Theopilium tricostatum	+					
Antocyrtidium ophirense	+					
Lithomelissa thoracites	+				+	
Cladococcus cervicornis	+					
Hexacontium asteracathion	+					
Hexacontium axotrias		+				

TINTINNINA						
Tintinnopsis campanula	+					
Tintinnopsis angulata					+	
Codonella aspera	+	+	+	+	+	+
Codonella galea	+	+			+	
Codonella amphorella		+				
Codonaria cistellula	+	+		+	+	+
Stenosemella ventricosa	+			+		
Codonellopsis orthoceras	+			+	+	
Codonellopsis schabi	+					
Cyttarocylis eucecryphalus	+	+		+	+	+
Cyttarocylis cassis	+	+	+		+	+
Epiplocylis acuminata	+		+		+	
Epiplocylis undella	+					
Petalotricha ampulla	+	+	+	+	+	+
Protorhabdonella curta					+	
Rhabdonella spiralis	+	+			+	
Parundella lohmannii	+				+	+
Xystonella lohmannii					+	+
Xystonella treforti		+				
Xystonellopsis brandti	+					
Xystonellopsis cymatica	+					
Undella hyalina	+		+		+	
Undella claparedei	+	+		+		
Undellopsis marsupialis	+			+	+	
Dictyocista elegans	+	+	+	+	+	+
Dictyocista lepida	+					
Dictyocista mitra	+					
Steenstrupiella steenstrupii	+				+	
Steenstrupiella intumescens	+					
Daturella spp.						+
Amphorides quadrilineata	+					
Amphorides quadril. var minor					+	
Eutintinnus fraknoi	+				+	
Eutintinnus lusus-undae	+	+		+	+	
Eutintinnus latus	+					
Salpingella glockentoegerii	+				+	
MOLLUSCA						
Limacina juv.					+	
Creseis juv.					+	
Gastropoda larvae					+	
Bivalvia larvae	+	+		+	+	
ANNELIDA						
Polychaeta larvae		+	+	+	+	
COPEPODA						
Oithona helgolandica					+	
Oithona nana	+		+		+	
Oithona setigera					+	
Oithona sp.						+
Monothula subtilis	+	+	+	+	+	+
Oncaea zernovi	+	+	+	+	+	+
Oncaea media	+			+	+	+
Oncaea mediterranea						+
Oncaea minima	+				+	
Oncaea vodjanitskii	+	+	+			
Oncaea sp.					+	+
Epicalymma exigua	+			+	+	
Spinoncaea ivlevi	+	+	+	+	+	+
Triconia dentipes					+	
Microsetella norvegica	+	+	+	+	+	+
Euterpina acutifrons				+	+	
Total number of taxa	47	23	13	19	43	21

Table 2 List of mesozooplankton taxa found in the Jabuka Pit

Tablica 2. Taksonomski sastav mezozooplanktona u Jabučkoj kotlini

	XII 1986	V 1987	IX 1987	V 1988	VIII 1990	VIII 1992
HYDROMEDUSAE	+	+	+	+	+	+
SIPHONOPHORAE	+	+	+	+	+	+
CLADOCERA						
Penilia avirostris	+		+	+	+	+
Evadne nordmannii		+	+	+	+	
Evadne spinifera	+	+	+	+	+	+
Evadne tergestina	+		+		+	
Podon polyphemoides	+					
Podon intermedius	+	+	+	+	+	
COPEPODA						
Calanus helgolandicus	+	+	+	+	+	+

Mesocalanus tenuicornis	+	+	+	+	+	+
Nannocalanus minor	+	+	+	+	+	+
Neocalanus gracilis	+	+		+	+	
Mecynocera clausi	+	+	+	+	+	
Calocalanus contractus	+	+	+	+	+	
Calocalanus neptunus	+					
Calocalanus ovalis					+	
Calocalanus pavo	+	+	+	+	+	
Calocalanus styliremis	+	+	+	+	+	
Eucalanus crassus			+		+	+
Eucalanus monachus	+	+	+	+	+	+
Pareucalanus attenuatus	+	+	+	+	+	+
Paracalanus denudatus	+	+	+	+	+	
Paracalanus nanus	+	+		+	+	
Paracalanus parvus	+	+		+	+	+
Ischnocalanus plumulosus	+	+	+	+	+	
Clausocalanus arcuicornis	+	+	+	+	+	+
Clausocalanus furcatus	+	+	+	+	+	+
Clausocalanus jobei	+	+	+	+	+	
Clausocalanus lividus	+	+		+	+	
Clausocalanus mastigophorus	+	+		+	+	
Clausocalanus parapergens	+	+	+	+		
Clausocalanus paululus	+	+	+	+	+	
Clausocalanus pergens	+	+	+	+	+	+
Ctenocalanus vanus	+	+	+	+	+	+
Pseudocalanus elongatus	+	+	+	+	+	
Aetideus armatus	+	+	+	+	+	+
Aetideus giesbrechti	+	+	+	+	+	+
Chiridius poppei	+	+		+	+	
Euchaeta acuta		+				
Euchaeta hebes	+	+	+	+	+	+
Scaphocalanus invalidus		+		+		
Scaphocalanus similis	+	+	+	+	+	
Scolecithricella dentata	+	+	+	+	+	+
Scolecithricella sp.	+	+				
Scolecitrix brady	+	+	+	+	+	
Diaixis pygmoea	+	+	+	+	+	
Pleuromamma abdominalis	+	+		+		
Pleuromamma gracilis	+	+	+	+	+	+
Lucicutia clausi		+				
Lucicutia flavicornis	+	+	+	+	+	
Lucicutia ovalis	+					
Lucicutia pera		+		+		
Heterorhabdus papilliger	+	+	+	+	+	
Haloptilus acutifrons	+	+		+	+	+
Haloptilus longicornis	+	+	+	+	+	+
Haloptilus ornatus	+					
Centropages kroyeri	+	+		+	+	+
Centropages typicus	+	+	+	+	+	+
Centropages violaceus	+	+			+	
Isias clavipes		+	+	+	+	
Temora longicornis	+	+	+	+	+	
Temora stylifera	+	+	+	+	+	+
Candacia bispinosa	+					
Candacia giesbrechti	+	+	+	+	+	+
Candacia simplex	+	+				
Labidocera wollastoni		+				
Pontella mediterranea	+					+
Acartia clausi	+	+	+	+	+	+
Acartia longiremis	+					
Oithona helgolandica	+	+	+	+	+	
Oithona nana	+	+	+	+	+	
Oithona plumifera	+	+	+	+	+	+
Oithona setigera	+	+	+	+	+	
Microsetella norvegica	+	+		+		
Microsetella gracilis					+	+
Euterpina acutifrons	+	+	+	+	+	
Clytemnestra rostrata	+		+	+	+	
Monothulla subtilis	+	+	+	+	+	+
Oncaea media	+	+	+	+	+	
Oncaea mediterranea	+	+	+	+	+	
Oncaea tenella		+				
Oncaea venusta	+	+	+	+	+	
Triconia conifera	+	+	+	+	+	
Triconia dentipes	+	+				
Lubbockia sp.	+	+			+	
Mormonilla minor	+					
Sapphirina sp.	+	+	+	+	+	+
Vettoria sp.	+	+	+	+	+	
Copilia mediterranea	+					
Corycaeus sp.	+	+	+	+	+	+
Monstriella sp.	+	+				
MYSIDACEA						
Lophogaster typica			+			

Siriella clausi			+			
Siriella jaltensis	+					
Anchialina agilis	+					
Haplostylus normanii	+					
Haplostylus lobatus	+	+	+	+		
Gastrosaccus lobatus					+	+
EUPHAUSIDACEA						
Euphausia krohni	+	+	+	+	+	+
Nyctiphanes couchii	+	+	+			
Meganyciphanes norvegica	+	+	+	+	+	
Thysanopoda aequalis	+					
Stylocherion longicorne	+		+			
Nematoscelis megalops		+	+			+
OSTRACODA	+	+	+	+	+	
PTEROPODA						
Creseis clava	+	+	+	+	+	+
Creseis perone					+	+
Heliconoides inflatus					+	+
Hyalocylis striata	+					
Limacina trochoformis					+	
CHAETOGNATHA						
Sagitta minima	+	+	+	+	+	+
Sagitta setosa	+	+	+	+	+	+
Sagitta enflata	+	+	+	+	+	+
Sagitta serratodentata	+	+		+	+	+
Sagitta hexaptera		+				
APPENDICULARIA						
Oikopleura albicans	+					
Oikopleura dioica	+	+	+	+	+	
Oikopleura fusiformis	+	+	+	+	+	+
Oikopleura longicauda	+	+	+	+	+	+
Oikopleura cophocerca	+	+	+			
Oikopleura intermedia	+					
Oikopleura parva	+					
Oikopleura rufescens	+					
Fritillaria borealis	+				+	+
Fritillaria pellucida	+	+	+	+	+	+
Fritillaria haplostoma	+	+	+	+	+	+
Fritillaria megachile	+		+			
Fritillaria gracilis					+	
Fritillaria tenella	+					+
Kowalewskia tenuis						+
DOLIOLIDA	+	+	+			+
SALPIDA	+	+	+			+
LARVAE						
Bivalvia	+	+	+	+	+	+
Gastropoda	+	+	+	+	+	
Polychaeta	+	+	+	+	+	+
Euphausidacea		+	+	+	+	+
Decapoda		+	+	+	+	+
Echinodermata	+	+	+	+	+	+
Pisces ova	+	+	+	+		+
Pisces	+	+	+	+	+	+
Total number of taxa	118	105	88	92	96	60

Table 3 Pearson's correlation coefficient (r) between nauplii, copepodites, small copepods and calanoids in the Jabuka Pit (n = 11, $p < 0.05$*, $p < 0.01$**, $p < 0.001$***)

Tablica 3. Pearsonov koeficijent korelacije (r) između nauplija, kopepodita, te malih i kalanoidnih kopepoda u području Jabučke kotline (n = 11, p < 0.05, p < 0.01**, p < 0.001***)*

	XII 1986	V 1987	IX 1987	V 1988	VIII 1990	VIII 1992
Nauplii–copepodites	0.848***	0.734**	0.922***	0.824**	0.420 n.s.	0.820**
Nauplii–small copepods	0.104 n.s.	0.466 n.s.	0.778**	0.508 n.s.	0.486 n.s.	0.670*
Nauplii–calanoids	0.772**	0.773**	0.791**	0.507 n.s.	0.829**	0.541 n.s.
Copepodites–small copepods	0.267 n.s.	0.331 n.s.	0.834***	0.591 n.s.	0.446 n.s.	0.867***
Copepodites-calanoids	0.669*	0.859***	0.799**	0.483 n.s.	0.638*	0.638*
Small copepods-calanoids	-0.115 n.s.	0.407 n.s.	0.521 n.s.	-0.192 n.s.	0.311 n.s.	0.741**