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MACROINVERTEBRATE DIVERSITY IN THE KARST JADRO RIVER (CROATIA)

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Abstract — This paper presents the results of 10 years of investigation of the aquatic macroinvertebrate fauna along the karst Jadro River. The Jadro is a typical karst river. Benthic macroinvertebrates were collected along the river at 15 sites by standard methods of sampling, in addition to which several physicochemical parameters were also determined. Based on qualitative and quantitative composition of the macroinvertebrate fauna, correspondence analysis divided the river course into three sections: upstream, midcourse, and downstream. Forty-three taxa were recorded. Results of saprobiological analysis based on macrozoobenthos indicate that water of the Jadro River belongs to quality classes I and II.

Key words: Aquatic macroinvertebrates, community composition, Jadro River, Dinaric karst, Croatia

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INTRODUCTION

It is well known that benthic macroinvertebrates are the best studied community of running waters. The Jadro River is part of the Dinaric karst, which occupies almost 50% of Croatia's territory (Fig. 1A). It consists of four paleo-dynamic and paleo-structural belts. The area in which Jadro River lies in a region of carbonate landforms and karst phenomena along the Adriatic Coast. The area includes carbonate landforms of Mesozoic and later age (K u h t a , 2002). The Jadro was chosen for investigation because it has a typical Mediterranean hydrological regime and is a very important karst river that has supplied the the city of Split with drinking water from Roman times to the present day. The spruce of the Jadro is located at an elevation of 30 meters above sea level. Total length of the Jadro is 4.5 km. It discharges into Kaštela Bay of the Adriatic Sea. The river's catchment area is approximately 260 km^2 and is part of watershed of the Cetina River (Fig. 1B). Physicochemical characteristics of the Jadro have been studied by Š t a m b u k - G i l j a n o v i ć (1994, 1999, 2002, 2005). The upper parts have preserved the river's natural characteristics, but the lower parts are polluted by the impact of human activities such as agriculture and by various wastewaters (Š t a m b u k - G i l j a n o v i ć , 2002, 2005). The range between minimum and maximum discharge is from 2 m^3/s (July 1995) to 100 m^3/s (December, 2002). Studies have also been carried out on the Jadro's phytobenthos (V u k o v i ć , 1981) and macrozoobenthos (R a đ a , 2002, 2006). Five sampling sites situated upstream, in midcourse, and downstream were examined. Upstream sites are subject to the direct influence of groundwaters, especially during the winter and spring seasons. Midcourse sites are polluted as a result of agriculture and by urban and industrial sources of pollution, as are downstream sites. Downstream sites are also under considerable influence of seawater, especially during summer. The aim of this paper is to present collected data on the community composition and diversity of macroinvertebrates, as well as differences between separate sectors of the river.

MATERIAL AND METHODS

Sampling of macroinvertebrates

One sample of benthic macroinvertebrates was taken at each station four times per year from 1994 to 2004 (total of 600 samples) using a standard pond net (mesh size 900 µm). The fauna attached to stone surfaces was collected by means of tweezers and, if necessary, scraped with a fine brush (planarians,

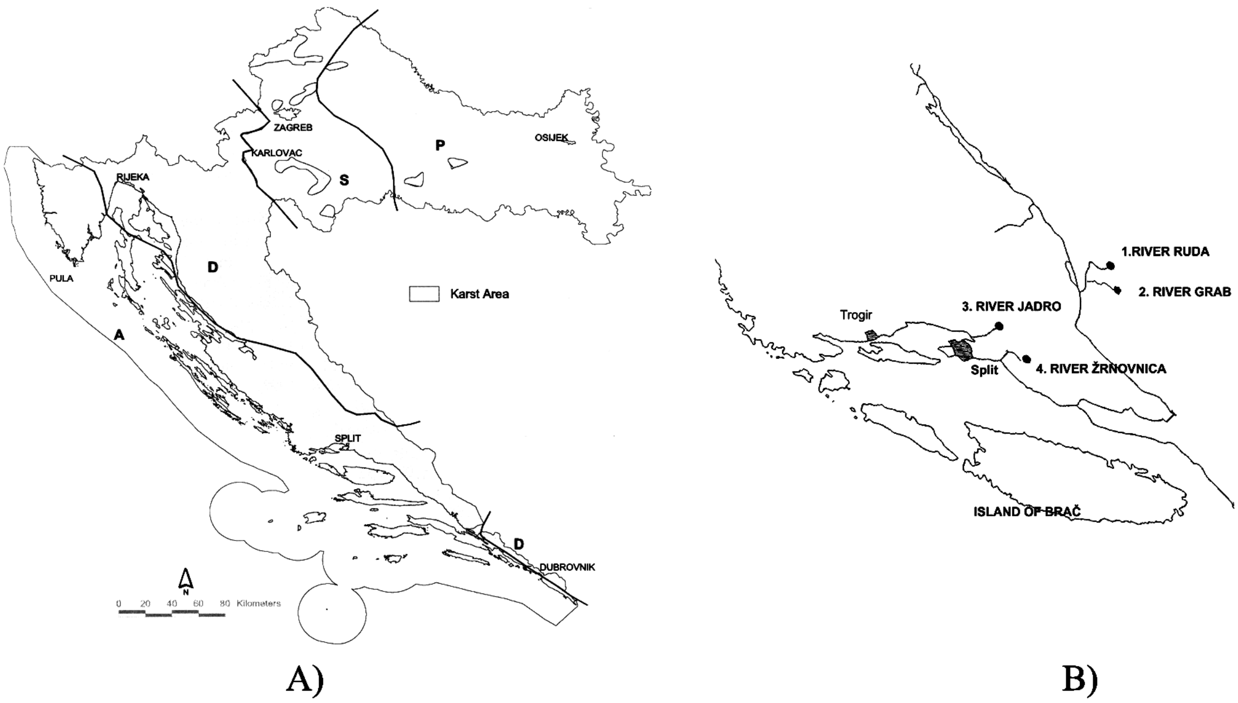


Fig. 1. A) Simplified general tectonic map of the Croatian part of the Dinarides with the distribution of karst; B) The catchment area of the River Jadro.

gastropods, leeches). The samples were placed in plastic bottles and preserved in 95% ethanol. They were sorted and identified to the lowest possible taxonomic level in the laboratory using a Leica MZ 7.5 stereozoom microscope (10x10 and 10x40) and manuals for identification (Bernasconi, 1986, 1990; Bole, 1971; Campaioli et al., 1994, 1999; Chinery, 1984; Danielopol and Marmonier, 1994; Dierl, 1988; Girod et al., 1980; Giusti and Pezzoli, 1980; Gourbault, 1994; Graf, 1974; Harde, 1999; Karaman and Sket, 1989; Radoman, 1973,1983; Sansoni, 1998; Schütt, 1975; Sket, 1965, 1969, 1988, 1994). Oligochaetes were identified by Prof. Eva Dumnicka, amphipods by Prof. Boris Sket, and hydrobiid snails by Tonći Rađa.

The study included qualitative and quantitative analysis of the benthic community. Species diversity was calculated using the number of observed taxa, Simpson's index, the Shannon-Weiner index, the Pielou index, and Margalef's index (Krebs, 1989), and community abundance was analyzed to illustrate the distribution of invertebrates along the river. Graphics were made using Primer 5.0 software (Clarke and Warwick, 2001). Quantitative samples were considered as the mean percentage of groups in samples. Data were calculated by the most frequently used clustering strategy, namely the unweighted pair-group method using arithmetic averages (UPGMA), Euclidean distance being taken as the correlation coefficient (Krebs, 1989). The relationship between macroinvertebrate taxa and physicochemical parameters on the one hand and sampling sites per year and season on the other was analyzed by multivariate techniques such as principal components analysis (PCA). Graphics were made using Statistica 7.1 software. The complete material is deposited in the invertebrate collection of the Department of Biology of Split University's Science Faculty. Estimation of saprobity was performed by saprobiological analysis according to Pantle and Buck (1955).

Physicochemical parameters

Several physicochemical parameters (temperature, dissolved oxygen, dissolved CO_2, alkalinity, hardness, pH and substrates) were measured at each station four times per year from 1994 to 2004 (total of 600 measurements). Surface water was sampled in 1-L polypropylene sampling bottles for determination of some physicochemical parameters. Temperature, dissolved oxygen, dissolved CO_2, alkalinity and pH were measured using a digital meter (Handylab, Schött) with the appropriate probes according to APHA (1995) and hardness in German degrees (d°H) was determined as the product of alkalinity (mg $CaCO_3$/l) times a factor of 2.8. Substrates were estimated at the Institute of Oceanography and Fisheries in Split and the percentage of particles was determined using a modified version of the Wentworth scale according to B o g n e r (1996).

RESULTS

Macroinvertebrate community structure

A total of 43 macroinvertebrate taxa were found during the investigation. The highest taxon richness was observed among insects (Insecta), especially mayflies (Ephemeroptera), snails (Gastropoda), with eight and seven species, respectively. Other invertebrate groups were less diverse. The number of taxa observed at each sampling site area varied between 33 and 43 (Table 1). Seasonal analysis of the macroinvertebrate community showed that snails have equal abundance from season to season (50 - 68%). Differences were determined for amphipods and insects, whose numbers increase during spring and summer (12 - 26%) in comparison with autumn and winter abundance (6 - 12%) (Fig. 2A-C).

1. Upstream sites

Fourteen groups of macroinvertebrates were isolated from upstream samples (Table 1). Gastropods were the dominant group in terms of mean relative abundance in all seasons (50 - 68%). In second place were amphipods, whose numbers increased from 6 - 12% (autumn and winter) to 26% (spring and summer). The dominant insects were mayflies (Ephemeroptera) and true flies (Diptera). The most frequent species was *Gammarus balcanicus* (Amphipoda). Relations between the number of individuals in macroinvertebrate groups by seasons are shown in Fig. 2A.

2. Midcourse sites

Thirteen macroinvertebrate groups were identified from midcourse samples (Table 1). Among them were two groups lacking in upstream samples: ostracods and worms. These samples contained no stoneflies (Plecoptera). Gastropods were still the dominant group. Amphipods and insects increased in number during spring and summer (Fig. 2B).

3. Downstream sites

Twelve groups of macroinvertebrates were identified from downstream sites (Table 1). The macroinvertebrate community differs from those observed upstream and midcourse sites. Under considerable marine influence, there were polychaetes in samples. Gastropods were present in smaller number than at upstream and midcourse sites, but they were numerous in autumn and winter, when the influence of fresh water is very strong. During spring and summer the influence of sea water is dominant and brakish individuals occur predominantly at sites near the estuary (Fig. 2C).

Analysis of sampling sites and taxa obtained using unweighted pairs of group (Fig. 2D) shows that downstream sampling sites exhibit greater distance than upstream and midcourse sites, the main factor for such distance being influence of the sea on downstream sites. There is also greater distance between upstream and downstream sites than between upstream and midcourse sites because the influence of underground waters in addition to physicochemical parameters defines community structure at upstream sites. Dissimilarity indices indicate that species diversity is more expressed in upstream and downstream parts of the river. In the investigated period, species diversity at upstream sites increased during 1994-1998. and 1999–2002 (Fig. 3A-C). In the midcourse part of the river, decreased values of all indices were detected during 2002, which was the result of an ecological incident (motor oil flowed into the river from a local factory) (Fig. 3B). The indices at downstream sites showed unequal values (Fig. 3C). Values of Sorensen's index were as follows: 85,70% between upstream and

Table 1. Composition of the benthic fauna of the karst Jadro River (+ - presence, 0 - absence).

TAXA		UPSTREAM SITES	MIDCOURSE SITES	DOWNSTREAM SITES
TURBELLARIA	*Polycelis felina*	+	+	**0**
	Dugesia gonocephala	+	+	+
OLIGOCHAETA-NEMATODA	*Nematoda*	**0**	+	+
	Limnodrilus sp.	**0**	+	**0**
	Nais sp.	**0**	**0**	+
	Tubifex sp.	**0**	**0**	+
OLIGOCHAETA-ANNELIDA	*Eiseniella tetraedra*	+	**0**	**0**
	Lumbricus rubellus	**0**	+	**0**
OLIGOCHAETA-HIRUDINEA	*Erpobdella octoculata*	+	+	**0**
	Glossiphonia complanata	+	+	+
	Helobdella stagnalis	**0**	+	**0**
GASTROPODA	*Adriohydrobia kutschigi*	+	+	**0**
	Ancylus fluviatilis	+	+	**0**
	Emmericia patula	+	+	**0**
	Lymnea stagnalis	+	+	+
	Oxyloma elegans	+	+	**0**
	Physa fontinalis	+	+	+
	Theodoxus fluviatilis	+	+	**0**
BIVALVIA	*Pisidium* sp.	+	+	+
	Sphaerium sp.	+	+	+
CRUSTACEA	*Asellus aquaticus*	+	+	**0**
	Gammarus balcanicus	+	+	+
OSTRACODA	*Cypris* sp.	**0**	+	**0**
ACARINA	*Hygrobates* sp.	+	**0**	**0**
	Neumania apinipes	+	**0**	**0**
EPHEMEROPTERA	*Baetis rhodani*	+	+	**0**
	Centroptilum luteolum	+	+	+
	Cloeon simile	+	+	+
	Ecdyonurus sp.	+	**0**	**0**
	Ephemera danica	+	+	+
	Ephemerella sp.	+	+	+
	Heptagenia sulphurea	+	+	**0**
	Rhithrogena sp.	+	+	+
PLECOPTERA	*Capnia* sp.	+	**0**	**0**
	Chloroperla sp.	+	**0**	**0**
	Perla bipunctata	+	**0**	**0**
ODONATA	*Anax imperator*	+	+	**0**
	Calopterix virgo	+	+	+
	Cordulegaster boltoni	+	+	+
	Rhynosoma sp.	+	+	**0**
TRICHOPTERA	*Agapetus* sp.	+	+	+
	Glossosoma boltoni	+	+	+
	Hydropsyche sp.	+	+	+
	Limnephilus sp.	+	+	+
	Odontocerum albicorne	+	+	**0**
	Polycentropus flavomaculatus	+	+	+
COLEOPTERA	*Elmis* sp.	+	+	+
DIPTERA	*Ablabesmyia* sp.	+	+	**0**
	Dixa sp.	+	+	**0**
	Chironomus sp.	+	+	+
	Simulium sp.	**0**	+	**0**
	Tanypus sp.	**0**	+	**0**
POLYCHAETA	*Heteronereis* sp.	**0**	**0**	+
	No. of taxa	**43**	**41**	**33**

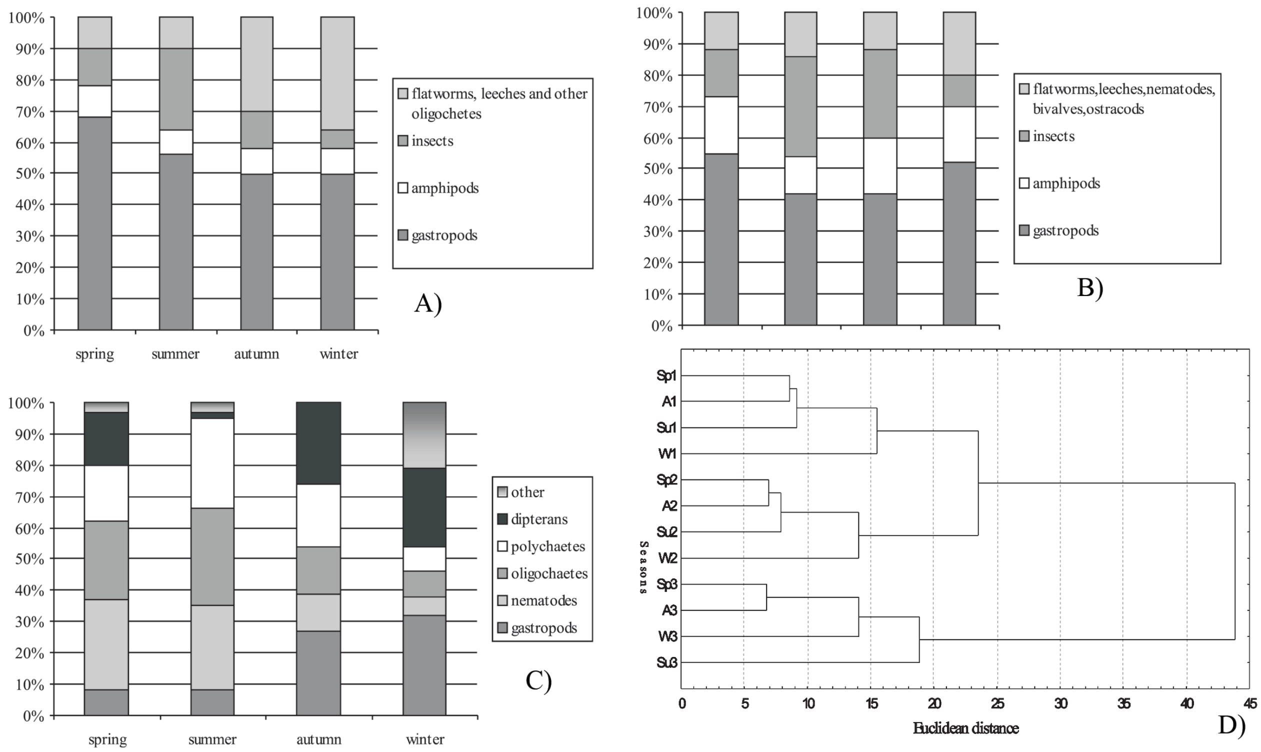
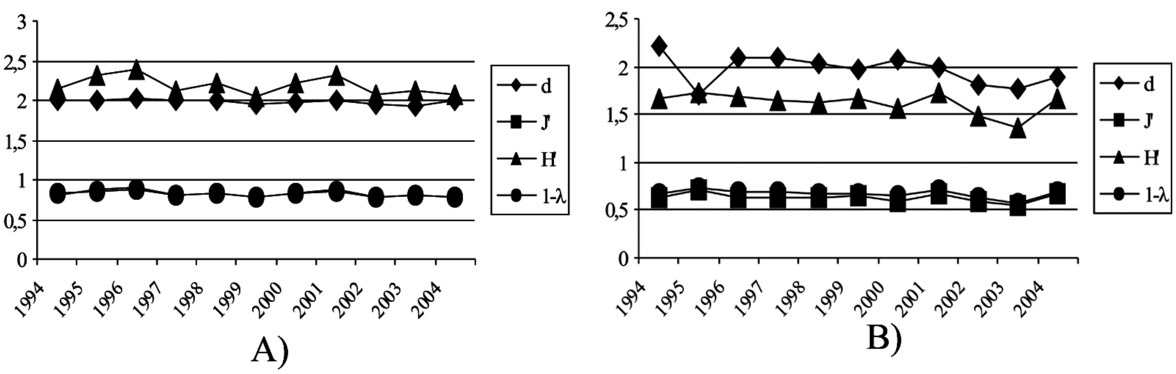


Fig. 2. A) The structure of macroinvertebrate community on upstream sites from 1994 to 2004. B) The structure of macroinvertebrate community on middlestream sites from 1994 to 2004. C) The structure of macroinvertebrate community on downstream sites from 1994 to 2004. D) Similarity between areas according community structure and physicochemical parameters through seasons.



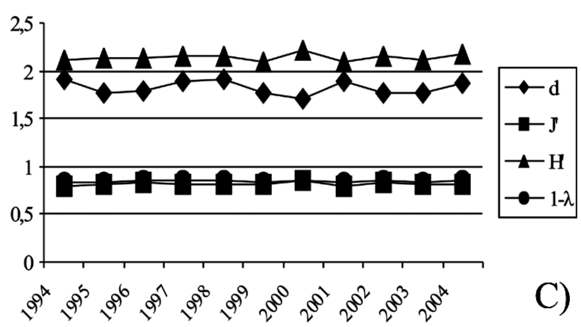


Fig. 3. Disimilarity indices for research period (d=Margalef's index, J'=Pielou index, H'=Shannon-Weaver index, 1-λ=Simpson's index). a) upstream area; b) middlestream area; c) downstream area.

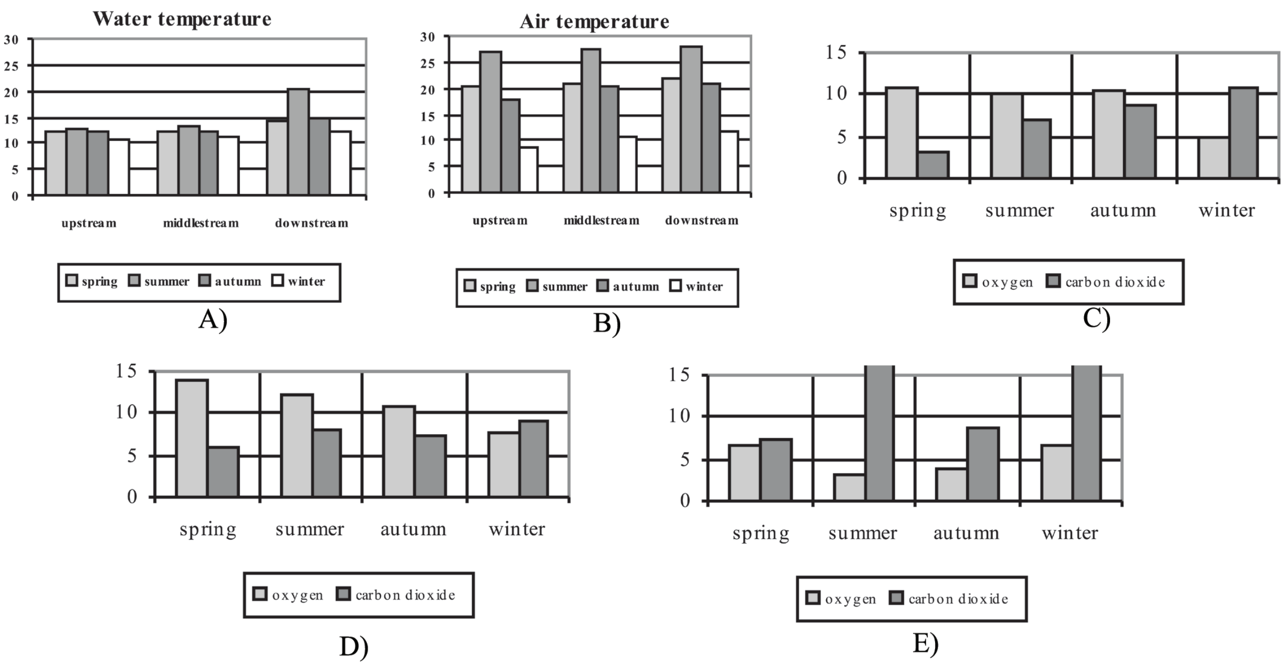


Fig. 4. Physicochemical parameters on sampling sites. a) air temperature; b) water temperature; c) the annual mean values of carbon dioxide and its relationship with dissolved oxygen through seasons - upstream sites; d) the annual mean values of carbon dioxide and its relationship with dissolved oxygen through seasons - middlestream sites; e) the annual mean values of carbon dioxide and its relationship with dissolved oxygen through seasons - downstream sites.

midcourse sites, 70,27% between midcourse and downstream sites, and 55,26% between upstream and downstream sites (Table 2).

Physicochemical parameters

The bottom substrate at upstream stations consists mainly of coarse material (cobbles, pebbles, and gravel). Substrate coarseness declines downstream (Table 3). The mean annual water temperature varied from 10.6 °C (upstream sites during the winter season) to 22.0 °C (downstream sites during the summer season). It follows seasonal changes in air temperature, but with slow warming and cooling (Fig. 4A). Mean annual air temperatures show characteristics of a dry Mediterranean climate. The measured values from 1994 to 2004 varied from 8.6 °C (winter) to 28.0 °C (summer). Spring and autumn values are mainly equal because there are no great differences between those two seasons in the Mediterranean area, including Middle Dalmatia (Fig. 4B). The mean annual values of dissolved oxygen at upstream sites varied from 4.0 mg/L (winter) to 12.5 mg/L (spring). The saturation of dissolved oxygen ranged from 36 to 115%. Low levels of dissolved oxygen at upstream sites are a result of strong influence of groundwaters, especially during winter. Spring values show supersaturation because of photosynthesis and rich macrophyte vegetation (Fig. 4C). The mean annual values at midcourse sites varied from 6.8 mg/L (winter) to 14.7 mg/L (spring). Because the distance from upstream to midcourse sites is short (1 km), the influence of groundwater is still present and the saturation of 61% during winter shows a deficit of dissolved oxygen (Fig. 4D). Downstream sites mean annual values of dissolved oxygen ranging from 3.1 mg/L (winter) to 7.5 mg/L (spring). A deficit of dissolved oxygen (33 to 72%) was present in each season and is a result of increased urbanization and strong influence of sea water. Higher mean annual values of carbon dioxide were measured during the winter season at upstream (11.8 mg/L) and midcourse (9.5

Table 2. Sørensen's index (QS – Sørensen's index, c – number of common species in two samples, a- total number of species in first sample, b- total number of species in second sample).

SAMPLING SITES	c	a	b	QS
upstream - midcourse	36	43	41	85.70%
midcourse - downstream	26	41	33	70.27%
upstream - downstream	21	43	33	55.26%

Table 3. Granulometric analysis of sampling sites on investigated karst river.

grain size (mm)		upstream (%)	midcourse (%)	downstream (%)
pebble	cobble (64-256)	14	3.5	
	coarse gravel (4-64)	85	93.5	70.5
	very fine gravel (2-4)	1.5	1.5	7.5
Sand (2-0.063)		0.5	1.5	22

mg/L) sites. At downstream sites, the values of carbon dioxide are higher than oxygen in each season (7.4 mg/L – 23.79 mg/L) as a result of heavy organic pollution caused by human activities and the influence of sea water from Kaštela Bay. An extremely high value (23.7 mg/L) was measured in summer (due to high water temperature, reduced flow, and low velocity). The values of carbon dioxide run counter to dissolved oxygen values. The relationship between those two parameters is shown in Fig. 4E. Alkalinity values show a bicarbonate character of the water. The mean annual values varied from 150 mg

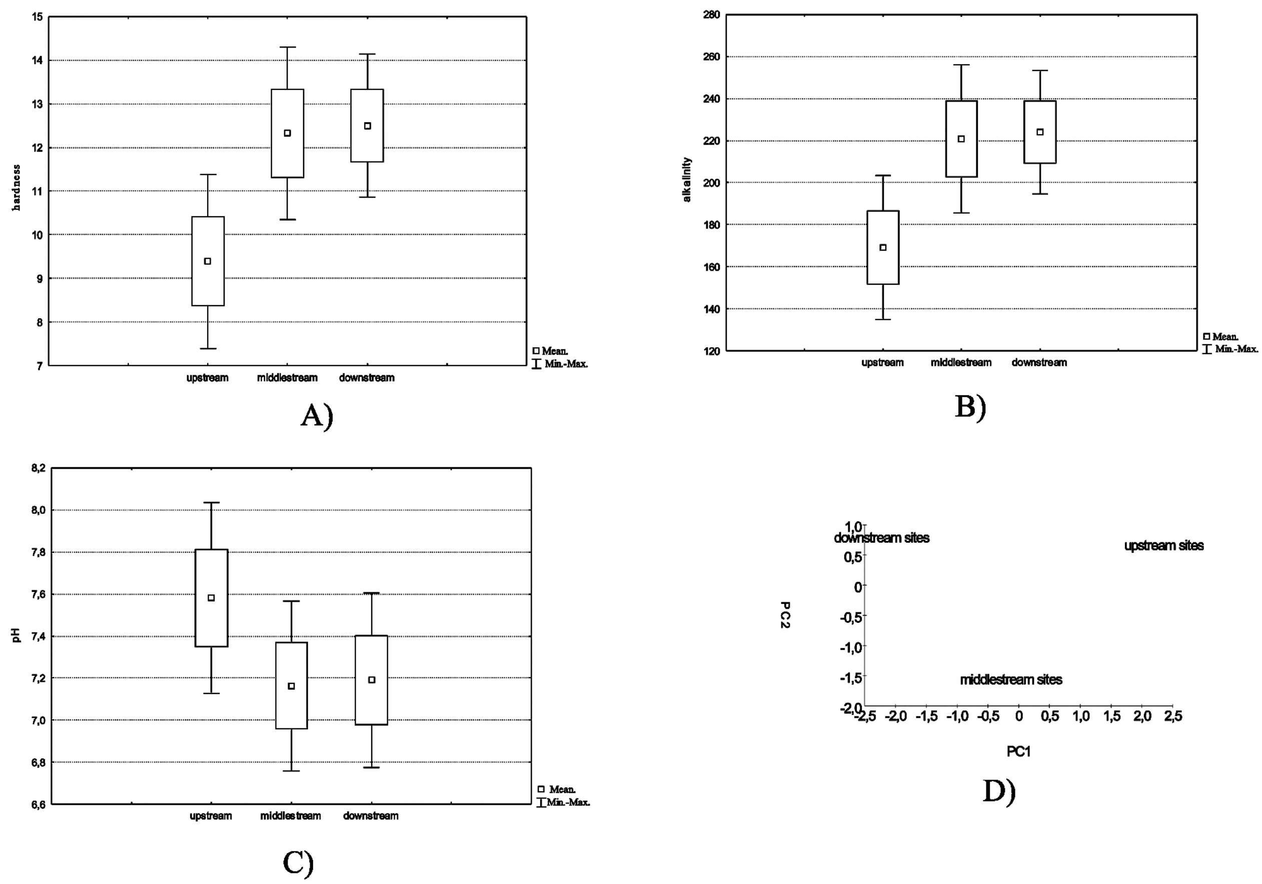


Fig. 5. Other measured physicochemical parameters. A) hardness; B) alkalinity; C) pH; D) PCA of seven physicochemical metrics and substrate type from 15 sites for each season during the period of 1994 to 2004.

of $CaCO_3$ /L (upstream sites) to 255 mg of $CaCO_3$/L (midcourse and downstream sites). pH values were in the range of 6.8 to 7.8 pH units (Fig. 5A-C). PCA analysis confirms that physicochemical parameters depend on the season and are mostly uniform at the investigated sampling sites. Downstream sites in the PC1 and PC2 axes describe almost 100% of data variability. Downstream sites are in the negative range of PC1 because of the quite different physicochemical parameters there as a result of the influence of sea water. In the middle of the ordinary diagram are the midcourse sampling sites, which show equal distance from upstream and downstream sites because of the different values of air and water temperature, as well as of dissolved oxygen and carbon dioxide. The upstream sites are situated on the positive side of the ordinary diagram because they are less different from the midcourse sites, but very different from the downstream sites owing to the direct influence of underground waters (Fig. 5D).

DISCUSSION

During the ten years of investigation, 43 macroinvertebrate taxa were observed. Some taxa were not identified to species level, so it could be supposed that the total number of taxa is certainly higher. Mollusks, amphipods, and insects were the principal components of the community with regard to the number of identified species, frequency of occurrence, and relative abundance. The observed community structure was what could be expected of this watercourse type and is quite different from that in continental rivers of Croatia, where chironomids and oligochaetes are the principal components. Because karst rivers are unique habitats in Europe, there are not many similar rivers to compare with. Investigations of the macroinvertebrate community in other karst rivers of Croatia show a community structure similar to that in the Jadro River, but karst rivers under the influence of a continental climate regime have some different taxa and different seasonal abundance of common taxa (Mihaljević et al., 1998; Habdija et al., 2003; Radanović et al., 2006). Previous investigations of the Jadro River determine yielded a smaller number of taxa, but values of the abundance of mollusks, amphipods, and insects were similar to those obtained in this investigation (Apostolska, 1988; Kerovec, 1996; Rađa, 2002, 2006; Vuković, 1981). It has been determined that the regular dynamics of physicochemical parameters greatly influences the structure and abundance of the macrozoobenthic community along the river course (Boyle and Fraileigh, 2003; Clarke *et al.*, 2002; Flanagan and Toner, 1972; Fleituch, 2003; Moss et al., 1987; Nedeau et al., 2003; Neumann et al., 2003, 2003a; Rosenberg and Resh, 1993). It has also been established that structure and abundance per sample change seasonally and in dependence on the sampling site (upstream, midcourse and downstream) (Fleituch, 2003). The most numerous form were snails (Gastropoda), followed by amphipods and insects. Such a proportion was determined in all years of sampling. In the case of amphipods and insects, a considerable increase in abundance was observed during spring and summer, as was also reported in previous investigations (Apostolska, 1988; Kerovec, 1996; Rađa, 2002, 2006; Vuković, 1981). *Adriohydrobia kutschigi*, *Emmericia patula* and *Oxyloma elegans* are endemic species protected by the Law on Nature Protection of the Republic of Croatia. *Ancylus fluviatilis*, *Physa fontinalis,* and *Theodoxus fluviatilis* are the most common Central European species in continental waters. The abundance of snails is seasonally uniform, and populations are most abundant in midcourse region. Such uniform abundance is a result of stable physicochemical conditions throughout the year. Qualitative samples from the Žrnovnica River which is hydrologically connected by an underground stream with the Jadro River (Bonacci, 1978, 1989, 1998), showed no differences of either groups or macrozoobenthic species. The mean value of flatworm abundance was 647 specimens at upstream sites during the investigated period of ten years which is 8,58% of the total number of specimens in the sample and is in accordance with the above mentioned data. The same species were isolated from midcourse sites, where the abundance was only 92 specimens in the total sample. The reason for such reduction lies in the change of habitat conditions, e. g., lower values of dissolved oxygen and higher water temperature, both being limiting conditions for the mentioned species. Oligochaeta group at upstream sites is represented by the species *Eiseniella tetraedra* (Lumbricidae) with a total number of 352, which represents 4.67%. The Jadro River is known to be a habitat of the mentioned species, which is widely distributed throughout the entire territory of former Yugoslavia (M r š i ć , 1991, 1991a). At midcourse and downstream sites, the Oligochaeta group was represented by roundworms (Nematoda). At downstream sites, the dominant species were *Nais barbata* (Naididae) and *Tubifex tubifex* (Tubificidae). Abundance of the mentioned species increases downstream parallel with organic pollution to 5.97% (nematodes) and 12.98% (other oligochaetes). Leeches (Hirudinea) are represented at upstream sites in a lower percentage (3.65%) in relation to other oligochaetes. There were two species in the sample: *Erpobdella octoculata* and *Glossiphonia complanata*. *Helobdella stagnalis* was isolated in the midcourse region and *Glossiphonia complanata* at downstream sites. Abundance of the mentioned species in the whole sample was 1.90% (midcourse) and 3.49% (downstream). The indicated taxa appear individually and are evenly distributed along the river. One family of bivalves was also isolated, the family Sphaeriidae being represented by two genera: *Pisidium* and *Sphaerium*. Species of both genera are widely distributed and appear most frequently on fine substrates such as fine gravel or sand, the same grain size as in the Jadro River. It has been demonstrated that the biodiversity of *Pisidium* is maximal on substrates with grain size of 0,18 mm (B u r c h , 1975). At upstream sites (with pebble and cobble substrates there were only 24 specimens. Midcourse samples yielded a total of 316 specimens and downstream samples 356 specimens. The increasing number is a result of granulometric composition. Crustaceans were represented by amphipods (Amphipoda), isopods (Isopoda), and ostracods (Ostracoda). With respect to abundance, isopods are the second group in the whole quality sample. This investigation confirms that their abundance changes seasonally, the greatest number of specimens appearing during spring, in summer and at the beginning of autumn. It was also established that their greatest abundance occurs upstream, where their presence in the whole sample was 10.64%. The abundance of isopods and amphipods is reduced downstream, as a result of changed ecological conditions. A so-called population boom (P e n n a k , 1989) was observed at upstream sites in 1994, when the total number of specimens in one sampling was 1450 per m^2. Water mites (Acarina) were determined only at upstream sites and were represented by the species *Neumania apinipes*. At midcourse and downstream sites, the presence of this group was not established. Six groups of insects were determined in the Jadro River: mayflies (Ephemeroptera), stone flies (Plecoptera), dragonflies (Odonata), caddis flies (Trichoptera), riffle beetles (Coleoptera), and true flies (Diptera). Mayflies (Ephemeroptera) are represented by eight different species. The species *Baëtis rhodani* and *Heptagenia sulphurea* were not isolated from downstream samples. V u k o v i ć (1981) determined eleven different species, some of which are common in European fresh waters. The abundance of stone flies (Plecoptera) is the lowest within the insect group (3.03%). They were isolated only from upstream samples because they develop only in cold, clear water and are evidently sensitive to low oxygen concentration and organic pollution. S i m i ć and S i m i ć (1999) indicate in their investigations that all Plecoptera species were found in clear spring waters and upstream regions of explored rivers. D i G i o v a n n i et al. (2003) confirmed the presence of Plecoptera in the Chiascio River in Italy. The same dragonfly species are confirmed by A s k e w (1988) in his list of Odonata for Europe. Trichopterans were isolated from all samples. There were six different species. The abundance of this group ranged from 4.93% (upstream) through 172% (midcourse) to 2.74% (downstream). In determination of the Jadro's biological minimum (K e r o v e c , 1996) based on macroinvertebrate composition, 13 different trichopteran species were recorded, three of which are endemic (*Rhyacophila balcanica*, *Hydropsicha dinarica,* and *Tinodes baueri)*. Aquatic beetles (Coleoptera) are represented by the genus *Elmis,* which is one of the most frequent freshwater coleopteran species (G i l l e r and M a l m q u i s t , 1998; C a m p a i o l i et al., 1994, 1999). The true flies (Diptera) are represented by five species belonging three genera: *Ablabesmyia*, *Chironomus* and *Tanypus*. All of them are from the family of Chironomidae, which is the most abundant group of true flies in continental rivers (Mihaljević et al., 2000). For comparison of structure of the macrozoobenthic community, we used the Sørensen's, Shannon's, Simpson's, Pielouo's, and Margalef's similarity indices. Sørensen's similarity index confirmed great similarity (85.70%) between upstream and midcourse sites, somewhat smaller similarity (70.27%) between midcourse and downstream sites, and the smallest similarity (55.26%) between upstream and downstream sites. This relationship also coincides with the results of PCA analysis and cluster analysis of physicochemical parameters, so it can be presumed that the macrozoobenthic community of the Jadro River is a result of established regularity of all measured parameters. From all that has been said above, it can be concluded that river's ecosystem is stable in both the physicochemical and the biological sense. The determined changes are more a result of short-term influence of underground waters, climatic circumstances, and sea water downstream than a sign of stronger disturbance of natural balance.

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РАЗНОВРСНОСТ МАКРОИНВЕРТЕБРАТА У КРАШКОЈ РЕЦИ ЈАДРО (ХРВАТСКА)

БИЉАНА РАЂА и САЊА ПУЉАС

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У овом раду приказани су резултати десетогодишњих истраживања акватичне фауне макроинвертебрата у крашком водотоку - реци Јадро. Макроинвертебрати бентоса су прикупљани дуж овог тока на 15 локалитета стандардним методама, уз анализу неколико физичко-хемијских параметара. На основу квалитативног и квантитативног састава фауне макроинвертебрата, одговарајућом анализом речни ток је диференциран у три сектора: узводни, средишни и низводни. Укупно је утврђено 43 таксона. Резултати сапробиолошке анализе, засноване на студији макрозобентоса, доказују да вода реке Јадро припада првој и другој класи квалитета.