



**Univerzitet Crne Gore  
Prirodno-matematički fakultet**

Džordža Vašingtona b.b.  
1000 Podgorica, Crna Gora

tel: +382 (0)20 245 204

fax: +382 (0)20 245 204

[www.pmf.ac.me](http://www.pmf.ac.me)

Broj: 1806

Datum: 03 OCT 2019

**UNIVERZITET CRNE GORE**

**-Centar za doktorske studije-  
-Senat-**

U skladu sa članom 41 Pravila doktorskih studija, u prilogu akta dostavljamo predlog Odluke Vijeća o imenovanju komisije za ocjenu doktorske disertacije Slađane Gvozdrenović pod nazivom „Integralni multi-trofički uzgoj dagnje (*Mytilus galloprovincialis* L.) i kamenice (*Ostrea edulis* L.) sa ribom u Bokotorskom zalivu“ korišćenjem softvera *Ithenticate*, radi davanja saglasnosti.



DEKAN

*Miranović*  
Prof. dr Predrag Miranović



Univerzitet Crne Gore

adresa / address: Cetinjska br. 2  
81000 Podgorica, Crna Gora  
telefon / phone: 00382 20 414 255  
fax: 00382 20 414 230  
mail: rektorat@ucg.me  
web: www.ucg.ac.me

University of Montenegro

Broj / Ref: 01/2-3172/1

Datum / Date: 02.10.2019

Crna Gora  
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Broj

Podgorica, 02. OCT 2019. god.

UNIVERZITET CRNE GORE  
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N/R KOMISJI ZA DOKTORSKE STUDIJE

Predmet: Evaluacija doktorske disertacije doktoranda Slađane Gvozdenović „Integralni multi – trofički uzgoj dagnje (*Mytilus galloprovincialis* L.) i kamenice (*Ostrea edulis* L.) sa ribom u Bokokotorskom zalivu“ korišćenjem softvera *Ithenticate*

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Saglasno članu 9 Odluke o korišćenju softvera za utvrđivanje plagijata na Univerzitetu Crne Gore, Odbor za doktorske studije izvršio je provjeru elektronske verzije doktorske disertacije doktoranda Slađane Gvozdenović „Integralni multi – trofički uzgoj dagnje (*Mytilus galloprovincialis* L.) i kamenice (*Ostrea edulis* L.) sa ribom u Bokokotorskom zalivu“ korišćenjem softvera *Ithenticate* dostavljene od strane Prirodno - matematičkog fakulteta. Nakon izvršene provjere, ustanovljeno je da u pomenutoj elektronskoj verziji doktorske disertacije nema elemenata koji bi se mogli tumačiti kao plagijat, saglasno kriterijumima propisanim članom 8 Odluke. U skladu sa navedenim, postupak sticanja doktorske disertacije doktoranda Slađane Gvozdenović može da se nastavi u skladu sa Pravilima doktorskih studija.

U prilogu Vam dostavljamo izvještaj o provjeri predmetne doktorske disertacije generisan od *Ithenticate* softvera.

Srdačan pozdrav,



ZA ODBOR ZA DOKTORSKE STUDIJE

PREDSJEDNIK

Prof. dr Predrag Miranović

## ISPUNJENOST USLOVA DOKTORANDA

OPŠTI PODACI O DOKTORANDU			
Titula, ime, ime roditelja, prezime	Mr Sladana (Dorđe) Gvozdrenović		
Fakultet	Prirodno-matematički fakultet		
Studijski program	Biologija		
Broj indeksa	1/14		
NAZIV DOKTORSKE DISERTACIJE			
Na službenom jeziku	Integralni multi-trofički uzgoj dagnje ( <i>Mytilus galloprovincialis</i> L.) i kamenice ( <i>Ostrea edulis</i> L.) sa ribom u Bokokotorskom zalivu		
Na engleskom jeziku	Integral multi-trophic farming of Mediterranean mussel ( <i>Mytilus galloprovincialis</i> L.) and European flat oyster ( <i>Ostrea edulis</i> L.) with fish in Boka Kotorska Bay		
Naučna oblast	Ekologija		
MENTOR/MENTORI			
Prvi mentor	Prof. dr Vladimir Pešić	Univerzitet Crne Gore, Crna Gora	Ekologija i Biodiverzitet
Druzi mentor	/	/	/
KOMISIJA ZA PREGLED I OCJENU DOKTORSKE DISERTACIJE			
Prof. dr Drago Marić	Univerzitet Crne Gore, Crna Gora	Ekologija i Biodiverzitet	i
Viši naučni saradnik Milica Mandić	Univerzitet Crne Gore, Crna Gora	Ihtioplankton marikultura	i
Prof. dr Nada Blagojević	Univerzitet Crne Gore, Crna Gora	Analitička hemija	
Prof. dr Ljiljana Tomović	Univerzitet u Beogradu, Srbija	Ekologija i Biodiverzitet	i
Prof. dr Vladimir Pešić	Univerzitet Crne Gore, Crna Gora	Ekologija i Biodiverzitet	i
Datum značajni za ocjenu doktorske disertacije			
Sjednica Senata na kojoj je data saglasnost na ocjenu teme kandidata	31.03.-04.04.2016		
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Spisak radova doktoranda iz oblasti doktorskih studija koje je publikovao u časopisima (upisati odgovarajuću listu)

**1. Gvozdenović Slađana**, Mandić Milica, Pešić Vladimir, Nikolić Marko, Pešić Ana & Ikica Zdravko (2017): Comparison between IMTA and monoculture farming of mussels (*Mytilus galloprovincialis* L.) in the Boka Kotorska Bay. Acta Adriatica, 58(2): 271-284. [http://iadran.izor.hr/acta/pdf/58\\_2/pdf/58\\_2\\_7.pdf](http://iadran.izor.hr/acta/pdf/58_2/pdf/58_2_7.pdf) Časopis indeksiran u SCI/SCIE (Ostampan rad dat uz obrazac)

**2. Gvozdenović Slađana**, Nikolić Marko, Pešić Vladimir, Peraš Ines & Mandić Milica (2019): At the Door yes, but inside no – up until now! First data on the alien mollusc *Fulvia fragilis* (Forsskål in Niebuhr, 1775) (Bivalvia: Cardiidae) from the Adriatic Sea. Acta Zoologica Bulgarica, 71, accepted. <http://www.acta-zoologica-bulgarica.eu/downloads/acta-zoologica-bulgarica/2018-12-articles-accepted.pdf> Časopis indeksiran u SCI/SCIE (Potvrda o prihvatanju rada data uz obrazac)

Obrazloženje mentora o korišćenju doktorske disertacije u publikovanim radovima

Rezultati dobijeni u toku rada na doktorskoj disertaciji objavljeni su u publikovanim radovima.

U radu (1) publikovanom u časopisu Acta Adriatica objavljeni su rezultati dobijeni u toku izrade disertacije koji se odnose na uporednu analizu između IMTA (integralnog multi-trofičkog uzgoja) i gajenja u monokulturi vrste dagnje *Mytilus galloprovincialis* L. na istraživanom području Boko-Kotorskog zaliva.

U radu (2) publikovanom u časopisu Acta Zoologica Bulgarica - invazivna vrsta *Fulvia fragilis* (Forsskål in Niebuhr, 1775) (Bivalvia: Cardiidae) registrovana je po prvi put za Jadransko more.

Datum i ovjera (pečat i potpis odgovorne osobe)

U Podgorici,



DEKAN

*Muhamed Štepanović*

Prilog dokumenta sadrži:

1. Potvrda o predaji doktorske disertacije organizacionoj jedinici
2. Odluku o imenovanju komisije za pregled i ocjenu doktorske disertacije
3. Kopiju rada publikovanog u časopisu sa odgovarajuće liste
4. Biografiju i bibliografiju kandidata
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1, Tsar Osvoboditel Blvd., 1000 Sofia, Bulgaria, phone (+359 2) 988 51 15,  
(+359) 884499726, e-mail: actazoologicabulgarica@gmail.com

Sofia, 01.10.2018

Dear Drs. Slađana Gvozdenović, Marko Nikolić, Vladimir Pešić, Ines Peraš & Milica  
Mandić

Your manuscript 2258 "At the Door yes, but inside no – up until now! First record on the  
alien mollusc *Fulvia fragilis* (Forsskal in Niebuhr, 1775) (Cardiida: Cardiidae) from the  
Adriatic Sea 1. Dr Fabio Crocetta"

has been accepted and will be printed in *Acta zoologica bulgarica* in issue 71, 2019.

Best regards,

Rosy Kaneva,  
managing editor and secretary



## Comparison between IMTA and monoculture farming of mussels (*Mytilus galloprovincialis* L.) in the Boka Kotorska Bay

Sladana GVOZDENOVIĆ<sup>1</sup>, Milica MANDIĆ<sup>2</sup>, Vladimir PEŠIĆ<sup>3</sup>, Marko NIKOLIĆ<sup>1</sup>,  
Ana PEŠIĆ<sup>2</sup> and Zdravko IKICA<sup>2\*</sup>

<sup>1</sup>BIO-ICT Centre of Excellence in Bioinformatics, Cetinjska br. 2, 81000 Podgorica, Montenegro

<sup>2</sup>Institute of Marine Biology, University of Montenegro, Dobrota b.b., 85330 Kotor, Montenegro

<sup>3</sup>Faculty of natural sciences and mathematics, University of Montenegro, Cetinjska br. 2, 81000 Podgorica, Montenegro

\*Corresponding author, e-mail: zdikica@ac.me

This paper presents the results of growth rate and condition index analysis of *Mytilus galloprovincialis* in integrated system and monoculture. The aim of this study was to show if there are differences in growth and condition index of mussels between integrated multi-trophic aquaculture (IMTA) and monoculture farming. The growth rate and condition index were monitored during a 13-month study at three different sites: 1) close to fish cages (NBL), 2) 100 m removed from fish cages (NUD), 3) at a monoculture mussel farm (SVN) around 8 km far away from cages. The most intense growth of mussels was recorded in spring, and the least intense in summer. After 13 months, monitored individuals at all three locations achieved commercial size. The growth rate was very similar at all sites. The condition index showed spatial and temporal differences. Condition index values on site NUD were mostly higher compared to SVN and NBL, which were very similar, except for the period from October to December when CI was similar on NBL and NUD site and higher in comparison with SVN. CI values on NBL and NUD site during cold period indicate on fact that mussels probably feed on the nutrients from fish farm origins. The highest mortality rate was recorded at the NBL site, probably due to the effects of fouling organisms.

**Key words:** *Mytilus galloprovincialis*, integrated multi-trophic aquaculture (IMTA), monoculture, Boka Kotorska Bay

### INTRODUCTION

Marine aquaculture or mariculture is a very important fish, crustacean, mollusc and algae production sector, which has the possibility to replace the reduced, potential of natural resources (FAO, 2010). Nowadays, terms such as "integrated" and "multi-trophic" are increasingly used in relation to the concept of mariculture and aquaculture in general (CHOPIN & ROBINSON, 2004). Integrated multi-trophic aquaculture

(IMTA) can be defined as the form of aquaculture where unconsumed fish food and fish metabolic products, which otherwise would have negative impact on the environment, can be used as a food source in another subsystem, leading to the increased productivity of the entire system under the complete control of the farmers (FAO, 2009; TROELL *et al.*, 2009; CHÁVEZ-CROOKER & OBREQUE-CONTRERAS, 2010). According to FAO (2004), one of the main goals of the aquaculture industry in the near future would be to minimize

negative impacts on the environment in order to achieve long-term viability. IMTA can be a good mechanism for achieving this goal, while also achieving another benefit — the increased economical productivity of the entire system (SARÀ *et al.*, 2009; RENDMOND *et al.*, 2010; SARÀ *et al.*, 2011; ŽUPAN 2012; MACDONALD *et al.*, 2013; HOLDT & EDWARDS, 2014; AL-HAFEDH *et al.*, 2014; RATCLIFF *et al.*, 2015).

Integrated multi-trophic farming systems of various marine organisms are known worldwide (FAO, 2009; ABREU *et al.*, 2009; NAVARRETE-MIER *et al.*, 2010; REID *et al.*, 2010; HUGHES & KELLY, 2011; HANDA *et al.*, 2012; LANDER *et al.*, 2012; IRISARRI *et al.*, 2014a). The possibility of implementation of the integrated multi-trophic farming in the Mediterranean was well studied in the last ten years (PEHARDA *et al.*, 2007; NAVARRETE-MIER *et al.*, 2010; SARÀ *et al.*, 2011; ŽUPAN, 2012; ŽUPAN *et al.*, 2012; ŽUPAN *et al.*, 2013; ŽUPAN *et al.*, 2014; ISARRI *et al.*, 2014a). Bivalves are known as filter feeders and they could potentially remove organic matter as well as uneaten fish food from water (RENDMOND *et al.*, 2010). According to SARÀ *et al.* (2009) and MAZZOLA & SARÀ (2001) this process can reduce negative impact on environment. Some studies have shown that the farming period for achieving market size in integrated farming of mussels (*Mytilus galloprovincialis*) and fish is similar to that in commercial monoculture (PEHARDA *et al.*, 2007). On the other hand, SARÀ *et al.* (2011) demonstrated higher growth rate of mussels (*M. galloprovincialis*) and the European flat oyster (*Ostrea edulis*) found close to fish farms compared to those found at the open sea. Higher condition index values of Noah's Ark shell (*Arca noae*) near fish farm, and the nearly identical periods for achieving market size of mussels (*M. galloprovincialis*) in integrated farming and monoculture have been proven by ŽUPAN (2012).

Mediterranean mussel, *M. galloprovincialis* Lamarek 1819, is a widely distributed species, autochthonous to the Mediterranean (GISD, 2016). The mussel lives in colonies in the tidal zone, fastened to the substrate by byssal threads. It feeds on phytoplankton, bacteria, zooplankton and detritus (DAVENPORT *et al.*, 2000; PRATO *et al.*, 2010). Genders are separated, and the spawning occurs mostly in spring and autumn. The mussels

are considered to be of market size when they are at least 5 cm in length (OFFICIAL GAZETTE OF MONTENEGRO, 8/2011; 56/2009, 47/2015).

The mussel farming tradition in the Boka Kotorska Bay area started about thirty years ago, although the first experiments regarding mussel and oyster farming begun in the 1960's (STJEPČEVIĆ, 1968). Today, there are 20 mussel farms in the Bay, all using floating park systems (long-lines). Gilthead sea bream (*Sparus aurata* Linnaeus, 1758) and European sea bass (*Dicentrarchus labrax* Linnaeus 1758) farming in the area started in the late nineties, and currently there are two farms (Orahovac and Stoliv) using the floating cage system farming method. The integrated farming of mussels and fish is used on both farms. In 2014, the mariculture production amounted to 45 t of sea bass, 38 t of sea bream, and 178 t of mussels (MONSTAT, 2015).

The main goal of this study was to obtain some data on IMTA farming, due to fact that this kind of farming has not been sufficiently studied in neither the Adriatic nor in the Mediterranean.

## MATERIAL AND METHODS

### Study area

The study was conducted on two locations in the Boka Kotorska Bay, Montenegro (South Adriatic) (Fig. 1). One location was the fish and mussel farm "COGImar" in the settlement of Orahovac, Kotor municipality, 42° 29' 07.79" N, 18° 44' 42.47" E. The second location was Sveta Nedelja mussel farm in the Kamenari settlement, municipality of Herceg Novi, 42° 27' 30.89" N, 18° 40' 21.42" E. The straight-line distance between the two study locations is 8 km. The COGImar farm farms Gilthead sea bream, European sea bass, Mediterranean mussel and European flat oyster in polyculture. On the COGImar localities two sites were chosen for the experimental part of the study: the mussel long-line closest to the floating fish cages (NBL), which was 10 m removed from the cages, and the mussel long-line furthest from the fish cages (about 100 m removed) (NUD). Sveta

Nedelja farm is a monoculture bivalve farm which produces Mediterranean mussel as well as the European flat oyster, and therefore only one site was selected (SVN).

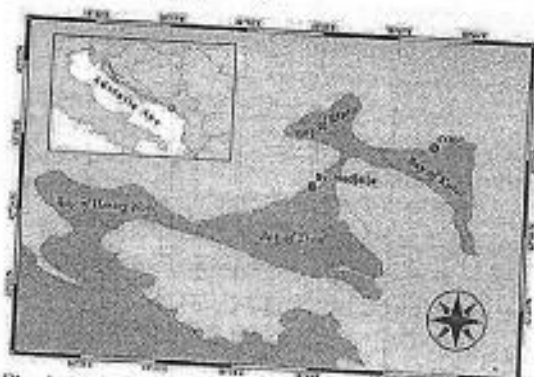


Fig. 1. Map showing the locations of sampling sites (NBL and NUD) at COGL, SVN at Sv. Nedelja)

### Experimental design

The growth experiment was set during a 13-month period, from January 2015 until January 2016. In January 2015, mussels of approximately the same size (mean length  $4.27 \pm 0.4$  cm) and age (around 8-10 months) were taken from the experimental farm at the Institute of Marine Biology, University of Montenegro, in Kotor. Mussels were cleaned of fouling organisms the same day, and shell lengths, widths and heights were measured using vernier caliper to the nearest 0.1 mm. Individual mussels were marked using improvised tags. The tags were made from kitchen plastic waterproof mats (WelkHOME, Italy). The mats were cut to rectangles, approx.  $12 \times 5$  mm in size, and markings etched on the surface using scalpel and soldering iron, with the markings visibility improved using waterproof felt-tip marker. Numbered tags were bonded to mussel shells with two-component waterproof adhesive (ABRO EPOXY STEEL, U.S.A.). During the marking process, duration of air exposure was around 2-3 minutes, until the adhesive hardened. Marked and measured mussels were placed in plastic baskets ( $48 \times 29 \times 5$  cm, with 2 cm stretched mesh size) and suspended in water at depths between 2 and 3 m. At the COGimar location, 110 individuals were placed together

on a farming line closest to the fish cages (NBL), and another 110 individuals on a farming line furthest from the fish cages (NUD). At the Sveta Nedelja location, 112 individuals were set together on a farming line (SVN). The mussels were checked every other month, removed from water, measured (length, width, height), cleaned from fouling organisms and resuspended in water.

Temperature and salinity on both localities were recorded monthly using the Multiline P4 WTW probe.

For condition index estimation, a total of 1,560 individual mussels of similar size and age (around 8-10 months) were taken from the experimental farm at the Institute of Marine Biology. Mussels were placed in nylon mesh nets (2-3 cm stretched mesh size). Forty individual mussels were put in each net, with 13 nets per site (i.e. 39 nets in total). Nets were placed on NBL, NUD and SVN sites at depths between 2 and 3 m. Once per month, one net from each site was taken. From each net 30 individual mussels were taken and processed in the laboratory the same day. The condition index was determined as the ratio between wet mass of meat (WMM) and total weight (TW), according to ALMEIDA *et al.* (1999).

### Statistical analyses

Growth ratios were tested using repeated-measures two-way ANOVA with Tukey post-hoc test. Parameters of von Bertalanffy's growth equation ( $L_t = L_{\infty} [1 - e^{-k(t-t_0)}]$ ) were estimated with analysis of growth increment data using Munro's method in the FISAT II v.1.2.2 statistical package (GAYANILO *et al.*, 2005).

The condition index samples were tested for normality of distribution of differences between each observation and the mean of its group using Kolmogorov-Smirnov test with Lilliefors significance correction.

The homogeneity of variance was tested using Fligner-Killeen test for samples that did not follow normal distribution, and with Bartlett test for those that did. Homoscedastic samples were then tested using one-way ANOVA, with



Tukey HSD (Honestly Significant Difference) used as a *post hoc* test. Heteroscedastic samples were analysed using Kruskal-Wallis rank sum test, with Dunn's test as a *post hoc* test.

## RESULTS

### Temperature and salinity

Minimum and maximum temperatures at the COGImar location ranged between 11.6°C in February 2015 and 27.9°C in July 2015. Temperature on the Sveta Nedelja location ranged between 10.5°C in January 2016, and 26.5°C in August 2015 (Fig. 2A). Salinity on the COGImar location was between the minimal value of 13.8‰ in February 2015, and the maximum value of 35.2‰ in December 2015. On the Sveta Nedelja location, the minimum salinity value of 19.8‰ was recorded in February 2015, and the maximum values of 37.1‰ in December 2015 (Fig. 2B).

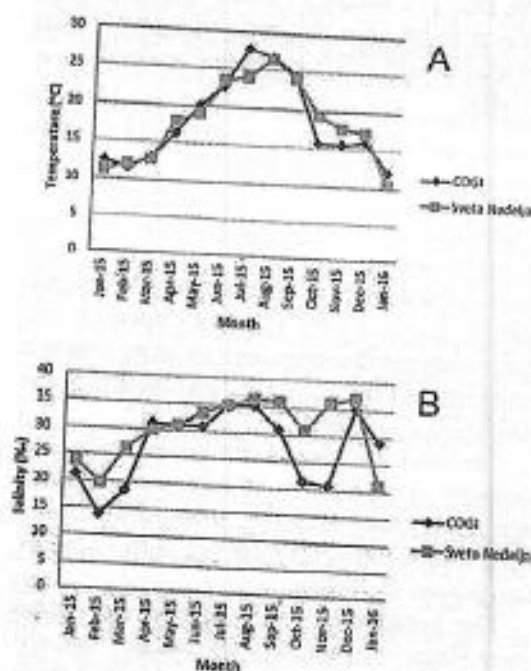


Fig. 2. Monthly temperature (A) and salinity (B) values on both localities (COGI and Sv. Nedelja)

### Survival, mortality and growth rate

Table 1 shows number of dead individuals at each site for each measuring period. The highest mortality was observed during the first two measuring periods (Jan 15 - May 15) on all three sites.

The mean mussel length increase during the study period is given in Table 2. At all sites, all surviving individuals reached the prescribed market size (5 cm in length, as defined in the OFFICIAL GAZETTE OF MONTENEGRO (8/2011; 56/2009, 47/2015)) after 13 months. At the start of the experiment, the mussels were estimated to be around 8-10 months old. At the SVN site, all surviving individuals reached market size after only 8 months, which could indicate production cycle of around 16-18 months in monoculture conditions. After the same period at site NUD, 81% of survived individuals reached market size, and on site NBL 76% of survived individuals reached market size for the same period.

Growth rate analysis (length, width, height) showed a statistically significant difference in both sampling period and sampling location (Table 3 - 5; Fig. 3). The growth in length was slowest during summer period (July-September), and the most rapid in spring (March-May) at all sites. The same results were obtained for growth in width and height. During all periods, mussels from the SVN and NUD sites showed similar growth in length, width and height, which was significantly higher compared to the NBL site.

Table 6 shows that the estimated growth rate parameters were highest for mussels from the SVN site ( $L_{\infty} = 69.18$  mm,  $k = 1.95$  year<sup>-1</sup>), and lowest for the NBL site ( $L_{\infty} = 62.52$  mm,  $k = 1.709$  year<sup>-1</sup>). On the NUD site estimated asymptotic length was  $L_{\infty} = 65.27$  mm, with  $k = 2.079$  year<sup>-1</sup>.

### Condition index

The highest values (34.47) of the condition index (CI) were recorded at the NUD site in May 2015, while the lowest values (19.28) were on the NBL site in September 2015. On all three sites, the lowest values of CI were in September

Table 1. Number of dead individuals at each site for each measuring period

Position	NBL	NUD	SVN
Jan'15-Mar'15	4	15	19
Mar'15-May'15	25	13	4
May'15-Jul'15	4	4	5
Jul'15-Sep'15	9	3	7
Sep'15-Nov'15	2	2	2
Nov'15-Jan'16	0	1	2

Table 2. The mean mussel length on the beginning and after 13 months

Position	NBL	NUD	SVN
Jan'15	4.38±0.39 cm	4.20±0.45 cm	4.23±0.35 cm
Jan'16	5.97±0.47 cm	6.37±0.56 cm	6.57±0.54 cm

Table 3. Analysis of growth increments for length using repeated-measures ANOVA with Tukey post hoc comparison

Factor	d.f.	F	P	Post hoc comparison
Period	5	179.63	<0.001	4 < 3 < 6 < 5 = 1 < 2
Site	2	36.32	<0.001	NBL < NUD = SVN
Interaction	10	5.34	<0.001	
Error	1248			

1 = Jan-Mar, 2 = Mar-May, 3 = May-Jul, 4 = Jul-Sep, 5 = Sep-Nov, 6 = Nov-Jan '16

Table 4. Analysis of growth increments for width using repeated-measures ANOVA with Tukey post hoc comparison

Factor	d.f.	F	P	Post hoc comparison
Period	5	138.87	<0.001	4 < 3 = 6 = 5 < 1 < 2
Site	2	36.55	<0.001	NBL < NUD = SVN
Interaction	10	10.16	<0.001	
Error	1248			

1 = Jan-Mar, 2 = Mar-May, 3 = May-Jul, 4 = Jul-Sep, 5 = Sep-Nov, 6 = Nov-Jan '16

Table 5. Analysis of growth increment for height using repeated-measures ANOVA with Tukey post hoc comparison

Factor	d.f.	F	P	Post hoc comparison
Period	5	91.91	<0.001	4 < 3 < 6 < 5 = 1 < 2
Site	2	32.18	<0.001	NBL < NUD = SVN
Interaction	10	8.27	<0.001	
Error	1248			

1 = Jan-Mar, 2 = Mar-May, 3 = May-Jul, 4 = Jul-Sep, 5 = Sep-Nov, 6 = Nov-Jan '16

Table 6. Growth parameters for mussels per sampling site

	SVN	NUD	NBL
$L_{\infty}$ (mm)	69.18	65.27	62.52
$k$ (year <sup>-1</sup> )	1.95	2.079	1.709

Table 7. Analysis of condition index according to site and month

Year	Month	ANOVA/KW	Post hoc comparison
2015	January	F = 1.744 <sup>NS</sup>	—
	February	H = 4.267 <sup>NS</sup>	—
	March	F = 13.99 <sup>***</sup>	NUD=NBL, SVN>NBL, SVN>NUD
	April	F = 17.22 <sup>***</sup>	NUD>NBL, SVN=NBL, NUD>SVN
	May	F = 21.39 <sup>***</sup>	NUD>NBL, SVN=NBL, NUD>SVN
	June	F = 5.439 <sup>**</sup>	NUD=NBL, SVN=NBL, SVN<NUD
	July	F = 11.99 <sup>***</sup>	NUD>NBL, SVN=NBL, NUD>SVN
	August	F = 4.224 <sup>*</sup>	NUD=NBL, SVN=NBL, NUD>SVN
	September	H = 2.3446 <sup>NS</sup>	—
	October	F = 13.8 <sup>***</sup>	NUD=NBL, NBL>SVN, NUD>SVN
	November	F = 20.74 <sup>***</sup>	NUD=NBL, NBL>SVN, NUD>SVN
	December	F = 31.65 <sup>***</sup>	NUD=NBL, NBL>SVN, NUD>SVN
2016	January	F = 5.235 <sup>**</sup>	NUD=NBL, NBL=SVN, NUD>SVN

\* <0.05; \*\* <0.01; \*\*\* <0.001; <sup>NS</sup> - not statistically significant

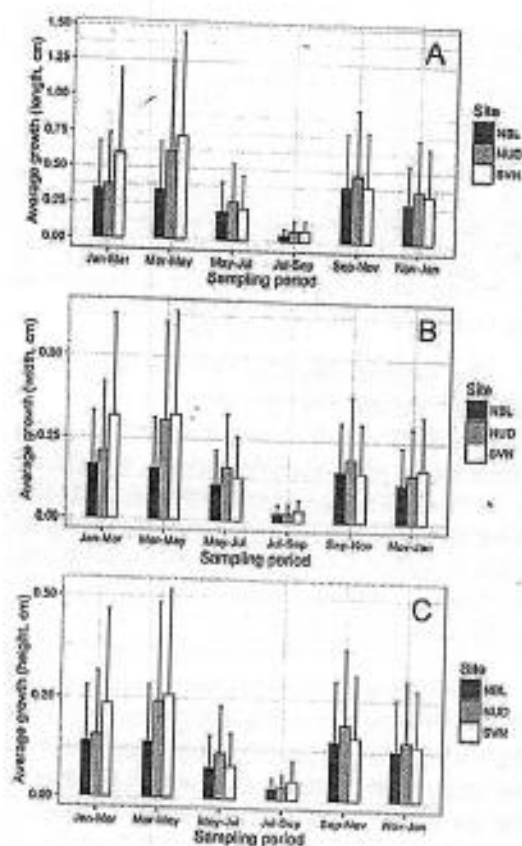


Fig. 3. Average growth increments and standard deviations for length (A), width (B), and height (C) according to sampling period and location

2015 (19.28 NBL; 21.18 NUD; 19.35 SVN). During the entire monitoring period the mean values of CI were higher on the NUD site compared to the other two sites (Fig. 4), except for February and March 2015. The analysis of condition index according to site and month is given in Table 7 and shows that there was no statistically significant difference in CIs at different sites during January, February and September 2015. From April until August 2015, as well as in January 2016, the CIs at the NBL and SVN sites were similar, while in the period from October to December the individuals from the NBL site had CI values which were statistically significantly higher than the CI values of individuals from the SVN site.

## DISCUSSION

The results of this study revealed statistically significant difference between sampling period and sampling location in both growth and condition index of mussels.

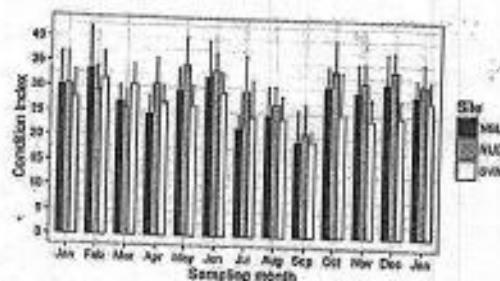


Fig. 4. Average monthly condition index and standard deviations according to month and sampling site

The obtained results indicate that growth in length, width and height at all three sampling sites was most intense in spring, and least intense in summer. These results agree with PEHARDA *et al.* (2007), who found the highest growth rates of mussels in period from March to May, which could indicate that the highest growth during the spring period can be the result of increased food availability. On the other hand, results of this study partly agree with results reported by IRISARRI *et al.* (2014a), who found maximum growth in mussels during both spring and summer period. According to VAN ERKOM SCHURINK & GRIFFITHS (1992) as well as ŽUPAN & ŠARIĆ (2014), highest availability of food is at temperatures between 10°C and 20°C, when the recorded mussel growth is most intense, while the growth slows at temperatures above 20°C. Temperatures in the 10-20°C range are typical for the Adriatic in spring, with temperatures above 20°C typical for summer (AZCÁRATE *et al.*, 2005), which can help explain the results obtained.

Salinity has an indirect influence on growth, with lower salinity having a positive influence, but through the fact that areas with higher influx of freshwater (and thus lower salinity) have increased amount of nutrients (ŽUPAN & ŠARIĆ, 2014). Salinity values at the COGÍmar location were significantly lower during winter

and spring seasons, compared to Sveta Nedelja (Fig. 3). The NUD site, which is about 100 m removed from fish cages, is under a significant influence of underwater freshwater sources, as well as the freshwater influx from the land (BELLAFIORE *et al.*, 2011), and the higher growth rates (in length, weight and height) at this site could be attributed, at least partially, to the increased amount of freshwater.

High growth rates in length, weight and height, which were recorded at the SVN site, similar to NUD, can be connected to the strong water currents in the Verige strait (>20 cm/s) (BELLAFIORE *et al.*, 2011). The Sveta Nedelja mussel farm is located just off the mouth of the strait. KARAYÜCEL & KARAYÜCEL (2000) report higher growth rate of *Mytilus edulis* individuals exposed to water current influence, as stronger currents carry more nutrients. BAINOCI (2014) found that mussels which were placed on the farthest point from fish cages had the highest growth rates in length, weight and height compared to those which were placed close to fish cages, but the differences were not statistically significant. NAVARRETE-MIER *et al.* (2010) also did not report significant differences in shell length growth of mussels on six different distances from fish cages. Results from IRISARRI *et al.* (2014a) showed similar shell length between mussels close to the fish farm and mussels distant from the fish farm.

Lower growth rates at the NBL site compared to SVN and NUD site could be affected by the large amount of fouling organisms detected during the entire year on this site. STJEPČEVIĆ (1974) reports that a large amount of fouling organisms "suffocates" the mussels, which stalls their growth, and can also cause increased mortality. Dominant fouling organism on NBL site was the White sea squirt (*Phallusia mammilata*, Cuvier 1815). Other fouling organism which were noted are: *Botryllus* spp., *Balanus* spp., European fan worm (*Sabella spallanzani*, Gmelin 1791), Keel worm (*Pomatoceros triquetus*, Linnaeus 1758) and Bryozoa (*Schizobrachiella sanguine*, Norman 1868). All of those organisms were also recorded on the other two localities,

but in different abundances. On the SVN site Keel worm was more abundant than any other organisms, as well as the European fan worm, while on NBL and NUD site White sea squirt was the dominant organism. Also, on the NBL and NUD sites the green algae *Chaetomorpha* spp. and *Cladophora* spp. were abundant, especially during spring months. These differences in fouling can be explained by the differences in sea currents at different localities.

The highest mortality in our study was recorded during the the first two measurement periods on all three sites, which can be explained by stress and adaptation of individuals to the new conditions (ŽUPAN, 2012). On the other hand, higher mortality at the NBL site during the entire monitoring period could be explained by an increased presence of fouling organisms due to the proximity of fish cages.

It is known that condition index is an important parameter indicating the quality of shellfish (ŽUPAN & ŠARIĆ, 2014). The results of this study indicate that location did consistently influence the CI of mussels, with individuals 100 m removed from fish cages (NUD) showing higher CI values for the major part of the study compared to individuals at the other two sites (NBL, SVN), which were quite similar among themselves, except for the colder period (October-December) when sites NBL and NUD were similar and had higher CI values. These results can indicate the fact that in colder months, when primary production is lower and there is little food available in water, mussels feed on the nutrients originating from fish farms. The benefits on mussels feeding on fish farm effluents were noted by MACDONALD *et al.* (2011).

This study's results regarding the CI are in accordance with those reported by SARÁ *et al.* (2009), LANDER *et al.* (2012) and ŽUPAN *et al.* (2014), who found a positive correlation between CI values in bivalves and their proximity to fish farms. IRISARRI *et al.* (2014b) found significantly higher CI in IMTA mussels than in monoculture individuals. On the other hand, the results of this study are not consistent with the results of TAYLOR *et al.* (1992) and CHESHUK *et al.* (2003),

who showed that there is no influence of salmon farming on CI of *M. edulis* and *M. planulatus*. IRISARRI *et al.* (2014a) has not found differences in CI values among mussels close to the fish farm and those distant from the fish farm. Also, NAVARRETE-MIER *et al.* (2010) did not report significant differences in dry weight of mussels farmed on six different distances from fish cages.

The results of this study also showed the lowest CI values during September 2015 at all three sites. This can be explained by the common spawning period of the mussel, which reaches its peak during spring and autumn (DARDIGNAC-CORBEL, 1990). However, even if the bibliographical data refer to spring spawning closely following the drop in CI values (MASON, 1976; OKUMUŞ & STIRLING, 1998; PEHARDA *et al.*, 2007), this was not recorded in this study. Rather, the CI values were relatively high at all three sampling sites. According to HRS-BRENKO (1980), water temperatures above 16°C have a significant effect on the reduction of sexual activity of mussels. It is important to mention that method for CI calculation in this study was based on "wet" method (ALMEIDA *et al.* 1999), while calculation of CI in most other studies was based on dried or cooked meat (FREEMAN, 1974; DAVENPORT & CHEN, 1987).

## CONCLUSIONS

This study analysed the growth rate and condition index of *M. galloprovincialis* in integrated system and monoculture. The growth rate and condition index were monitored during a 13-month study at three different sites: 1) close to the fish cages (NBL), 2) 100 m far from fish cages (NUD), and 3) at a monoculture mussel farm (SVN). Significant differences in growth rate and condition index according to sampling period and location were found. The results

showed a similar production cycle in monoculture and integrated multi-trophic systems. The highest mortality rate was recorded at the NBL site. The results of the study refer to the minimum market size of mussels in Montenegro (5 cm shell length) (OFFICIAL GAZETTE OF MONTENEGRO, 8/2011; 56/2009, 47/2015). As such, the results of the study might not be directly applicable to areas with different minimum market sizes e.g. in Croatia, where mussel minimum market size is 6 cm (OFFICIAL GAZETTE OF THE REPUBLIC OF CROATIA, 63/10, 68/10, 145/10, 18/12, 29/12), although they should be considered indicative. CI results indicate the possibility that mussels feed on the nutrients from fish farm during periods when little food would naturally be available in water.

It is known that, besides temperature and salinity, the other important factors influencing growth in mussels are the availability of food, water current direction and population density (GOSLING, 1992), and that food availability and changes in the reproduction phases are the most important factors in CI variations (GOSLING, 1992), the obtained results suggest that a much more detailed study, which would include abiotic and biotic parameters on all sampling locations, should be performed in order to get more relevant results.

## ACKNOWLEDGMENTS

This study was been supported by the Ministry of Science of Montenegro and the HERIC project through the BIO-ICT Centre of Excellence (Contract No. 01-1001), and also by the Ministry of rural development and agriculture – Monitoring of water quality at mussel and fish farms for the period 2014-2015, financed through the Agro-budget.

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Received: 30 January 2017

Accepted: 27 July 2017

## Usporedba između IMTA i uzgoja dagnje u monokulturi (*Mytilus galloprovincialis* L.) u Bokokotorskom zaljevu

Sladana GVOZDENOVIĆ, Milica MANDIĆ, Vladimir PEŠIĆ, Marko NIKOLIĆ,  
Ana PEŠIĆ i Zdravko IKICA\*

\*Kontakt e-adresa: [zdikica@ac.me](mailto:zdikica@ac.me)

### SAŽETAK

Cilj ovog istraživanja bio je pokazati postojanja mogućih razlika u rastu i kondicijskom indeksu dagnji (*Mytilus galloprovincialis*) u integralnom multi-trofičkom uzgoju i uzgoju u monokulturi. Rast i kondicijski indeks praćeni su tijekom razdoblja od 13 mjeseci na tri postaje: 1) u blizini uzgajališta ribe (NBL), 2) 100 m od uzgajališta ribe (NUD), 3) u monokulturi (SVN) na uzgajalištu koje je oko 8 km udaljeno od kaveza sa ribom. Najintenzivniji rast zabilježen je tijekom proljetnog razdoblja, a najmanje intenzivan tijekom ljetnog. Nakon 13 mjeseci, praćene jedinice su na sve tri pozicije dostigle komercijalnu dužinu. Stopa rasta je bila slična na sve tri pozicije, dok je kondicijski indeks pokazao prostorne i vremenske razlike. Vrijednosti kondicionog indeksa na postaji NUD bile su više od vrijednosti na postajama SVN i NBL, koje su međusobno bile prilično slične, osim u razdoblju od listopada do prosinca kada su vrijednosti kondicijskog indeksa bile slične na postajama NBL i NUD, a veće u usporedbi sa vrijednostima na postaji SVN poziciji. Vrijednosti kondicionog indeksa na postajama NBL i NUD tijekom hladnog perioda godine ukazuju na to da se dagnje vjerovatno hrane nutrijentima porijeklom sa uzgajališta riba. Visoki mortalitet zabilježen je na postaji NBL, najvjerojatnije zbog obraštajnih organizama.

**Ključne riječi:** *Mytilus galloprovincialis*, integralna multi-trofička akvakultura, monokultura, Bokokotorski zaljev



**Univerzitet Crne Gore  
Prirodno-matematički fakultet**

Džordža Vašingtona b.b.  
1000 Podgorica, Crna Gora

tel: +382 (0)20 245 204

fax: +382 (0)20 245 204

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Datum: 18 JUL 2019

Na osnovu službene evidencije i dokumentacije Prirodno-matematičkog fakulteta u Podgorici, izdaje se

**POTVRDA**

MSc Slađana Gvozdenović, student doktorskih studija na Prirodno-matematičkom fakultetu u Podgorici, dana **18.07.2019.** godine, dostavila je ovom Fakultetu doktorsku disertaciju pod nazivom **"Integralni multi-trofički uzgoj dagnje (*Mytilus galloprovincialis* L.) i kamenice (*Ostrea edulis* L.) sa ribom u Bokotorskom zalivu"**, na dalji postupak.

*Miranović*  
DEKAN  
Prof. dr Predrag Miranović



**Univerzitet Crne Gore  
Prirodno-matematički fakultet**

Džordža Vašingtona b.b.  
1000 Podgorica, Crna Gora

tel: +382 (0)20 245 204

fax: +382 (0)20 245 204

[www.pmf.ac.me](http://www.pmf.ac.me)

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Datum: 3 FEB 2019

Na osnovu člana 69 statuta Univerziteta Crne Gore i člana 41 Pravila doktorskih studija, na XXVIII sjednici Vijeća održanoj 08.02.2019. godine donijeta je

**ODLUKA**

**I**

Predlažemo Centru za doktorske studije i Senatu Univerziteta da imenuje komisiju za ocjenu doktorske disertacije "Integralni multi-trofički uzgoj dagnje (*Mytilus galloprovincialis* L.) i kamenice (*Ostrea edulis* L.) sa ribom u Bokokotorskom zalivu.", kandidata mr Slađane Gvozdenović, u sastavu:

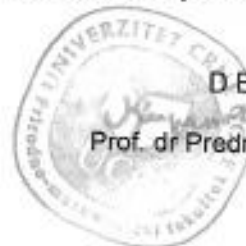
1. Prof. dr Vladimir Pešić, Prirodno-matematički fakultet Univerziteta Crne Gore; (Naučna oblast: Ekologija i Biodiverzitet) – mentor;
2. Prof. dr Nada Blagojević, Metalurško tehnološki fakultet Univerziteta Crne Gore (Naučna oblast: Analitička hemija);
3. Prof. dr Ljiljana Tomović, Biološki fakultet, Univerzitet u Beogradu, (Naučna oblast: Ekologija i Biodiverzitet);
4. Prof. dr Drago Marić, Prirodno - matematički fakultet Univerziteta Crne Gore (Naučna oblast: Ekologija i Biodiverzitet) i
5. Dr Milica Mandić, viši naučni saradnik na Institutu za biologiju mora na Univerzitetu Crne Gore (Naučna oblast: Ihtioplankton i marikultura);

**Obrazloženje**

Mr Slađana Gvozdenović je predala doktorsku disertaciju pod nazivom " Integralni multi-trofički uzgoj dagnje (*Mytilus galloprovincialis* L.) i kamenice (*Ostrea edulis* L.) sa ribom u Bokokotorskom zalivu". Vijeće Prirodno-matematičkog fakulteta je utvrdilo da su ispunjeni uslovi iz člana 38 Pravila doktorskih studija, da kandidat mr Slađana Gvozdenović ima, kao prvi autor, rad sa rezultatima iz teze objavljen u časopisu sa SCI/SCIE liste. Samim tim su se stekli uslovi da se imenuje komisija za ocjenu pomenute doktorske disertacije.

**DOSTAVLJENO**

- Senatu
- Centru za doktorske studije
- a/a



**DEKAN**

Prof. dr Predrag Miranović

## LIČNI PODACI

**Slađana Gvozdrenović**


📍 Dubovica 2 B7/1, 85310, Budva, Crna Gora

☎ 0038269286485

✉ [sladjana@ucg.ac.me](mailto:sladjana@ucg.ac.me); [sladjana87gvozdrenovic@gmail.com](mailto:sladjana87gvozdrenovic@gmail.com)

Pol **Ženski** | Datum rođenja 17/06/1987 | Nacionalnost **Crnogorska**

## RADNO ISKUSTVO

- |                         |                                                                                                                                                                                                                                                                                                                 |
|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 01.09.2018- ...         | <b>Saradnica u istraživanju</b><br>Institut za biologiju mora, Univerzitet Crne Gore<br><ul style="list-style-type: none"> <li>• Integralna multi-trofička akvakultura, zoobentos (Školjkaši), rad na nacionalnim i internacionalnim projektima, terenski rad, pripreme izvještaja i elaborata</li> </ul>       |
| 15.01.2015 – 31.08.2018 | <b>Istraživač</b><br>Elektrotehnički fakultet, Univerzitet Crne Gore<br><ul style="list-style-type: none"> <li>• Integralna multi-trofička akvakultura, biotoksini, analitička hemija, zoobentos (Školjkaši), terenski rad, priprema izvještaja</li> </ul>                                                      |
| 28.08.2014 – 15.10.2014 | <b>Istraživač</b><br>Institut za biologiju mora, Univerzitet Crne Gore<br><ul style="list-style-type: none"> <li>• Terenski rad u oblasti marinske biologije</li> </ul>                                                                                                                                         |
| 10.09.2012-10.09.2012   | <b>Pripravnica</b><br>Institut za biologiju mora, Univerzitet Crne Gore<br><ul style="list-style-type: none"> <li>• Laboratorijski i terenski rad u oblasti marinske biologije (hemijska analiza morske vode, ronjenje, biološka analiza morske vode, determinacija zoobentosa, priprema izvještaja)</li> </ul> |

## EDUKACIJA

- |                         |                                                                                                                                                                                                                                 |       |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 01.10.2014 - ...        | <b>Student doktorand u oblasti ekologije</b><br>Prirodno-matematički fakultet, Departman za biologiju, Univerzitet Crne Gore<br><ul style="list-style-type: none"> <li>• Marinska biologija i ekologija, marikultura</li> </ul> | VII/2 |
| 01.10.2010 – 05.07.2013 | <b>Master u oblasti ekologije</b><br>Prirodno-matematički fakultet, Departman za biologiju, Univerzitet Crne Gore<br><ul style="list-style-type: none"> <li>• Biologija, Ekologija, Herpetologija</li> </ul>                    | VII/1 |
| 01.09.2009 – 10.09.2010 | <b>Specialista u oblasti ekologije</b><br>Prirodno-matematički fakultet, Departman za biologiju, Univerzitet Crne Gore<br><ul style="list-style-type: none"> <li>• Biologija, Ekologija</li> </ul>                              | VI    |
| 01.09.2006 – 01.09.2009 | <b>Bečelor biologije</b><br>Prirodno-matematički fakultet, Departman za biologiju, Univerzitet Crne Gore<br><ul style="list-style-type: none"> <li>• Biologija</li> </ul>                                                       | VI    |

**VJEŠTINE I KOMPETENCIJE**

Maternji jezik(ci) Crnogorski jezik

Drugi jezik(ci)

Engleski jezik

RAZUMJEVANJE		GOVOR		PISANJE
Slušanje	Čitanje	Govorna interakcija	Govorna produkcija	
B2	B2	B2	B2	B2

Nivoi: A1/A2: Osnovno- B1/B2: Vrlo dobro - C1/C2: Odlično

Računarske vještine

SAMOSTALNA PROCJENA				
Obrada informacija	Komunikacija	Kreiranje sadržaja	Sigurnost	Rešavanje problema
Vrlo dobro	Vrlo dobro	Vrlo dobro	Vrlo dobro	Vrlo dobro

Levels: Osnovno - Vrlo dobro - Odlično

- Mikrosft: MS Word, Excel, Internet explorer, Power Point
- Softveri za obradu slika: Adobe Photoshop, FastStone image viewer, Paint
- Statistički programi: Primer

Vozačka dozvola B

**PROJEKTI**

- Systematic and Molecular genetic assessment of Aquatic Biodiversity in Montenegro I – koordinator Prof. dr Vladimir Pešić (Prirodno-matematički fakultet, Univerzitet Crne Gore) 2009. godina
- Systematic and Molecular genetic assessment of Aquatic Biodiversity in Montenegro II – coordinator Doc dr Danilo Mrdak (Prirodno-matematički fakultet, Univerzitet Crne Gore) 2010. godine
- Cheking the distribution and populations' status of the highly endangered Balkan Terrapin (*Mauremys rivulata*) in Montenegro – koordinator mr Vuk Ikočić (NVO Crnogorsko društvo ekologa) 2013. godina
- Research, Conservation and Promotion of the Endemic Balkan Rock Lizards (*Dinarolacerta* spp.) in Montenegro – koordinator dr Katarina Ljubisavljević (NVO Crnogorsko društvo ekologa) 2014. godina
- The olm (*Proteus anguinus*) in Croatia, Bosnia and Herzegovina and Montenegro – protection plan
- Distribution and Treats to European pond turtle (*Emys orbicularis*) at Zeta and Bjelopavlići Plain at Montenegro – koordinator mr Ana Vujović (NVO Udruženje prirodnjaka Crne Gore) 2014. godina
- Determination of the Degree of Vulnerability and Distribution Balkan Terrapin in Montenegro – koordinator mr Vuk Ikočić (NVO Crnogorsko društvo ekologa) 2015. godina
- Distribution and conservation of highly endangered Karst Viper (*Vipera ursinii macrops*) in Montenegro – koordinator Vernes Zagora (NVO Crnogorsko društvo ekologa) 2014. godina
- Distribution and Vulnerability of Highly Endangered Karst Viper in Central and North Part of Montenegro, and Preparing for Long-Term Monitoring – koordinator Vernes Zagora (NVO Crnogorsko društvo ekologa) 2016. godina
- Distribution and Conservation of Vulnerable Blue Shark (*Prionace glauca*) in Coastal Waters of Montenegro – koordinator Ilija Četković (NVO Crnogorsko društvo ekologa) 2016. godina
- Distribution and Conservation Three New and Three Threatened Species of Moss in Montenegro – koordinator mr Branko Anđić, 2016. godina
- Assessing Threats and Setting Conservation Priorities for Endemic Balkan Rock Lizards (*Dinarolacerta* spp.) and their Habitats in the Mountains of Montenegro – koordinator dr Katarina Ljubisavljević (NVO Crnogorsko društvo ekologa) 2016. godina
- AdriaMed project „Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea” – koordinator dr Aleksandar Joksimović (Institut za biologiju mora, Univerzitet Crne Gore) 2013, 2014, 2015, 2016. godina
- Actions for ecological valorisation of Buljarica cove – koordinator dipl. biol. Mihajlo Jovičević (NVO Crnogorsko društvo ekologa) 2016. godina

- Cross Border Marine Nature 2000 Mapping, Monitoring and Management – koordinator NVO Zeleni Dom, 2016. godina
- The study, protection and possible breeding of Noble pen shell (*Pinna nobilis*) in Boka Kotorska Bay – koordinator dr Danijela Joksimović (Institut za biologiju mora, Univerzitet Crne Gore) 2016 – 2019. godina
- Derelict fishing gear management system in the Adriatic Sea, koordinator dr Milica Mandić (Institut za biologiju mora, Univerzitet Crne Gore), 2013 – 2016. godina
- Network of protected areas – Natura 2000 in Montenegro – koordinator AAM Consulting, 2016 – 2019. godina
- Assessment of Demographic Structure and Protection Measures of the Balkan Terrapin (*Mauremys rivulata*) in Montenegro – koordinator Vuk Iković (NVO Crnogorsko društvo ekologa), 2018-2019. godina
- Centre of Excellence in Bioinformatics – koordinator Prof. dr Igor Radusinović (Elektrotehnički fakultet, Univerzitet Crne Gore), 2014 – 2019 godina
- Use of Mediterranean mussel and European oyster shells for heavy metal remove – koordinator dr Milica Mandić (Institut za biologiju mora, Univerzitet Crne Gore), 2016-2017. godina
- Experimental farming of *Pecten jacobaeus* in the Boka Kotorska Bay – koordinator dr Milica Mandić (Institut za biologiju mora, Univerzitet Crne Gore), 2017-2018 godina
- Monitoring of water quality at mussel and fish farms for the period 2015 – 2018 – koordinator dr Milica Mandić (Institut za biologiju mora, Univerzitet Crne Gore), 2015, 2016, 2017, 2018. godina
- Regional network for biodiversity (BioNET) – koordinator Milica Kandić (NVO Zeleni Dom), 2017. godina
- Research and Protection the Moss Biodiversity on Cijevna River – koordinator mr Branko Anđić, 2017-2018. godina
- Welcome, WatEr LandsCapes sustainability through reuse of Marine littEr – koordinator dr Mandić Milica (Institut za biologiju mora, Univerzitet Crne Gore), 2018 – 2020. godina
- Adopt a beach – koordinator dr Mandić Milica (Institut za biologiju mora, Univerzitet Crne Gore), 2018 – 2019 godina
- Recycle and valorization of bivalve shells – koordinator dr Milica Mandić (Institut za biologiju mora, Univerzitet Crne Gore), 2019 – 2020. godina

#### TRENINZI/SEMINARI

- Trening za upotrebu PCR metode na Institutu za Zoologiju, Grac 2009. godina
- Trening za upotrebu PCR metode na Institutu za Zoologiju, Grac 2010. godina
- Radionica za zaštitu riječne kornjače u oblasti zapadnog Balkana, Dubrovnik, maj 2013. godina
- Radionica za kreiranje menadžment plana u ribarstvu kroz EAF, Rim, jun 2013. godina
- Kurs ekološkog monitoringa u zaštićenim marinskim oblastima, Alkante, septembar 2013. godina
- Trening Evropska Unija i Crna Gora – zakonodavstvo u oblasti životne sredine i primjena u praksi, Podgorica, novembar 2013. godina
- Trening za plan i menadžment javnih kampanja u oblasti životne sredine, Podgorica, april, 2014. godina
- Trening monitoringa, zaštite i praćenja ptica u zaštićenim močvaram oblastima BiH i Crne Gore, Tivat, februar, 2014. godina
- Trening održivog upravljanja u zaštićenim oblastima Crne Gore i BiH, Tivat, april 2014. godina
- Trening za jačanje kapaciteta za mapiranje i monitoring u marinskim oblastima, Petrovac, jun 2016. Godina
- Trening za izgradnju kapaciteta za mapiranje i monitoring u marinskim oblastima, Petrovac, septembar, 2016. godina
- Trening rada na HPLC-u i detekciji biotoksina iz amnezisjske i paralitičke grupe, Split, april, 2015
- Trening rada na HPLC-u i detekciji biotoksina iz amnezisjske i paralitičke grupe, Podgorica, oktobar, 2016
- Trening rada na HPLC-u i detekciji biotoksina iz amnezisjske i paralitičke grupe, Split, decembar, 2016
- Trening rada na HPLC-u i detekciji biotoksina iz amnezisjske i paralitičke grupe, Podgorica, mart, 2017
- BioNET mreža u Natura 2000 menadžmentu zaštićenih oblasti i životinja, Žabljak, novembar, 2017. godina
- Trening za jačanje kapaciteta za učešće u Horizon 2020, septembar 2017. godina

#### REFERENCE

##### Naučni radovi

- Ajtić, R., Tomović, Lj., Sterijovski, B., Cmornja-Isalović, J., Djordjević, S., Djurakić, M., Golubović, A., Simović, A., Arsovski, D., Anđelković, M., Krstić, M., Šukalo, G., **Gvozdenović, S.**, Aïdam, A., Micheli, C.L., Ballouard, J.-M., Bonnet, X. (2013): Unexpected life history traits in a very dense population of dice snakes. *Zoologischer Anzeiger. A Journal of Comparative Zoology*, 252: 350-358
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- Šukalo, G., Đorđević, S., **Gvozdenović, S.**, Simović, S., Anđelković, M., Blagojević, V. Tomović, Lj. (2014): Intra- and Inter-population variability of food preferences of two *Natrix* species on the Balkan Peninsula. *Herpetological Conservation and Biology*, 9(1):123-136
- Gvozdenović, S.** & Iković, V. (2014): The Capture of a spectacled caiman *Caiman crocodillus* Linnaeus, 1758 (Crocodylia, Alligatoridae) in Montenegro. *Hyla*, Vol. 2014, 1: 30-32
- Iković, V. & **Gvozdenović, S.** (2014): First data about Black rat *Rattus rattus* Linnaeus, 1758 (Rodentia, Muridae) as a prey of Caspian whip snake *Dolichopsis caspius* Linnaeus, 1758 (Serpentes, Colubridae). *Hyla*, Vol. 2014, 1: 22-24



- Gvozdenović, S.** & Schweiger, M. (2014): Melanism in *Natrix natrix* and *Natrix tessellata* (Serpentes: Colubridae) from Montenegro. *Ecologica Montenegrina*, 1(4), 2014: 231-233
- Iković, V., Krsić, M. & **Gvozdenović, S.** (2014): A record of melanistic viviparous lizard *Zootoca vivipara* (Lichtenstein, 1823) (Squamata, Lacertidae) on Prokletije Mountain, Montenegro. *Hyla*, Vol. 2014, 2: 41-44
- Gvozdenović, S.** & Iković, V. (2014): Egg incubation period in the Hermann's tortoise *Testudo hermanni* Gmelin, 1789 (Testudines, Cryptodira, Testudinidae). *Hyla*, Vol. 2014, 2: 45-46
- Gvozdenović, S.** & Iković, V. (2015): Dead Sea turtles on the Montenegrin coast. *Studia Marina*, 28(1): 61-66
- Gvozdenović, S.** & Čavor, N. (2015): First record of dicephalism in the four-lined snake *Elaphe quatuorlineata* Lacépède, 1789 (Serpentes: Colubridae) from Montenegro. *Natura Sloveniae*, 17(1): 49-50
- Gvozdenović, S.**, Mandić, M., Drakulović, D. & Joksimović, A. (2015): The shellfish biotoxins. *Agriculture & Forestry*, 61(3): 135-142.
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- Drakulović, D., **Gvozdenović, S.**, Joksimović, D., Mandić, M., Pestorić, B. (2017): Toxic and potentially toxic phytoplankton in the mussel and fish farms in the transitional area of Montenegrin coast (South-eastern Adriatic Sea). *Turkish Journal of Fisheries and Aquatic Sciences*, 17: 885-900
- Ljubisavljević, K., Tomović, Lj., Urošević, A., **Gvozdenović, S.**, Iković, V., Zagora, V., Labus, N. (2018): Species diversity and distribution of lizards in Montenegro. *Acta Herpetologica*, 13(1): 3-11
- Peraš, I., **Gvozdenović, S.**, Petović, S., Mandić, M. (2018): Comparative analysis of bivalves diversity on experimental spat collectors. *Water Research and Management*, 8: 25-31
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- Gvozdenović, S.**, Nikolić, M., Pešić, V., Peraš, I. & Mandić, M. (2019): First Data on the Alien Mollusc *Fulvia fragilis* (Forsskål in Niebuhr, 1775) (Cardiida: Cardiidae) from the Adriatic Sea. *Acta Zoologica Bulgarica*, 71 (2): 267-272.
- Golubović, A., Tomović, Lj., Nikolić, M.Lj., Nikolić, S., Anđelković, M., Arsovski, D., Iković, V., **Gvozdenović, S.**, Popović, M. A. (2019): Distribution of Hermann's tortoise across Serbia with implications for conservation. *Archives of Biological Science*, DOI: 10.2298/ABS190406034G
- Nikolić, M., Kuznetsova, T., Kholodkevich, S., **Gvozdenović, S.**, Mandić, M., Joksimović, D., Teodorović, I. (2019): Use of cardiac activity in the Mediterranean mussel (*Mytilus galloprovincialis* Lamarck, 1819) as a biomarker for assessing sea water quality in Boka Kotorska Bay, South Adriatic Sea. *Mediterranean Marine Science*, DOI:10.12681/mms.18119
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#### Konferencije, simpozijumi

- Gvozdenović, S.**, Pešić, V. & Tomović, Lj. (2013): Preliminary population study on Dice Snake – *Natrix tessellata* (Laurenti, 1786) from Skadar Lake, pp. 112-113. *The Book of Abstracts and Programme, 5<sup>th</sup> International Symposium of Ecologists of Montenegro*
- Gvozdenović, S.**, Drakulović, D., Mandić, M. & Joksimović, A. (2015): Toxic and potentially toxic phytoplankton species in the Boka Kotorska Bay (Montenegro), pp. 58-59. *The Book of Abstracts and Programme, 6<sup>th</sup> International Symposium of Ecologists of Montenegro*
- Gvozdenović, S.**, Mandić, M., Pešić, V., Ikica, Z., Drakulović, D. (2016): Biotoxins and impact on human populations. 54<sup>th</sup> Congress of Anthropological Society of Serbia with international participation
- Nikolić, M., Joksimović, A., **Gvozdenović, S.**, Joksimović, D., Pešić, A. (2016): System for environmental monitoring with aim of human population protection. 54<sup>th</sup> Congress of Anthropological Society of Serbia with international participation (ISBN 978-86-911461-3-9)
- Pešić, A., Joksimović, A., Ikica, Z., Nikolić, M., **Gvozdenović, S.** (2016): Kondicioni faktor kod brancina (*Dicentrarchus labrax*) na uzgajalištu riba u Bokokotorskom zalivu. 45. Međunarodna konferencija o korišćenju i zaštiti voda
- Drakulović, D., Pestorić, B., Mandić, M., **Gvozdenović, S.** & Joksimović, D. (2016): Spatial and temporal distribution of diatoms in shellfish farms in Boka Kotorska Bay (South-Eastern Adriatic Sea). 41<sup>st</sup> CIESM Congress, Kiel, Germany.
- Gvozdenović, S.** & Iković, V. (2016): Distribution and vulnerability of Balkan Terrapin (*Mauremys rivulata*) in Montenegro. The Rufford Small Grants Conference "Nature knows no boundaries"

- Zagora, V., Gvozdenović, S. & Jelić, D. (2017): Preliminary data on distribution of the Karst Viper (*Vipera ursinii macrops*) in Montenegro. 7<sup>th</sup> International Symposium of Ecologist
- Nikolić, M., Gvozdenović, S., Kholodkevich, S., Kuznetsova, T., Kurakin, A. (2017): Valve movement in bivalves as a behavioral biomarker. 22<sup>nd</sup> Information Technologies
- Mandić, M., Gvozdenović, S., Joksimović, A., Pešić, A. (2017): Condition of cultured sea bass and sea bream and occurrence of their spawning in the cages in Boka Kotorska Bay. 22<sup>nd</sup> Information Technologies
- Zagora, V., Gvozdenović, S., Iković, V., Jelić, D. (2018): Distribution and Vulnerability of Highly Endangered Karst Viper (*Vipera ursinii macrops*) in Central and North Part of Montenegro. 27<sup>th</sup> Rufford Small Grants Conferences
- Nikolić, M., Kholodkevich, S., Kuznetsova, T., Gvozdenović, S., Mandić, M., Joksimović, D., Teodorović, I. (2018): Water quality assessment in the Boka Kotorska bay based on the heart rate of Mediterranean mussel (*Mytilus galloprovincialis* L.). 12<sup>th</sup> Panhellenic Symposium of Oceanography and Fisheries
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## Comparison between IMTA and monoculture farming of mussels (*Mytilus galloprovincialis* L.) in the Boka Kotorska Bay

Sladana GVOZDENOVIĆ<sup>1</sup>, Milica MANDIĆ<sup>2</sup>, Vladimir PEŠIĆ<sup>3</sup>, Marko NIKOLIĆ<sup>1</sup>,  
Ana PEŠIĆ<sup>2</sup> and Zdravko IKICA<sup>2\*</sup>

<sup>1</sup>BIO-ICT Centre of Excellence in Bioinformatics, Cetinjska br. 2, 81000 Podgorica, Montenegro

<sup>2</sup>Institute of Marine Biology, University of Montenegro, Dobrota b.b., 85330 Kotor, Montenegro

<sup>3</sup>Faculty of natural sciences and mathematics, University of Montenegro, Cetinjska br. 2, 81000 Podgorica, Montenegro

\*Corresponding author, e-mail: [zdikica@ac.me](mailto:zdikica@ac.me)

*This paper presents the results of growth rate and condition index analysis of *Mytilus galloprovincialis* in integrated system and monoculture. The aim of this study was to show if there are differences in growth and condition index of mussels between integrated multi-trophic aquaculture (IMTA) and monoculture farming. The growth rate and condition index were monitored during a 13-month study at three different sites: 1) close to fish cages (NBL), 2) 100 m removed from fish cages (NUD), 3) at a monoculture mussel farm (SVN) around 8 km far away from cages. The most intense growth of mussels was recorded in spring, and the least intense in summer. After 13 months, monitored individuals at all three locations achieved commercial size. The growth rate was very similar at all sites. The condition index showed spatial and temporal differences. Condition index values on site NUD were mostly higher compared to SVN and NBL, which were very similar, except for the period from October to December when CI was similar on NBL and NUD site and higher in comparison with SVN. CI values on NBL and NUD site during cold period indicate on fact that mussels probably feed on the nutrients from fish farm origins. The highest mortality rate was recorded at the NBL site, probably due to the effects of fouling organisms.*

**Key words:** *Mytilus galloprovincialis*, integrated multi-trophic aquaculture (IMTA), monoculture, Boka Kotorska Bay

### INTRODUCTION

Marine aquaculture or mariculture is a very important fish, crustacean, mollusc and algae production sector, which has the possibility to replace the reduced potential of natural resources (FAO, 2010). Nowadays, terms such as "integrated" and "multi-trophic" are increasingly used in relation to the concept of mariculture and aquaculture in general (CHOPIN & ROBINSON, 2004). Integrated multi-trophic aquaculture

(IMTA) can be defined as the form of aquaculture where unconsumed fish food and fish metabolic products, which otherwise would have negative impact on the environment, can be used as a food source in another subsystem, leading to the increased productivity of the entire system under the complete control of the farmers (FAO, 2009; TROELL *et al.*, 2009; CHÁVEZ-CROOKER & OBREQUE-CONTRERAS, 2010). According to FAO (2004), one of the main goals of the aquaculture industry in the near future would be to minimize

negative impacts on the environment in order to achieve long-term viability. IMTA can be a good mechanism for achieving this goal, while also achieving another benefit — the increased economical productivity of the entire system (SARÀ *et al.*, 2009; RENDMOND *et al.*, 2010; SARÀ *et al.*, 2011; ŽUPAN 2012; MACDONALD *et al.*, 2013; HOLDT & EDWARDS, 2014; AL-HAFEDH *et al.*, 2014; RATCLIFF *et al.*, 2015).

Integrated multi-trophic farming systems of various marine organisms are known worldwide (FAO, 2009; ABREU *et al.*, 2009; NAVARRETE-MIER *et al.*, 2010; REID *et al.*, 2010; HUGHES & KELLY, 2011; HANDÁ *et al.*, 2012; LANDER *et al.*, 2012; IRISARRI *et al.*, 2014a). The possibility of implementation of the integrated multi-trophic farming in the Mediterranean was well studied in the last ten years (PEHARDA *et al.*, 2007; NAVARRETE-MIER *et al.*, 2010; SARÀ *et al.*, 2011; ŽUPAN, 2012; ŽUPAN *et al.*, 2012; ŽUPAN *et al.*, 2013; ŽUPAN *et al.*, 2014; ISARRI *et al.*, 2014a). Bivalves are known as filter feeders and they could potentially remove organic matter as well as uneaten fish food from water (RENDMOND *et al.*, 2010). According to SARÀ *et al.* (2009) and MAZZOLA & SARÀ (2001) this process can reduce negative impact on environment. Some studies have shown that the farming period for achieving market size in integrated farming of mussels (*Mytilus galloprovincialis*) and fish is similar to that in commercial monoculture (PEHARDA *et al.*, 2007). On the other hand, SARÀ *et al.* (2011) demonstrated higher growth rate of mussels (*M. galloprovincialis*) and the European flat oyster (*Ostrea edulis*) found close to fish farms compared to those found at the open sea. Higher condition index values of Noah's Ark shell (*Arca noae*) near fish farm, and the nearly identical periods for achieving market size of mussels (*M. galloprovincialis*) in integrated farming and monoculture have been proven by ŽUPAN (2012).

Mediterranean mussel, *M. galloprovincialis* Lamarck 1819, is a widely distributed species, autochthonous to the Mediterranean (GISD, 2016). The mussel lives in colonies in the tidal zone, fastened to the substrate by byssal threads. It feeds on phytoplankton, bacteria, zooplankton and detritus (DAVENPORT *et al.*, 2000; PRATO *et al.*, 2010). Genders are separated, and the spawning occurs mostly in spring and autumn. The mussels

are considered to be of market size when they are at least 5 cm in length (OFFICIAL GAZETTE OF MONTENEGRO, 8/2011; 56/2009, 47/2015).

The mussel farming tradition in the Boka Kotorska Bay area started about thirty years ago, although the first experiments regarding mussel and oyster farming begun in the 1960's (STJEPČEVIĆ, 1968). Today, there are 20 mussel farms in the Bay, all using floating park systems (long-lines). Gilthead sea bream (*Sparus aurata* Linnaeus, 1758) and European sea bass (*Dicentrarchus labrax* Linnaeus 1758) farming in the area started in the late nineties, and currently there are two farms (Orahovac and Stoliv) using the floating cage system farming method. The integrated farming of mussels and fish is used on both farms. In 2014, the mariculture production amounted to 45 t of sea bass, 38 t of sea bream, and 178 t of mussels (MONSTAT, 2015).

The main goal of this study was to obtain some data on IMTA farming, due to fact that this kind of farming has not been sufficiently studied in neither the Adriatic nor in the Mediterranean.

## MATERIAL AND METHODS

### Study area

The study was conducted on two locations in the Boka Kotorska Bay, Montenegro (South Adriatic) (Fig. 1). One location was the fish and mussel farm "COGImar" in the settlement of Orahovac, Kotor municipality, 42° 29' 07.79" N, 18° 44' 42.47" E. The second location was Sveta Nedelja mussel farm in the Kamenari settlement, municipality of Herceg Novi, 42° 27' 30.89" N, 18° 40' 21.42" E. The straight-line distance between the two study locations is 8 km. The COGImar farm farms Gilthead sea bream, European sea bass, Mediterranean mussel and European flat oyster in polyculture. On the COGImar localition two sites were chosen for the experimental part of the study: the mussel long-line closest to the floating fish cages (NBL), which was 10 m removed from the cages, and the mussel long-line furthest from the fish cages (about 100 m removed) (NUD). Sveta

Nedelja farm is a monoculture bivalve farm which produces Mediterranean mussel as well as the European flat oyster, and therefore only one site was selected (SVN).



Fig. 1. Map showing the locations of sampling sites (NBL and NUD at COGI, SVN at Sv. Nedelja)

### Experimental design

The growth experiment was set during a 13-month period, from January 2015 until January 2016. In January 2015, mussels of approximately the same size (mean length  $4.27 \pm 0.4$  cm) and age (around 8-10 months) were taken from the experimental farm at the Institute of Marine Biology, University of Montenegro, in Kotor. Mussels were cleaned of fouling organisms the same day, and shell lengths, widths and heights were measured using vernier caliper to the nearest 0.1 mm. Individual mussels were marked using improvised tags. The tags were made from kitchen plastic waterproof mats (WelkHOME, Italy). The mats were cut to rectangles, approx.  $12 \times 5$  mm in size, and markings etched on the surface using scalpel and soldering iron, with the markings visibility improved using waterproof felt-tip marker. Numbered tags were bonded to mussel shells with two-component waterproof adhesive (ABRO EPOXY STEEL, U.S.A.). During the marking process, duration of air exposure was around 2-3 minutes, until the adhesive hardened. Marked and measured mussels were placed in plastic baskets ( $48 \times 29 \times 5$  cm, with 2 cm stretched mesh size) and suspended in water at depths between 2 and 3 m. At the COGI location, 110 individuals were placed together

on a farming line closest to the fish cages (NBL), and another 110 individuals on a farming line furthest from the fish cages (NUD). At the Sveta Nedelja location, 112 individuals were set together on a farming line (SVN). The mussels were checked every other month, removed from water, measured (length, width, height), cleaned from fouling organisms and resuspended in water.

Temperature and salinity on both localities were recorded monthly using the Multiline P4 WTW probe.

For condition index estimation, a total of 1,560 individual mussels of similar size and age (around 8-10 months) were taken from the experimental farm at the Institute of Marine Biology. Mussels were placed in nylon mesh nets (2-3 cm stretched mesh size). Forty individual mussels were put in each net, with 13 nets per site (i.e. 39 nets in total). Nets were placed on NBL, NUD and SVN sites at depths between 2 and 3 m. Once per month, one net from each site was taken. From each net 30 individual mussels were taken and processed in the laboratory the same day. The condition index was determined as the ratio between wet mass of meat (WMM) and total weight (TW), according to ALMEIDA *et al.* (1999).

### Statistical analyses

Growth ratios were tested using repeated-measures two-way ANOVA with Tukey post-hoc test. Parameters of von Bertalanffy's growth equation ( $L_t = L_\infty [1 - e^{-k(t-t_0)}]$ ) were estimated with analysis of growth increment data using Munro's method in the FISAT II v.1.2.2 statistical package (GAYANILO *et al.*, 2005).

The condition index samples were tested for normality of distribution of differences between each observation and the mean of its group using Kolmogorov-Smirnov test with Lilliefors significance correction.

The homogeneity of variance was tested using Fligner-Killeen test for samples that did not follow normal distribution, and with Bartlett test for those that did. Homoscedastic samples were then tested using one-way ANOVA, with

Tukey HSD (Honestly Significant Difference) used as a *post hoc* test. Heteroscedastic samples were analysed using Kruskal-Wallis rank sum test, with Dunn's test as a *post hoc* test.

## RESULTS

### Temperature and salinity

Minimum and maximum temperatures at the COGImar location ranged between 11.6°C in February 2015 and 27.9°C in July 2015. Temperature on the Sveta Nedelja location ranged between 10.5°C in January 2016, and 26.5°C in August 2015 (Fig. 2A). Salinity on the COGImar location was between the minimal value of 13.8‰ in February 2015, and the maximum value of 35.2‰ in December 2015. On the Sveta Nedelja location, the minimum salinity value of 19.8‰ was recorded in February 2015, and the maximum values of 37.1‰ in December 2015 (Fig. 2B).

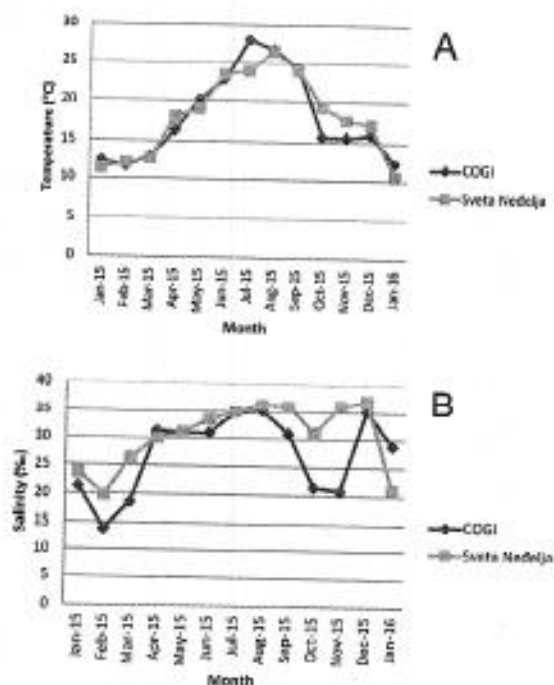


Fig. 2. Monthly temperature (A) and salinity (B) values on both localities (COGI and Sv. Nedelja)

### Survival, mortality and growth rate

Table 1 shows number of dead individuals at each site for each measuring period. The highest mortality was observed during the first two measuring periods (Jan 15 - May 15) on all three sites.

The mean mussel length increase during the study period is given in Table 2. At all sites, all surviving individuals reached the prescribed market size (5 cm in length, as defined in the OFFICIAL GAZETTE OF MONTENEGRO (8/2011; 56/2009, 47/2015)) after 13 months. At the start of the experiment, the mussels were estimated to be around 8-10 months old. At the SVN site, all surviving individuals reached market size after only 8 months, which could indicate production cycle of around 16-18 months in monoculture conditions. After the same period at site NUD 81% of survived individuals reached market size, and on site NBL 76% of survived individuals reached market size for the same period.

Growth rate analysis (length, width, height) showed a statistically significant difference in both sampling period and sampling location (Table 3 - 5; Fig. 3). The growth in length was slowest during summer period (July-September), and the most rapid in spring (March-May) at all sites. The same results were obtained for growth in width and height. During all periods, mussels from the SVN and NUD sites showed similar growth in length, width and height, which was significantly higher compared to the NBL site.

Table 6 shows that the estimated growth rate parameters were highest for mussels from the SVN site ( $L_{\infty} = 69.18$  mm,  $k = 1.95$  year<sup>-1</sup>), and lowest for the NBL site ( $L_{\infty} = 62.52$  mm,  $k = 1.709$  year<sup>-1</sup>). On the NUD site estimated asymptotic length was  $L_{\infty} = 65.27$  mm, with  $k = 2.079$  year<sup>-1</sup>.

### Condition index

The highest values (34.47) of the condition index (CI) were recorded at the NUD site in May 2015, while the lowest values (19.28) were on the NBL site in September 2015. On all three sites, the lowest values of CI were in September

Table 1. Number of dead individuals at each site for each measuring period

Position	NBL	NUD	SVN
Jan'15-Mar'15	4	15	19
Mar'15-May'15	25	13	4
May'15-Jul'15	4	4	5
Jul'15-Sep'15	9	3	7
Sep'15-Nov'15	2	2	2
Nov'15-Jan'16	0	1	2

Table 2. The mean mussel length on the beginning and after 13 months

Position	NBL	NUD	SVN
Jan'15	4.38±0.39 cm	4.20±0.45 cm	4.23±0.35 cm
Jan'16	5.97±0.47 cm	6.37±0.56 cm	6.57±0.54 cm

Table 3. Analysis of growth increments for length using repeated-measures ANOVA with Tukey post hoc comparison

Factor	d.f.	F	P	Post hoc comparison
Period	5	179.63	<0.001	4 < 3 < 6 < 5 = 1 < 2
Site	2	36.32	<0.001	NBL < NUD = SVN
Interaction	10	5.34	<0.001	
Error	1248			

1 = Jan-Mar, 2 = Mar-May, 3 = May-Jul, 4 = Jul-Sep, 5 = Sep-Nov, 6 = Nov-Jan '16

Table 4. Analysis of growth increments for width using repeated-measures ANOVA with Tukey post hoc comparison

Factor	d.f.	F	P	Post hoc comparison
Period	5	138.87	<0.001	4 < 3 = 6 = 5 < 1 < 2
Site	2	36.55	<0.001	NBL < NUD = SVN
Interaction	10	10.16	<0.001	
Error	1248			

1 = Jan-Mar, 2 = Mar-May, 3 = May-Jul, 4 = Jul-Sep, 5 = Sep-Nov, 6 = Nov-Jan '16

Table 5. Analysis of growth increment for height using repeated-measures ANOVA with Tukey post hoc comparison

Factor	d.f.	F	P	Post hoc comparison
Period	5	91.91	<0.001	4 < 3 < 6 < 5 = 1 < 2
Site	2	32.18	<0.001	NBL < NUD = SVN
Interaction	10	8.27	<0.001	
Error	1248			

1 = Jan-Mar, 2 = Mar-May, 3 = May-Jul, 4 = Jul-Sep, 5 = Sep-Nov, 6 = Nov-Jan '16

Table 6. Growth parameters for mussels per sampling site

	SVN	NUD	NBL
$L_{\infty}$ (mm)	69.18	65.27	62.52
$k$ (year <sup>-1</sup> )	1.95	2.079	1.709

Table 7. Analysis of condition index according to site and month

Year	Month	ANOVA/KW	Post hoc comparison
2015	January	F = 1.744 <sup>NS</sup>	—
	February	H = 4.267 <sup>NS</sup>	—
	March	F = 13.99***	NUD=NBL, SVN>NBL, SVN>NUD
	April	F = 17.22***	NUD>NBL, SVN=NBL, NUD>SVN
	May	F = 21.39***	NUD>NBL, SVN=NBL, NUD>SVN
	June	F = 5.439**	NUD=NBL, SVN=NBL, SVN<NUD
	July	F = 11.99***	NUD>NBL, SVN=NBL, NUD>SVN
	August	F = 4.224*	NUD=NBL, SVN=NBL, NUD>SVN
	September	H = 2.3446 <sup>NS</sup>	—
	October	F = 13.8***	NUD=NBL, NBL>SVN, NUD>SVN
	November	F = 20.74***	NUD=NBL, NBL>SVN, NUD>SVN
	December	F = 31.65***	NUD=NBL, NBL>SVN, NUD>SVN
2016	January	F = 5.235**	NUD=NBL, NBL=SVN, NUD>SVN

\* <0.05; \*\* <0.01; \*\*\* <0.001; <sup>NS</sup> – not statistically significant



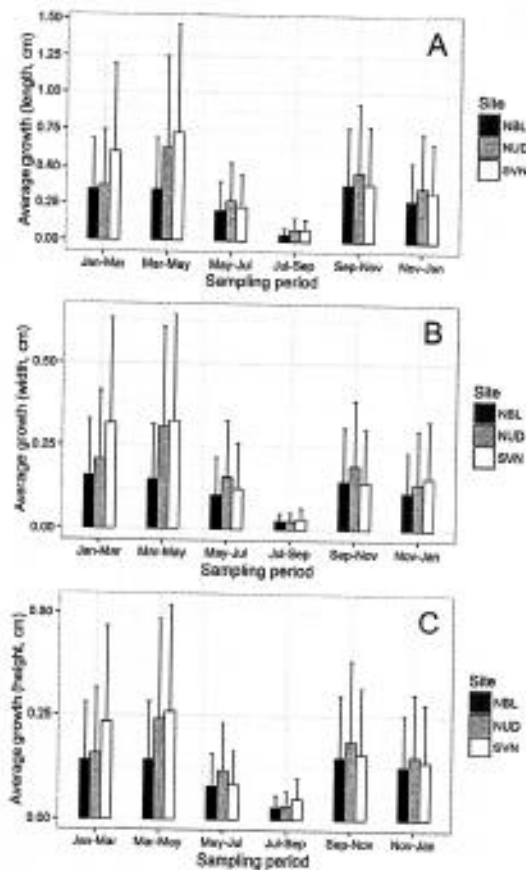


Fig. 3. Average growth increments and standard deviations for length (A), width (B), and height (C) according to sampling period and location

2015 (19.28 NBL; 21.18 NUD; 19.35 SVN). During the entire monitoring period the mean values of CI were higher on the NUD site compared to the other two sites (Fig. 4), except for February and March 2015. The analysis of condition index according to site and month is given in Table 7 and shows that there was no statistically significant difference in CIs at different sites during January, February and September 2015. From April until August 2015, as well as in January 2016, the CIs at the NBL and SVN sites were similar, while in the period from October to December the individuals from the NBL site had CI values which were statistically significantly higher than the CI values of individuals from the SVN site.

## DISCUSSION

The results of this study revealed statistically significant difference between sampling period and sampling location in both growth and condition index of mussels.

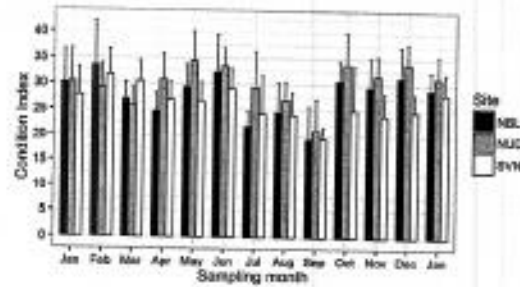


Fig. 4. Average monthly condition index and standard deviations according to month and sampling site

The obtained results indicate that growth in length, width and height at all three sampling sites was most intense in spring, and least intense in summer. These results agree with PEHARDA *et al.* (2007), who found the highest growth rates of mussels in period from March to May, which could indicate that the highest growth during the spring period can be the result of increased food availability. On the other hand, results of this study partly agree with results reported by IRISARRI *et al.* (2014a), who found maximum growth in mussels during both spring and summer period. According to VAN ERKOM SCHURINK & GRIFFITHS (1992) as well as ŽUPAN & ŠARIĆ (2014), highest availability of food is at temperatures between 10°C and 20°C, when the recorded mussel growth is most intense, while the growth slows at temperatures above 20°C. Temperatures in the 10-20°C range are typical for the Adriatic in spring, with temperatures above 20°C typical for summer (AZCÁRATE *et al.*, 2005), which can help explain the results obtained.

Salinity has an indirect influence on growth, with lower salinity having a positive influence, but through the fact that areas with higher influx of freshwater (and thus lower salinity) have increased amount of nutrients (ŽUPAN & ŠARIĆ, 2014). Salinity values at the COGImar location were significantly lower during winter

and spring seasons, compared to Sveta Nedelja (Fig. 3). The NUD site, which is about 100 m removed from fish cages, is under a significant influence of underwater freshwater sources, as well as the freshwater influx from the land (BELLAFIORE *et al.*, 2011), and the higher growth rates (in length, weight and height) at this site could be attributed, at least partially, to the increased amount of freshwater.

High growth rates in length, weight and height, which were recorded at the SVN site, similar to NUD, can be connected to the strong water currents in the Verige strait (>20 cm/s) (BELLAFIORE *et al.*, 2011). The Sveta Nedelja mussel farm is located just off the mouth of the strait. KARAYÜCEL & KARAYÜCEL (2000) report higher growth rate of *Mytilus edulis* individuals exposed to water current influence, as stronger currents carry more nutrients. BAJNOCI (2014) found that mussels which were placed on the farthest point from fish cages had the highest growth rates in length, weight and height compared to those which were placed close to fish cages, but the differences were not statistically significant. NAVARRETE-MIER *et al.* (2010) also did not report significant differences in shell length growth of mussels on six different distances from fish cages. Results from IRISARRI *et al.* (2014a) showed similar shell length between mussels close to the fish farm and mussels distant from the fish farm.

Lower growth rates at the NBL site compared to SVN and NUD site could be affected by the large amount of fouling organisms detected during the entire year on this site. STJEPČEVIĆ (1974) reports that a large amount of fouling organisms "suffocates" the mussels, which stalls their growth, and can also cause increased mortality. Dominant fouling organism on NBL site was the White sea squirt (*Phallusia mammilata*, Cuvier 1815). Other fouling organism which were noted are: *Botryllus* spp., *Balanus* spp., European fan worm (*Sabella spallanzani*, Gmelin 1791), Keel worm (*Pomatoceros triqueter*, Linnaeus 1758) and Bryozoa (*Schizobrachiella sanguine*, Norman 1868). All of those organisms were also recorded on the other two localities,

but in different abundances. On the SVN site Keel worm was more abundant than any other organisms, as well as the European fan worm, while on NBL and NUD site White sea squirt was the dominant organism. Also, on the NBL and NUD sites the green algae *Chaetomorpha* spp. and *Cladophora* spp. were abundant, especially during spring months. These differences in fouling can be explained by the differences in sea currents at different localities.

The highest mortality in our study was recorded during the first two measurement periods on all three sites, which can be explained by stress and adaptation of individuals to the new conditions (ŽUPAN, 2012). On the other hand, higher mortality at the NBL site during the entire monitoring period could be explained by an increased presence of fouling organisms due to the proximity of fish cages.

It is known that condition index is an important parameter indicating the quality of shellfish (ŽUPAN & ŠARIĆ, 2014). The results of this study indicate that location did consistently influence the CI of mussels, with individuals 100 m removed from fish cages (NUD) showing higher CI values for the major part of the study compared to individuals at the other two sites (NBL, SVN), which were quite similar among themselves, except for the colder period (October-December) when sites NBL and NUD were similar and had higher CI values. These results can indicate the fact that in colder months, when primary production is lower and there is little food available in water, mussels feed on the nutrients originating from fish farms. The benefits on mussels feeding on fish farm effluents were noted by MACDONALD *et al.* (2011).

This study's results regarding the CI are in accordance with those reported by SARÁ *et al.* (2009), LANDER *et al.* (2012) and ŽUPAN *et al.* (2014), who found a positive correlation between CI values in bivalves and their proximity to fish farms. IRISARRI *et al.* (2014b) found significantly higher CI in IMTA mussels than in monoculture individuals. On the other hand, the results of this study are not consistent with the results of TAYLOR *et al.* (1992) and CHESHUK *et al.* (2003),

who showed that there is no influence of salmon farming on CI of *M. edulis* and *M. planulatus*. IRISARRI *et al.* (2014a) has not found differences in CI values among mussels close to the fish farm and those distant from the fish farm. Also, NAVARRETE-MIER *et al.* (2010) did not report significant differences in dry weight of mussels farmed on six different distances from fish cages.

The results of this study also showed the lowest CI values during September 2015 at all three sites. This can be explained by the common spawning period of the mussel, which reaches its peak during spring and autumn (DARDIGNAC-CORBEL, 1990). However, even if the bibliographical data refer to spring spawning closely following the drop in CI values (MASON, 1976; OKUMUŞ & STIRLING, 1998; PEHARDA *et al.*, 2007), this was not recorded in this study. Rather, the CI values were relatively high at all three sampling sites. According to HRS-BRENKO (1980), water temperatures above 16°C have a significant effect on the reduction of sexual activity of mussels. It is important to mention that method for CI calculation in this study was based on "wet" method (ALMEIDA *et al.* 1999), while calculation of CI in most other studies was based on dried or cooked meat (FREEMAN, 1974; DAVENPORT & CHEN, 1987).

## CONCLUSIONS

This study analysed the growth rate and condition index of *M. galloprovincialis* in integrated system and monoculture. The growth rate and condition index were monitored during a 13-month study at three different sites: 1) close to the fish cages (NBL), 2) 100 m far from fish cages (NUD), and 3) at a monoculture mussel farm (SVN). Significant differences in growth rate and condition index according to sampling period and location were found. The results

showed a similar production cycle in monoculture and integrated multi-trophic systems. The highest mortality rate was recorded at the NBL site. The results of the study refer to the minimum market size of mussels in Montenegro (5 cm shell length) (OFFICIAL GAZETTE OF MONTENEGRO, 8/2011; 56/2009, 47/2015). As such, the results of the study might not be directly applicable to areas with different minimum market sizes e.g. in Croatia, where mussel minimum market size is 6 cm (OFFICIAL GAZETTE OF THE REPUBLIC OF CROATIA, 63/10, 68/10, 145/10, 18/12, 29/12), although they should be considered indicative. CI results indicate the possibility that mussels feed on the nutrients from fish farm during periods when little food would naturally be available in water.

It is known that, besides temperature and salinity, the other important factors influencing growth in mussels are the availability of food, water current direction and population density (GOSLING, 1992), and that food availability and changes in the reproduction phases are the most important factors in CI variations (GOSLING, 1992), the obtained results suggest that a much more detailed study, which would include abiotic and biotic parameters on all sampling locations, should be performed in order to get more relevant results.

## ACKNOWLEDGMENTS

This study was been supported by the Ministry of Science of Montenegro and the HERIC project through the BIO-ICT Centre of Excellence (Contract No. 01-1001), and also by the Ministry of rural development and agriculture – Monitoring of water quality at mussel and fish farms for the period 2014-2015, financed through the Agro-budget.

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Received: 30 January 2017

Accepted: 27 July 2017

## Usporedba između IMTA i uzgoja dagnje u monokulturi (*Mytilus galloprovincialis* L.) u Bokokotorskom zaljevu

Sladana GVOZDENOVIĆ, Milica MANDIĆ, Vladimir PEŠIĆ, Marko NIKOLIĆ,  
Ana PEŠIĆ i Zdravko IKICA\*

\*Kontakt e-adresa: [zdikica@ac.me](mailto:zdikica@ac.me)

### SAŽETAK

Cilj ovog istraživanja bio je pokazati postojanja mogućih razlika u rastu i kondicijskom indeksu dagnji (*Mytilus galloprovincialis*) u integralnom multi-trofičkom uzgoju i uzgoju u monokulturi. Rast i kondicijski indeks praćeni su tijekom razdoblja od 13 mjeseci na tri postaje: 1) u blizini uzgajališta ribe (NBL), 2) 100 m od uzgajališta ribe (NUD), 3) u monokulturi (SVN) na uzgajalištu koje je oko 8 km udaljeno od kaveza sa ribom. Najintenzivniji rast zabilježen je tijekom proljetnog razdoblja, a najmanje intenzivan tijekom ljetnog. Nakon 13 mjeseci, praćene jedinke su na sve tri pozicije dostigle komercijalnu dužinu. Stopa rasta je bila slična na sve tri pozicije, dok je kondicijski indeks pokazao prostorne i vremenske razlike. Vrijednosti kondicionog indeksa na postaji NUD bile su više od vrijednosti na postajama SVN i NBL, koje su međusobno bile prilično slične, osim u razdoblju od listopada do prosinca kada su vrijednosti kondicijskog indeksa bile slične na postajama NBL i NUD, a veće u usporedbi sa vrijednostima na postaji SVN poziciji. Vrijednosti kondicionog indeksa na postajama NBL i NUD tijekom hladnog perioda godine ukazuju na to da se dagnje vjerovatno hrane nutrijentima porijeklom sa uzgajališta riba. Visoki mortalitet zabilježen je na postaji NBL, najvjerojatnije zbog obraštajnih organizama.

**Ključne riječi:** *Mytilus galloprovincialis*, integralna multi-trofička akvakultura, monokultura, Bokokotorski zaljev



# First Data on the Alien Mollusc *Fulvia fragilis* (Forsskål in Niebuhr, 1775) (Cardiida: Cardiidae) from the Adriatic Sea

Sladana Gvozdenović<sup>1</sup>, Marko Nikolić<sup>1</sup>, Vladimir Pešić<sup>2</sup>, Ines Peraš<sup>1</sup> & Milica Mandić<sup>1</sup>

<sup>1</sup> Institute of Marine Biology, University of Montenegro, Kotor, Montenegro; E-mail: sladjanag@ucg.ac.me; markon@ucg.ac.me; inesperas91@gmail.com; mamilica@ucg.ac.me

<sup>2</sup> Faculty of Natural Sciences and Mathematics, University of Montenegro, Podgorica, Montenegro; E-mail: vladopesic@gmail.com

**Abstract:** The first record of *Fulvia fragilis* (Forsskål in Niebuhr, 1775) from the Adriatic Sea is presented. Two empty shells of *F. fragilis* were found in the area of the Boka Kotorska Bay (South Adriatic Sea), in front of the St. Marko Island. The shipping/maritime transport is the assumed vector of introduction. An overview of the recent findings of this species in the Mediterranean Sea is given.

**Key words:** *Fulvia fragilis*, Lessepsian migrants, Boka Kotorska Bay, Bivalvia

## Introduction

An alien species is an organism occurring outside of its known or consensual range (OCCHIPINTI-AMBROGI & GALIL 2004). Such species can negatively affect native species through different processes, such as predation, competition, introduction of genes – hybridisation, parasite and pathogens diffusion (STRAYER et al. 2006). Generally recognised main vectors of introduction of alien species into the Mediterranean waters are: migration through the Suez Canal, also called “Lessepsian migration”, transportation on ship hulls (as fouling organisms) and with ballast waters, intentional introduction (mariculture), market discards and other aquaculture-related activities - aquaculture (POR 1978, ZIBROWIUS 1992, KATSANEVAKIS et al. 2013, ZENETOS et al. 2017). Additionally, the global warming can also be considered as one of the reasons for introduction of species into new areas (RATTSOS et al. 2010).

*Fulvia fragilis* (Forsskål in Niebuhr, 1775) is a common species with established populations in Egypt, Israel, Lebanon, Cyprus, Turkey, Greece, Italy, Malta, Albania, Tunisia and Spain (MOAZZO 1939, GOFAS & ZENETOS 2003, ZENETOS et al. 2003, 2008, 2009, PASSAMONTI 2006, GOUD & MIFSUD 2009, CROCETTA et al. 2008, 2013, GEROVASILEIOU et

al. 2017). It is recognised as a “Lessepsian migrant” (see ZENETOS et al. 2003). *Fulvia fragilis* inhabits littoral to shallow waters 9-37 m deep, with sandy and (or) muddy bottoms as well as sandy bottoms together with *Zostera* spp. Its shell is fragile, equivalve, slightly inequilateral and can reach up to 75 mm in height. Outline of shell is almost circular, with rounded anterior margin; posterior part more or less transversely expanded, possessing c. 41 ribs (34-52). Ribs are generally rounded in the anterior part, flatly rounded to asymmetrically triangular in the median third of the shell; rounded with calcareous spines or tubercles in posterior part. Width of ribs and interstices generally equal, with width of interstices of first anterior ribs sometimes wider. In each valve, anterior and posterior lateral teeth present as well as two cardinal teeth. Internal margin crenulated; with two sub-equal adductor muscle scars. Pallial line broad, without a sinus. Internal surface nearly smooth from umbo to mid-height of valves, and radially ribbed ventralward. External colour of valves whitish-beige to yellow, with purple stain on umbo, while interior is white with purple colour in the posterior third and sometimes in the umbonal cavity (ZENETOS et al. 2003, ÖZTÜRK & POUTIERS 2005).

Native populations of *F. fragilis* are distributed throughout the Indian Ocean, from the Red Sea and the Persian Gulf to Mozambique and Madagascar (VIDAL 1994). Since its first record from the Mediterranean Sea, it colonised almost the whole basin until the Otranto Strait (the channel linking the Adriatic and Ionian Seas) (MOAZZO 1939, GOPAS & ZENETOS 2003, ZENETOS et al. 2003, 2008, 2009, PASSAMONTI 2006, GOUD & MIPSUD 2009, CROCETTA et al. 2008, GEROVASILEIOU et al. 2017). Many authors presumed that shipping is the introduction vector for this species, since reports have usually come from harbours (e.g. ZENETOS et al. 2003, GALIL 2008, OCCHIPINTI-AMBROGI et al. 2010, GEROVASILEIOU et al. 2017).

In this article, we present the first report of *F. fragilis* from the Adriatic Sea.

## Materials and Methods

The study was performed at the locality of St. Marko (42°41' N, 18°69' E), in Tivat Bay (Boka Kotorska Bay, Montenegro, Fig. 1) in the course of the estimation of the distribution and biomass of edible bivalves in the area of the Boka Kotorska Bay during two seasons (May and October, 2016). Sampling was done by SCUBA diving along a 100-m transect. The collected material was identified according to ZENETOS et al. (2003), ÖZTÜRK & POUTIERS (2005) and HUBER (2010). Measurements were taken using a calliper (precision of 0.1 mm).

The scientific literature was reviewed in order to show temporal changes in the distribution of *F. fragilis* in the Mediterranean, with numbering corresponding to that in Fig. 3 (1. MOAZZO 1939; 2. BARASH & DANIN 1973; 3. GHISOTTI 1974; 4. BARASH & DANIN 1977; 5. LINDNER 1988; 6. ENZENROSS et al. 1990; 7. NIEDERHÖFER et al. 1991; 8. FISCHER 1993; 9. BUZZURRO & GREPPI 1996; 10. PASSAMONTI 1996; 11. VARDALA-THEODOROU 1999; 12. DELAMOTTE & VARDALA-THEODOROU 2001; 13. ENZENROS & ENZENROS 2001; 14. BEN SOUISSI et al. 2003; 15. ZENETOS et al. 2003; 16. CROCETTA 2005; 17. ZENETOS et al. 2005; 18. ÖZTÜRK & POUTIERS 2005; 19. ÇINAR et al. 2006; 20. CROCETTA et al. 2008; 21. TAMAYO-GOYA 2008; 22. ZENETOS et al. 2008; 23. BRANCATO & REITTANO 2009; 24. CROCETTA et al. 2009; 25. GOUD & MIPSUD 2009; 26. LÓPEZ SORIANO et al. 2009; 27. ZENETOS et al. 2009; 28. DONEDDU 2010; 29. MAHMOUD et al. 2011; 30. RIFI et al. 2011; 31. RIFI et al. 2012; 32. ANGELIDIS 2013; 33. CROCETTA et al. 2013; 34. MARCHINI et al. 2013; 35. SPERONE et al. 2015; 36. LIPEJ et al. 2017; 37. GEROVASILEIOU et al. 2017; 38. CROCETTA et al. 2017; 39. Present study). The data were divided into five periods: 1939–1960; 1961–1980; 1981–2000; 2001–2010; 2011–present.

## Results

The first record of *F. fragilis* in the Adriatic Sea (Montenegrin coast) represented two empty shells.

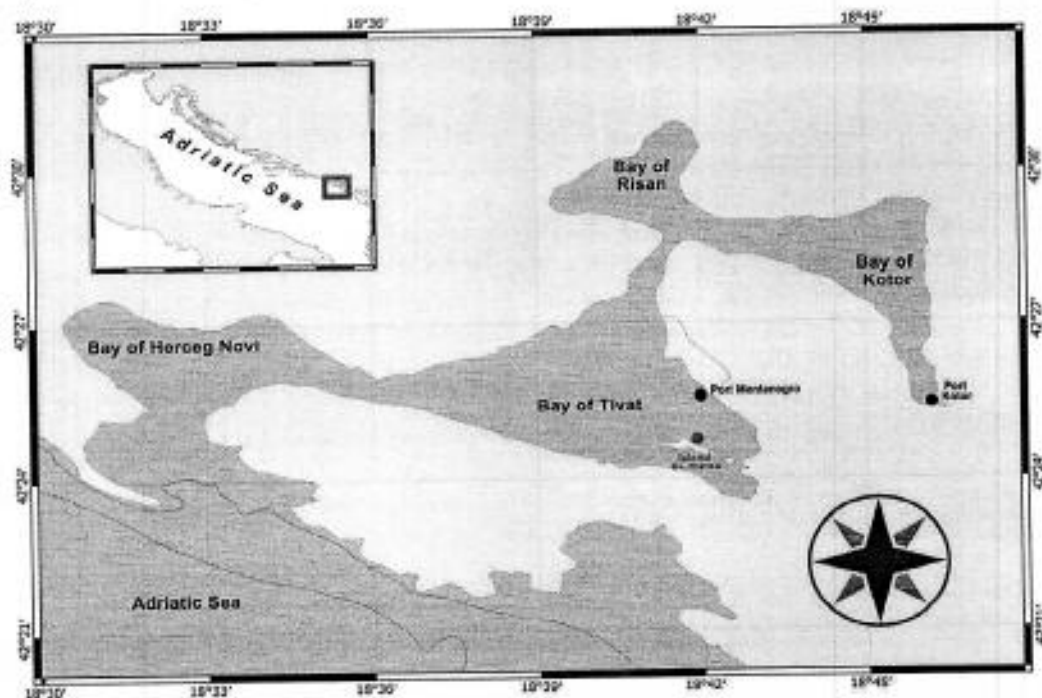


Fig. 1. Map showing the locality where *Fulvia fragilis* was found, as well as the position of the marina Porto Montenegro and harbour Port of Kotor.

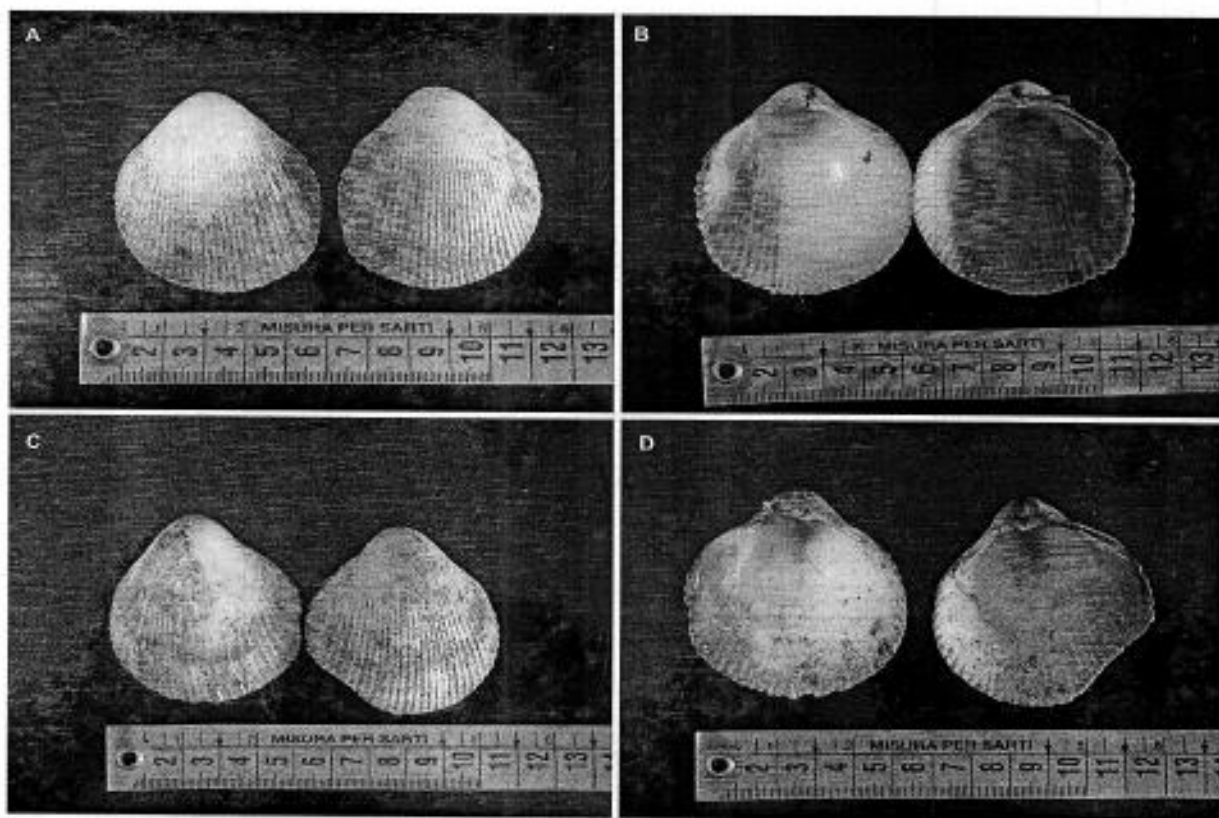


Fig. 2. Shells of *Fulvia fragilis*, outside and inside, found in front of the St. Marko Island; A and B shell found on 6<sup>th</sup> October 2016; C and D shell found on 11<sup>th</sup> May 2016.

The first shell of *F. fragilis*, found on the 11<sup>th</sup> May 2016, was 56.5 mm long. The external part of the shell was white-beige with a purple stain on the umbo and had 40 ribs, while the interior was white with purple colour in the posterior third and in the umbonal cavity. The second shell, found on the 6<sup>th</sup> October 2016, was 56 mm long and had 39 ribs. Its interior was white with purple colour restricted to the posterior third. Both shells were fragile, almost circular with rounded anterior margin, as well as obliquely expanded posterior part. In each valve, anterior and posterior lateral teeth were present, as well as two cardinal teeth. The internal margin was crenulated and two not so evident adductor muscle scars were present internally, as well as a pallial line without a sinus. The internal surface from umbones to mid-height of valves was almost smooth and radially ribbed ventralward (Fig. 2).

The maximum depth of the transect was 12 m and the area surveyed at the depth up to 5 m was characterised by a rocky-gravel bottom and the seaweeds *Cystoseira foeniculacea* (Linnaeus) Greville, 1830 and *Acetabularia acetabulum* (Linnaeus) P.C. Silva, 1952, followed by the seagrasses *Cymodocea nodosa* (Ucria) Ascherson, 1870 and *Posidonia oceanica* (Linnaeus) Delile, 1813 meadows, where a

large number of the bivalve *Pinna nobilis* (Linnaeus, 1758) was present. This section was followed by a steep abruption of the bottom (4 m deep) and at the depth of 9 m to 12 m the bottom was sandy-muddy and muddy.

The species had apparently been present in this area for a certain period of time, since both shells, judging by their length, were adults. No living specimens or shell residues were found in surveys carried along the same transect during 2015 and 2017. Further research is needed to evaluate the establishment status of the species in the area.

## Discussion

The occurrence of *F. fragilis* in the Adriatic Sea has been expected, especially due to the number of findings and its progression throughout the Mediterranean Sea (Fig. 3). The site where it was found, the Island of St. Marko, is located in the vicinity of the "Porto Montenegro" marina, so it is highly probable that this species was introduced by shipping (maritime) transport (Fig. 1). *Fulvia fragilis* is considered as a Lessepsian migrant but its spreading in the Mediterranean Sea seems to be not only through natural dispersal but also via shipping, since it has

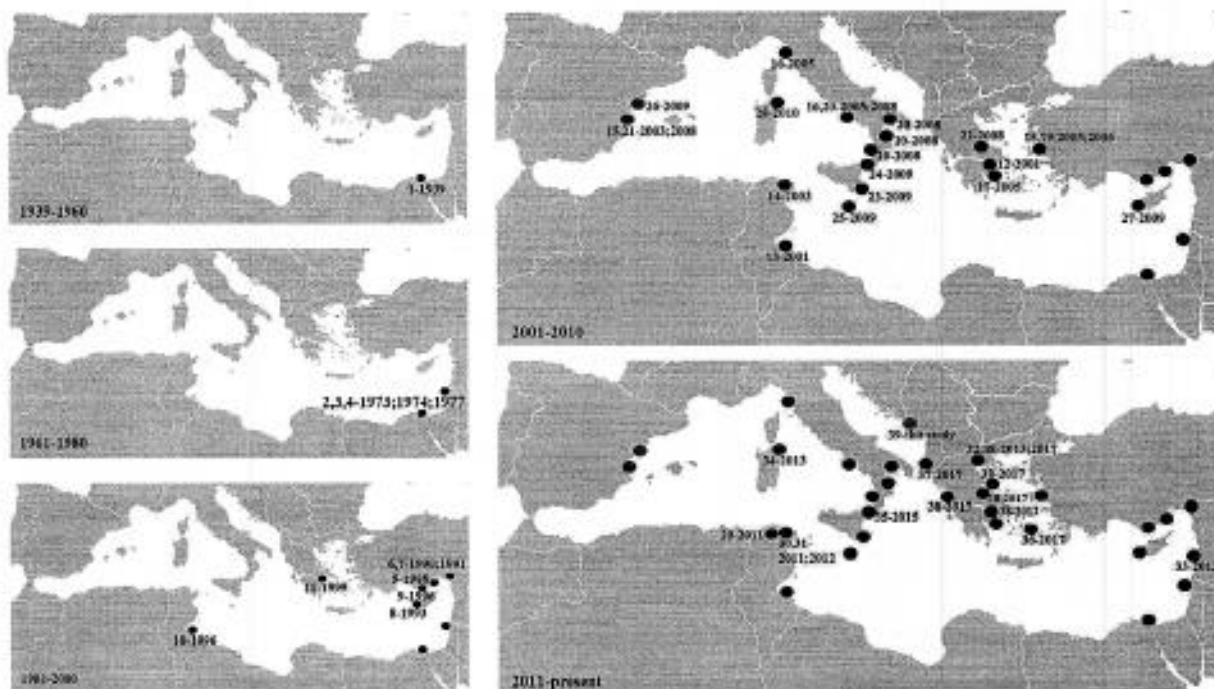


Fig. 3. Mediterranean spreading of *Fulvia fragilis* divided into five periods (1939–1960; 1961–1980; 1981–2000; 2001–2010; 2011–present). For numbering of the sites, see Materials and Methods.

been often found near harbours (GEROVASILEIOU et al. 2017). ZENETOS et al. (2004) indicate the typical Lessepsian migrant distribution of *F. fragilis* (recorded in the Suez Canal, then in Israel, Tunisia and S. Turkey) but also suggest transport via shipping based on records in the vicinity of harbours.

Further spreading of *F. fragilis* in the Boka Kotorska Bay can be expected as the bay is home to a number of important harbours such as “The Port of Kotor” (one of the busiest ports in the segment of cruise tourism with more than 350 passenger ships throughout a year). Moreover, further spreading of this species along the Adriatic Sea coast is expected to occur in the years to follow.

The Mediterranean records and temporal changes in distribution of *F. fragilis* from the first record in 1939 up to 2018 are presented in Fig. 3. Spreading has typical east-west character, with early first records in the East and one record in Central Mediterranean up until 2000. During the period 2001–2010, the species has spread in Greece, the Central and West Mediterranean Sea and has been reconfirmed in the Gulf of Tunis, Eleusis Bay and Phayos. Also in this period, the most northern Mediterranean finding was recorded in Livorno (CROCETTA 2005). Since 2011 up to present, some new records have been indicated in Greece and the species has been reconfirmed for the Eleusis Bay, Evvoikos Gulf, Tunisia Bay, Olbia and Messina Strait. In the same period, the first record for *F. fra-*

*gilis* for Albania (Vlore Bay, Strait of Otranto) was published (GEROVASILEIOU et al. 2017). Our finding in the Boka Kotorska Bay presents its first record for Montenegro, as well as for the Adriatic Sea.

**Acknowledgements:** This study was supported by the Ministry of Rural Development and Agriculture – Monitoring of water quality at mussel and fish farms for the period 2014–2016 funded through the Agro-budget and partly by the Ministry of Science of Montenegro and the HERIC project through the BIO-ICT Centre of Excellence. Authors thank Dr Slavica Petović, Dr Melita Peharda Ujević and Professor Dr Serge Gofas who helped in identifying the species, as well as Dr Vesna Mačić who was engaged in the fieldwork and made corrections to the manuscript. We are grateful to an anonymous reviewer for comments and suggestions that improved the paper.

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Received: 23.07.2018  
Accepted: 18.09.2018



## УНИВЕРЗИТЕТ У БЕОГРАДУ

Адреса: Студентски трг 1, 11000 Београд, Република Србија  
Тел.: 011 3207400; Факс: 011 2638818; E-mail: officebu@rect.bg.ac.rs

СЕНАТ УНИВЕРЗИТЕТА  
У БЕОГРАДУ

Београд, 22.02.2017. године  
06-01 Број: 61202-302/3-17  
МЦ

На основу чл. 65. ст. 2. Закона о високом образовању ("Службени гласник РС", број 76/05, 100/07-аутентично тумачење, 97/08, 44/10 и 93/12), чл. 42. ст. 1. тач. 23. и чл. 43. ст. 4. Статута Универзитета у Београду ("Гласник Универзитета у Београду", број 186/15-пречишћени текст и 189/16), чл. 25. ст. 1. и ст. 2. тач. 1. Правилника о начину и поступку стицања звања и заснивања радног односа наставника Универзитета у Београду ("Гласник Универзитета у Београду", број 142/08, 150/09 и 160/11) и Критеријума за стицање звања наставника на Универзитету у Београду ("Гласник Универзитета у Београду", број 183/15-пречишћени текст), а на предлог Изборног већа Биолошког факултета, број: 15/3 од 20.01.2017. године и мишљења Већа научних области природних наука, број: 61202-302/2-17 од 02.02.2017. године, Сенат Универзитета, на седници одржаној 22.02.2017. године, донео је

### ОДЛУКУ

**БИРА СЕ** др Љиљана Томовић у звање редовног професора на Универзитету у Београду-Биолошки факултет, за ужу научну област Морфологија, систематика и филогенија животиња.

### Образложење

Биолошки факултет је дана 23.11.2016. године у листу „Данас“ (додатак „Послови“) објавио конкурс за избор у звање редовног професора, за ужу научну област Морфологија, систематика и филогенија животиња, због истека изборног периода.

Извештај Комисије за припрему извештаја о пријављеним кандидатима стављен је на увид јавности дана 27.12.2016. године преко Стручне службе и сајта Факултета.

На основу предлога Комисије за припрему извештаја о пријављеним кандидатима, Изборно веће Биолошког факултета, на седници одржаној дана 20.01.2017. године, донело је одлуку о утврђивању предлога да се кандидат др Љиљана Томовић изабере у звање редовног професора.

Биолошки факултет је дана 24.01.2017. године доставио Универзитету комплетан захтев за избор у звање на прописаним обрасцима.


Универзитет је комплетну документацију коју је доставио Факултет ставио на веб страницу Универзитета дана 26.01.2017. године.

Веће научних области природних наука, на седници одржаној дана 02.02.2017. године дало је мишљење да се др Љиљана Томовић може изабрати у звање редовног професора.

Сенат Универзитета, на седници одржаној дана 22.02.2017. године разматрао је захтев Биолошког факултета и утврдио да кандидат испуњава услове прописане чл. 64. и 65. Закона о високом образовању, чланом 125. Статута Универзитета у Београду, као и услове прописане Критеријумима за стицање звања наставника на Универзитету у Београду, па је донета одлука као у изреци.

ПРЕДСЕДНИК СЕНАТА

Ректор

  
Академик Владимир Бумбаширевић

Доставити:

- Факултету (2)
- архиви Универзитета
- сектору 06



## CURRICULUM VITAE – Ljiljana Tomović

### KRETANJE U SLUŽBI:

1. Godina izbora u zvanje asistenta pripravnika: 1996.
2. Godina izbora u zvanje asistenta (uključujući i reizbore): 2000. (reizbor, 2004.)
3. Godina izbora u zvanje docenta (uključujući i reizbore): 2006. (reizbor, 2011.)
4. Godina izbora u zvanje vanrednog profesora: 2012.
5. Godina izbora u zvanje redovnog profesora: 2017.

### OBLASTI ISTRAŽIVANJA:

Morfologija i sistematika kičmenjaka, herpetologija, filogeografija, populaciona biologija, reproduktivna biologija, odlike životne istorije, etologija, faunistika, zoogeografija, konzervaciona biologija, biodiverzitet herpetofaune.

## NASTAVNI RAD

### OSNOVNE NASTAVNE AKTIVNOSTI

#### UDŽBENICI, SKRIPTA I PRAKTIKUMI:

##### OBJAVLJEN UDŽBENIK

Kalezić, M. & Tomović, Lj. (2007). Hordati. NNK Internacional, Beograd, pp. 1-416. (ISBN: 978-86-83635-63-4).

Pešić, V., Crnobrnja-Isailović, J. & Tomović, Lj. (2009). Principi ekologije. Univerzitet Crne Gore, Podgorica, pp. 1-123. (ISBN: 978-86-7664-073-7).

##### RECENZIRANA SKRIPTA

Kalezić, M. & Tomović, Lj. (2003). Hordati – skripta. III izdanje. Biološki fakultet Univerziteta u Beogradu, Beograd, pp. 1-383.

Tomović, Lj. & Kalezić, M. (2011). Hordati – biologija grupa (CD izdanje). Biološki fakultet Univerziteta u Beogradu, Beograd, pp. 1-684. (ISBN: 978-86-7078-081-1).

##### OBJAVLJEN PRAKTIKUM ILI ZBIRKA ZADATAKA

Simonović, P., Tomović, Lj., Radojičić, J., Krizmanić, I. & Marić, S. (2004). Sistematika Vertebrata – praktikum. NNK Internacional, Beograd, pp. 1-111. (ISBN: 86-83635-35-X).

Marić, S., Krizmanić, I., Tomović, Lj., Simonović, P. (2006). Morfologija hordata – praktikum (CD izdanje). Biološki fakultet Univerziteta u Beogradu, Beograd, pp. 1-469. (ISBN: 86-7078-039-9).

Pešić, V. & Tomović, Lj. (2010). Praktikum iz ekologije. Univerzitet Crne Gore, Podgorica, pp. 1-108. (ISBN: 978-86-7664-094-2).

#### MENTORSTVO/KOMENTORSTVO:

##### ODBRANJENA DOKTORSKA DISERTACIJA:

1. **Sonja Djordjević** (2012). «Polni dimorfizam šumske kornjače (*Testudo hermanni*) centralnog dela Balkanskog poluostrva». Komisija: **dr Ljiljana Tomović** (mentor), dr Xavier Bonnet (mentor), dr Jelka Crnobrnja-Isailović, dr Ana Ivanović, dr Miloš Kalezić. Biološki fakultet Univerziteta u Beogradu.
2. **Metodija Velevski** (2013). «Odlike životne istorije i distribucije bele kanje *Neophron percnopterus* u Republici Makedoniji». Komisija: **dr Ljiljana Tomović**

- (mentor), dr José Antonio Donázar, dr Ana Ivanović. Biološki fakultet Univerziteta u Beogradu.
3. **Dušan Jelić** (2013). «Viperidae Hrvatske i okolnih područja, sa posebnim naglaskom na *Vipera ursinii* Bonaparte 1835 (Squamata, Viperidae) – distribucija, ekologija, genetička varijabilnost i zaštita». Komisija: **dr Ljiljana Tomović** (mentor), dr Milorad Mrakovčić (mentor), dr Zoran Tadić, dr Luca Luiselli, dr Mladen Kerovec. Prirodoslovno-matematički fakultet Sveučilišta u Zagrebu.
  4. **Ana Golubović** (2014). «Funcionalno-morfološke i etološke karakteristike šumske kornjače (*Testudo hermanni*)». Komisija: **dr Ljiljana Tomović** (mentor), dr Xavier Bonnet (mentor), dr Sonja Djordjević, dr Ana Ivanović, dr Sofija Pavković-Lučić. Biološki fakultet Univerziteta u Beogradu.
  5. **Marko Anđelković** (2017). «Morfološka varijabilnost kinetičkog glavenog skeleta i pileusa zmija iz roda *Natrix* (*N. natrix* i *N. tessellata*)». Komisija: **dr Ljiljana Tomović** (mentor), dr Ana Ivanović (mentor), dr Vida Jojić. Biološki fakultet Univerziteta u Beogradu.
  6. **Goran Šukalo** (2017). «Populaciono-ekološke odlike i morfološka varijabilnost bjelouške (*Natrix natrix*) i ribarice (*Natrix tessellata*) na području sjeverozapadnog dijela Republike Srpske». Komisija: **dr Ljiljana Tomović** (mentor), dr Dragojla Golub (komentor), dr Dragan Mikavica. Prirodno-matematički fakultet Univerziteta u Banjoj Luci.

#### **ODBRANJENA MAGISTARSKA TEZA:**

1. **Šukalo Goran** (2012). «Morfološka varijabilnost i populacione karakteristike ribarice (*Natrix tessellata*) na području donjeg toka rijeke Vrbanje». Komisija: **dr Ljiljana Tomović** (mentor), dr Dragojla Golub (mentor), dr Dragan Mikavica. PMF Univerziteta u Banjoj Luci.

#### **ODBRANJEN DIPLOMSKI ILI MASTER RAD:**

1. **Ivana Lepoev** (2006). «Diverzitet bezrepih vodozemaca (Anura) na odabranim zagadenim lokacijama u okolini Pančeva». Komisija: dr Jelka Crnobrnja-Isailović (mentor), **dr Ljiljana Tomović** (mentor). Biološki fakultet Univerziteta u Beogradu.
2. **Nikola Kolundžić** (2006). «Seksualni dimorfizam morfoloških karakteristika tri vrste guštera roda *Podarcis* u uslovima sintopije u regionu reke Pčinje (Srbija)». Komisija: **dr Ljiljana Tomović** (mentor), dr Jelka Crnobrnja-Isailović. Biološki fakultet Univerziteta u Beogradu.
3. **Aleksandar Urošević** (2007). «Varijabilnost morfoloških odlika i morfološka diferencijacija populacija zidnog guštera (*Podarcis muralis*) u Srbiji». Komisija: **dr Ljiljana Tomović** (mentor), dr Jelka Crnobrnja-Isailović. Biološki fakultet Univerziteta u Beogradu.
4. **Marko Anđelković** (2011). «Uporedna analiza morfološke varijabilnosti i polnog dimorfizma ribarice (*Natrix tessellata*) iz dve populacije sa područja Republike Makedonije i Republike Srbije». Komisija: **dr Ljiljana Tomović** (mentor), Sonja Đorđević. Biološki fakultet Univerziteta u Beogradu.
5. **Nataša Nikolić** (2012). «Reprodukcija zmija». Komisija: **dr Ljiljana Tomović** (mentor), Sonja Đorđević. Biološki fakultet Univerziteta u Beogradu.
6. **Aleksandra Rohalj** (2014). «Diverzitet batraho i herpetofaune Obedske bare». Komisija: **dr Ljiljana Tomović** (mentor), dr Imre Krizmanić, dr Saša Marić. Biološki fakultet Univerziteta u Beogradu.

7. **Jasna Rajić** (2016). «Analiza rodentofaune Počute». Komisija: **dr Ljiljana Tomović** (mentor), dr Saša Marić. Biološki fakultet Univerziteta u Beogradu.
8. **Ana Cvetković** (2017). «Etološke odlike populacije ribarice (*Natrix tessellata*) sa ostrva Golem Grad na Prespanskom jezeru (Republika Makedonija)». Komisija: **dr Ljiljana Tomović** (mentor), dr Ana Golubović (mentor). Biološki fakultet Univerziteta u Beogradu.
9. **Milica Lajić** (2017). «Reproduktivne odlike populacije ribarice (*Natrix tessellata*) sa ostrva Golem Grad na Prespanskom jezeru (Republika Makedonija)». Komisija: **dr Ljiljana Tomović** (mentor), dr Ana Golubović. Biološki fakultet Univerziteta u Beogradu.
10. **Neda Bogdanović** (2018). «Procena uticaja saobraćajne infrastrukture na populacije vodozemaca i gmizavaca na području Obedske bare (Vojvodina)». Komisija: **dr Ljiljana Tomović** (mentor), dr Ana Golubović. Biološki fakultet Univerziteta u Beogradu.

#### UČEŠĆE U KOMISIJAMA:

##### ZA ODBRANU DOKTORSKE DISERTACIJE:

1. **mr Dragana Miličić** (2007). «Morfološka varijabilnost i taksonomski status populacija roda *Branchipus* Schaeffer 1766 (Branchipoda, Crustacea) na teritoriji Srbije». Komisija: dr Brigita Petrov (mentor), dr Aleksandar Ostojić, **dr Ljiljana Tomović**. Biološki fakultet Univerziteta u Beogradu.
2. **Jean-marie Ballouard** (2010). «Espèces charismatiques, espèces locales et serpents en Education a l'environnement». Komisija: dr Didier Bouchon, dr Stephen J. Mullin, dr Luca Luiselli, dr Catherine Souty-Grosset, **dr Ljiljana Tomović**, dr Xavier Bonnet (mentor). Universite de Poitiers, Francuska.
3. **Milena Cvijanović** (2010). «Evolucija velikih mrmoljaka, *Triturus cristatus* superspecies (Salamandridae, Caudata): odlike životne istorije i ontogenija oblika». Komisija: dr Ana Ivanović (mentor), dr Miloš Kalezić, dr Georg Džukić, **dr Ljiljana Tomović**. Biološki fakultet Univerziteta u Beogradu.
4. **Ana Pavićević** (2011). «Sezonska dinamika makroinvertebrata Mareze i Rimanića sa posebnim osvrtom na vodene koleoptere». Komisija: dr Vladimir Pešić (mentor), dr Drago Marić, dr Sreten Mandić, dr Srećko Čurčić, **dr Ljiljana Tomović**. Odsjek za biologiju, PMF Univerziteta Crne Gore.
5. **Aleksandar Urošević** (2012). «Polni dimorfizam glavenog skeleta lacertidnih guštera». Komisija: dr Katarina Ljubisavljević, dr Ana Ivanović, **dr Ljiljana Tomović**. Biološki fakultet Univerziteta u Beogradu.
6. **mr Lidija Polović** (2012). «Morfološke odlike i karakteristike reprodukcije endemičnog guštera *Algyroides nigropunctatus* (Dumeril & Bibron, 1839) (Lacertilia: Lacertidae) sa Skadarskog jezera» Komisija: dr Vladimir Pešić (mentor), dr Gordan Karaman, dr Sreten Mandić, dr Katarina Ljubisavljević, **dr Ljiljana Tomović**. Odsjek za biologiju, PMF Univerziteta Crne Gore.
7. **Jelena Gavrić** (2015). «Biomarkeri oksidacionog stresa i koncentracija metala u odabranim tkivima belouške (*Natrix natrix*) i ribarice (*Natrix tessellata*) sa područja Obedske bare i Pančevačkog rita» Komisija: dr Slađan Pavlović (mentor), dr Siniša Đurašević (mentor), dr Nebojša Jasnić, **dr Ljiljana Tomović**, dr Zorica Saičić. Biološki fakultet Univerziteta u Beogradu.

##### ZA ODBRANU MAGISTARSKOJ TEZE:

1. **Nela Vešović-Dubak** (2008). «Procena abundantnosti populacija najznačajnijih vrsta ptica iz roda *Anas* i *Aythya* (Anatidae) na Skadarskom jezeru». Komisija: dr

- Vladimir Pešić (mentor), dr Marijana Krivokapić, **dr Ljiljana Tomović**. Odsjek za biologiju, PMF-a, Univerzitet Crne Gore, Podgorica.
- Rastko Ajtić** (2009). «Morfološke, biogeografske i ekološke odlike Kočijevog gekona (*Cyrtodactylus kotschy* Steindachner, 1870 Gekkonidae) sa kopnenog dela areala». Komisija: dr Jelka Crnobrnja-Isailović (mentor), dr Vladimir Randelović, **dr Ljiljana Tomović**. Odsek za biologiju i ekologiju, PMF Univerziteta u Nišu.
  - Slađana Gvozdenović** (2013). «Morfološka varijabilnost i populaciono-ekološke karakteristike ribarice (*Natrix tessellata*) na području Skadarskog jezera». Komisija: dr Vladimir Pešić (mentor), dr Drago Marić, **dr Ljiljana Tomović**. Odsjek za biologiju, PMF-a, Univerzitet Crne Gore, Podgorica.
  - Milica Dajović** (2013). «Morfometrijska analiza i polni dimorfizam crvendaća (*Erithacus rubecula* L.) na području Srbije». Komisija: dr Saša Marić (mentor), **dr Ljiljana Tomović**, dr Sonja Đorđević, dr Saša Marinković. Biološki fakultet Univerziteta u Beogradu.

#### ZA ODBRANU DIPLOMSKOG ILI MASTER RADA:

- Saša Marić** (2000). «Morfološka varijabilnost pastrmke (*Salmo trutta* m. *fario*) Godljevačke reke». Komisija: dr Predrag Simonović (mentor), **mr Ljiljana Tomović**. Biološki fakultet Univerziteta u Beogradu.
- Nadežda Stefanović** (2001). «Fenetički odnosi populacija pastrmke (*Salmo trutta*) i mladice (*Hucho hucho*)». Komisija: dr Predrag Simonović (mentor), **mr Ljiljana Tomović**, Saša Marić. Biološki fakultet Univerziteta u Beogradu.
- Nina Krstonijević** (2002). «Morfološka varijabilnost pastrmke (*Salmo trutta* m. *fario* L.) Zeta, Buna i Tara». Komisija: dr Predrag Simonović (mentor), **mr Ljiljana Tomović**. Biološki fakultet Univerziteta u Beogradu.
- Goran Sekulić** (2002). «Prilog poznavanju ornitofaune Makiškog rita». Komisija: dr Saša Marinković (mentor), **mr Ljiljana Tomović**. Biološki fakultet Univerziteta u Beogradu.
- Stefan Skorić** (2002). «Uloga i značaj vetruške (*Falco tinnunculus*) u Beogradu». Komisija: dr Saša Marinković (mentor), **mr Ljiljana Tomović**. Biološki fakultet Univerziteta u Beogradu.
- Biljana Macura** (2006). «Diverzitet gmizavaca Nacionalnog parka Đerdap». Komisija: dr Jelka Crnobrnja-Isailović (mentor), **dr Ljiljana Tomović**. Biološki fakultet Univerziteta u Beogradu.
- Branka Čubrilović** (2006). «Variranje uzajamnog ograničavanja nekih osobina životne istorije u evropskim populacijama živorodnog guštera (*Zootoca vivipara*, Von Jacquin, 1787)». Komisija: dr Jelka Crnobrnja-Isailović (mentor), **dr Ljiljana Tomović**. Biološki fakultet Univerziteta u Beogradu.
- Marija Radovanović** (2006). «Uticaj ekoloških faktora na evoluciju živog sveta i biološku raznovrsnost». Komisija: dr Jelka Crnobrnja-Isailović (mentor), **dr Ljiljana Tomović**. Biološki fakultet Univerziteta u Beogradu.
- Dragana Milojković** (2006). «Uporedna analiza diverziteta gmizavaca (Reptilia) Nacionalnih parkova Đerdap, Durmitor i Kopaonik». Komisija: dr Jelka Crnobrnja-Isailović (mentor), **dr Ljiljana Tomović**. Biološki fakultet Univerziteta u Beogradu.
- Nenad Smiljković** (2008). «Diverzitet herpetofaune Gornje Pčinje sa okolinom». Komisija: dr Jelka Crnobrnja-Isailović (mentor), dr Vladimir Randelović, **dr Ljiljana Tomović**. Odsek za biologiju i ekologiju, PMF Univerziteta u Nišu.

11. **Branko Botić** (2009). «Uticaj dohrane na populaciju beloglavog supa *Gyps fulvus* u specijalnom rezervatu «Klisura reke Gornja Trešnjica». Komisija: dr Saša Marinković (mentor), **dr Ljiljana Tomović**.
12. **Jelena Krstić** (2009). «Zmije Balkanskog poluostrva». Komisija: dr Dragana Miličić (mentor), **dr Ljiljana Tomović**, dr Predrag Simonović. Biološki fakultet Univerziteta u Beogradu.
13. **Nemanja Mišić** (2013). «Genetička diferencijacija populacija potočne pastrmke (*Salmo trutta*) Republike Tatarstan - Ruska Federacija». Komisija: dr Saša Marić (mentor), **dr Ljiljana Tomović**. Biološki fakultet Univerziteta u Beogradu.

#### **DRŽANJE NASTAVE NA KURSEVIMA:**

1. Uporedna morfologija i sistematika hordata (osnovne studije) (1996.-2007.)
2. Uporedna morfologija Vertebrata (osnovne studije) (1996.-2007.)
3. Sistematika i filogenija životinja (osnovne studije) (1998.-2007.)
4. Sistematika i filogenija hordata (osnovne studije) (2008.-2011.)
5. Biologija odabranog taksona 1 – gmizavci (2007.-2011.)
6. Biologija odabranog taksona 2 – gmizavci (2007.-2011.)
7. Biologija odabranog taksona 3 – gmizavci (2007.-2011.)
8. Molekularna sistematika (doktorske studije) (2006.-2011.)
9. Uzorkovanje i priprema materijala – gmizavci (doktorske studije) (2007.-2011.)
10. Populaciona i evolucionarna biologija odabrane grupe (doktorske studije) (2007.-2011.)
11. Specijalni kurs faunistike (doktorske studije) (2007.-2011.)
12. Specijalni kurs morfol., sistem. i filog. (doktorske studije) (2007.-2011.)
1. Sistematika i filogenija hordata (osnovne studije) (2012.-)
2. Biologija odabranog taksona 1 (master studije) (2012.-)
3. Biologija odabranog taksona 2 (master studije) (2012.-)
4. Evolucija hordata (master studije) (2012.-)
5. Molekularna sistematika (doktorske studije) (2012.-)
6. Populaciona i evolucionarna biologija odabrane grupe (doktorske studije) (2012.-)
7. Specijalni kurs faunistike (doktorske studije) (2012.-)
8. Specijalni kurs morfološkije, sistematike i filogenije (doktorske studije) (2012.-)

#### **OSTALE NASTAVNE AKTIVNOSTI**

##### **RECENZIJA UDŽBENIKA KATEGORIJE M90:**

«Osnovi evolucionarne morfologije sa praktikumom» autori: dr Miloš Kalezić & dr Ana Ivanović.

«Osnovi biospeleologije» autori: dr Ivo Karaman, dr Slobodan Makarov & dr Mladen Horvatić.

##### **RECENZIJA OSTALIH PUBLIKACIJA KATEGORIJE M90:**

«Funkcijska morfologija i morfološke adaptacije – praktikum» autori: dr Ana Golubović & dr Ana Ivanović.

# NAUČNO-ISTRAŽIVAČKI RAD

## OSNOVNE NAUČNE AKTIVNOSTI

### NACIONALNE MONOGRAFIJE

#### M41 – ISTAKNUTA MONOGRAFIJA NACIONALNOG ZNAČAJA

1. Kalezić, M., **Tomović, Lj.** & Džukić, G. (Urednici) (2015). Crvena knjiga faune Srbije I – Vodozemci. Univerzitet u Beogradu – Biološki fakultet & Zavod za zaštitu prirode Srbije, pp. 1-207. (ISBN: 978-86-80877-52-5).
2. **Tomović, Lj.**, Kalezić, M. & Džukić, G. (Urednici) (2015). Crvena knjiga faune Srbije II – Gmizavci. Univerzitet u Beogradu – Biološki fakultet & Zavod za zaštitu prirode Srbije, pp. 1-265. (ISBN: 978-86-7078-125-2).

#### M44 – POGLAVLJE U ISTAKNUTOJ MONOGRAFIJI NACIONALNOG ZNAČAJA

1. Kalezić, M., **Tomović, Lj.** & Džukić, G. (2015). Crvena knjiga faune Srbije I – Vodozemci. U: Kalezić i sar. (Ured.): Crvena knjiga faune Srbije I – Vodozemci. pp. 17-39. Univerzitet u Beogradu – Biološki fakultet & Zavod za zaštitu prirode Srbije.
2. **Tomović, Lj.** (2015). Principi rada i struktura podataka za Crvenu knjigu. U: Kalezić i sar. (Ured.): Crvena knjiga faune Srbije I – Vodozemci. pp. 43-50. Univerzitet u Beogradu – Biološki fakultet & Zavod za zaštitu prirode Srbije.
3. **Tomović, Lj.** & Lakušić, D. (2015). Staništa vodozemaca u Srbiji. U: Kalezić i sar. (Ured.): Crvena knjiga faune Srbije I – Vodozemci. pp. 53-64. Univerzitet u Beogradu – Biološki fakultet & Zavod za zaštitu prirode Srbije.
4. **Tomović, Lj.** (2015). Struktura tekstova o ugroženim vrstama vodozemaca Srbije. U: Kalezić i sar. (Ured.): Crvena knjiga faune Srbije I – Vodozemci. pp. 123-125. Univerzitet u Beogradu – Biološki fakultet & Zavod za zaštitu prirode Srbije.
5. **Tomović, Lj.**, Kalezić, M. & Džukić, G. (2015). Crvena knjiga faune Srbije II – Gmizavci. U: Tomović i sar. (Ured.): Crvena knjiga faune Srbije II – Gmizavci. pp. 17-35. Univerzitet u Beogradu – Biološki fakultet & Zavod za zaštitu prirode Srbije.
6. **Tomović, Lj.** (2015). Principi rada i struktura podataka za Crvenu knjigu. U: Tomović i sar. (Ured.): Crvena knjiga faune Srbije II – Gmizavci. pp. 39-46. Univerzitet u Beogradu – Biološki fakultet & Zavod za zaštitu prirode Srbije.
7. **Tomović, Lj.** & Lakušić, D. (2015). Staništa gmizavaca u Srbiji. U: Tomović i sar. (Ured.): Crvena knjiga faune Srbije II – Gmizavci. pp. 49-63. Univerzitet u Beogradu – Biološki fakultet & Zavod za zaštitu prirode Srbije.
8. Urošević, A. & **Tomović, Lj.** (2015). Procene ugroženosti gmizavaca Srbije. U: Tomović i sar. (Ured.): Crvena knjiga faune Srbije II – Gmizavci. pp. 67-81. Univerzitet u Beogradu – Biološki fakultet & Zavod za zaštitu prirode Srbije.
9. **Tomović, Lj.** (2015). Struktura tekstova o ugroženim vrstama gmizavaca Srbije. U: Tomović i sar. (Ured.): Crvena knjiga faune Srbije II – Gmizavci. pp. 131-133. Univerzitet u Beogradu – Biološki fakultet & Zavod za zaštitu prirode Srbije.
10. **Tomović, Lj.** (2015). *Testudo graeca*. U: Tomović i sar. (Ured.): Crvena knjiga faune Srbije II – Gmizavci. pp. 144-150. Univerzitet u Beogradu – Biološki fakultet & Zavod za zaštitu prirode Srbije.
11. Đorđević, S. & **Tomović, Lj.** (2015). *Dolichophis caspius*. U: Tomović i sar. (Ured.): Crvena knjiga faune Srbije II – Gmizavci. pp. 213-219. Univerzitet u Beogradu – Biološki fakultet & Zavod za zaštitu prirode Srbije.

12. **Tomović, Lj.** & Džukić, G. (2015). *Elaphe quatuorlineata*. U: Tomović i sar. (Ured.): Crvena knjiga faune Srbije II – Gmizavci. pp. 220-226. Univerzitet u Beogradu – Biološki fakultet & Zavod za zaštitu prirode Srbije.
13. **Tomović, Lj.** & Džukić, G. (2015). *Platyceps najadum*. U: Tomović i sar. (Ured.): Crvena knjiga faune Srbije II – Gmizavci. pp. 227-232. Univerzitet u Beogradu – Biološki fakultet & Zavod za zaštitu prirode Srbije.
14. **Tomović, Lj.** (2015). *Vipera ammodytes*. U: Tomović i sar. (Ured.): Crvena knjiga faune Srbije II – Gmizavci. pp. 233-239. Univerzitet u Beogradu – Biološki fakultet & Zavod za zaštitu prirode Srbije.
15. Ajtić, R. & **Tomović, Lj.** (2015). *Vipera berus*. U: Tomović i sar. (Ured.): Crvena knjiga faune Srbije II – Gmizavci. pp. 240-247. Univerzitet u Beogradu – Biološki fakultet & Zavod za zaštitu prirode Srbije.
16. **Tomović, Lj.** & Ajtić, R. (2015). *Vipera ursinii*. U: Tomović i sar. (Ured.): Crvena knjiga faune Srbije II – Gmizavci. pp. 248-254. Univerzitet u Beogradu – Biološki fakultet & Zavod za zaštitu prirode Srbije.

#### NAUČNI RADOVI

##### RADOVI OBJAVLJENI U ČASOPISIMA MEĐUNARODNOG ZNAČAJA:

##### M21A – RAD U VRHUNSKOM MEĐUNARODNOM ČASOPISU

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#### ZBORNICI MEĐUNARODNIH NAUČNIH SKUPOVA:

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##### M34 – SAOPŠTENJE SA MEĐUNARODNOG SKUPA ŠTAMPANO U IZVODU

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2. Radojičić, J., **Tomović, Lj.** & Džukić, G. (1997). Morphological relationships within fire-bellied toads (*Bombina*, Discoglossidae) in Yugoslavia. 3<sup>rd</sup> World Congress of Herpetology. Book of Abstracts, p. 166.
3. **Tomović, Lj.**, Džukić, G., Radojičić, J. & Kalezić, M. (1999). Variability of morphological characters of sand viper populations (*Vipera ammodytes* L.) from central part of the Balkan peninsula. 10<sup>th</sup> Ordinary General Meeting of Societas Europaea Herpetologica. Book of Abstracts, p. 246.
4. Radojičić, J., Cvetković, D., **Tomović, Lj.**, Kalezić, M. & Džukić, G. (1999). Sexual dimorphism in fire-bellied toads *Bombina* spp. from central Balkans. 10<sup>th</sup> Ordinary General Meeting of Societas Europaea Herpetologica. Book of Abstracts, p. 230.
5. Crnobrnja-Isailović, J., **Tomović, Lj.** & Ajtić, R. (2003). Syntopic populations of Orsini's viper (*Vipera ursinii*) and adder (*Vipera berus*) in northeastern

- Montenegro. 12<sup>th</sup> Ordinary General Meeting of Societas Europaea Herpetologica. Book of Abstracts, p. 52.
6. Ajtić, R. & **Tomović, Lj.** (2003). Morphological Analysis of Kotschy's Gecko (*Cyrtodactylus kotschyi*, Steindachner, 1870): A Multivariate Study. 12<sup>th</sup> Ordinary General Meeting of Societas Europaea Herpetologica. Book of Abstracts, p. 30-31.
  7. Krizmanić, I., Ajtić, R. & **Tomović, Lj.** (2003). Contribution to Batrachofauna and Herpetofauna of Western Serbia. 2<sup>nd</sup> Congress of Ecologists of the Republic of Macedonia, Book of Abstracts, p. 174-175.
  8. **Tomović, Lj.**, Ajtić, R. & Krizmanić, I. (2003). Conservation Problems of Vipers (*Vipera*, Viperidae) in Serbia and Montenegro. 2<sup>nd</sup> Congress of Ecologists of the Republic of Macedonia, Book of Abstracts, p. 168-169.
  9. Crnobrnja-Isailović, J., Ajtić, R., Aleksić, I. & **Tomović, Lj.** (2005). Variation of clutch size in meadow viper (*Vipera ursinii macrops*) from eastern Montenegro. 13<sup>th</sup> Ordinary General Meeting of Societas Europaea Herpetologica. Book of Abstracts, p. 40-41.
  10. **Tomović, Lj.**, Ajtić, R., Aleksić, I. & Crnobrnja-Isailović, J. (2005). Morphological characteristics and sexual dimorphism of meadow viper (*Vipera ursinii macrops*) from eastern Montenegro. 13<sup>th</sup> Ordinary General Meeting of Societas Europaea Herpetologica. Book of Abstracts, p. 112.
  11. Ajtić, R., Crnobrnja-Isailović, J. & **Tomović, Lj.** (2005). Nose-horned viper (*Vipera ammodytes*) – Conservation problems in Serbia and Montenegro. 13<sup>th</sup> Ordinary General Meeting of Societas Europaea Herpetologica. Book of Abstracts, p. 22-23.
  12. Sterijovski, B., Ajtić, R., Naumov, B. & **Tomović, Lj.** (2006). Batraho- and Herpetofauna in southern parts of Republic of Macedonia. 2<sup>nd</sup> International Symposium of Ecologists of the Republic of Montenegro, Book of Abstracts, p. 48.
  13. Sterijovski, B. & **Tomović, Lj.** (2007). Contribution to the knowledge of the reptile fauna of the Former Yugoslav Republic of Macedonia. 14<sup>th</sup> Ordinary General Meeting of Societas Europaea Herpetologica. Book of Abstracts, p. 140.
  14. Ajtić, R., Crnobrnja-Isailović, J. & **Tomović, Lj.** (2007). Morphological differentiation of mainland populations of the Kotschy's gecko (*Cyrtopodion kotschyi*) from the Balkans and Asia Minor. 14<sup>th</sup> Ordinary General Meeting of Societas Europaea Herpetologica. Book of Abstracts, p. 43.
  15. Sterijovski, B., **Tomović, Lj.**, Ajtić, R. & Crnobrnja-Isailović, J. (2007). Preliminary study of population ecology of an insular population of the nose-horned viper (*Vipera ammodytes*) from Former Yugoslav Republic of Macedonia. 2<sup>nd</sup> Biology of the Vipers Conference. Book of Abstracts, p. 50.
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  17. Ajtić, R., **Tomović, Lj.** & Crnobrnja-Isailović, J. (2007). Thermal biology and microhabitat preferences of meadow viper (*Vipera ursinii macrops*) from Bjelasica Mt. (Montenegro). 2<sup>nd</sup> Biology of the Vipers Conference. Book of Abstracts, p. 39.
  18. Crnobrnja-Isailović, J., Ajtić, R., Aleksić, I. & **Tomović, Lj.** (2007). Population viability analysis of a local population of *Vipera ursinii* in north-eastern Montenegro. 2<sup>nd</sup> Biology of the Vipers Conference. Book of Abstracts, p. 51.
  19. Jelić, D., Ajtić, R., Sterijovski, B., Crnobrnja-Isailović, J., Lelo, S. & **Tomović, Lj.** (2010). Distribution and conservation problems of the Vipers in the western and central part of the Balkans. 3<sup>rd</sup> Biology of the Vipers Conference. Book of Abstracts, p. 8-9.

20. Crnobrnja-Isailović, J., Ajtić, R. & **Tomović, Lj.** (2010). Some aspects of venom production and body mass variation in *Vipera ammodytes* kept under laboratory condition. 3<sup>rd</sup> Biology of the Vipers Conference. Book of Abstracts, p. 36-37.
21. **Tomović, Lj.**, Crnobrnja-Isailović, J. & Brito, J. C. (2010). The use of Geostatistics and GIS for Evolutionary History Studies: the case of the nose-horned viper (*Vipera ammodytes*) in the Balkan Peninsula. 3<sup>rd</sup> Biology of the Vipers Conference. Book of Abstracts, p. 45-46.
22. **Tomović, Lj.**, Crnobrnja-Isailović, J., Ajtić, R., Sterijovski, B., Jelić, D., Dorđević, S., Đurakić, M. & Bonnet, X. (2010). Sexual size and shape dimorphism of the Vipers at the Balkans – small, medium and large scale. 3<sup>rd</sup> Biology of the Vipers Conference. Book of Abstracts, p. 52.
23. Ferchaud, A-L., Ursenbacher, S., Luiselli, L., Jelić, D., Halpern, B., Major, A., Kotenko, T., Crnobrnja-Isailović, J., **Tomović, Lj.**, Ghira, I., Ioannidis, Y., Arnal, V. & Nontgelard, C. (2011). From South to North: mitochondrial markers reveal an unexpected colonization route for vipers of the *Vipera ursinii* complex in the Palearctic region. 16<sup>th</sup> Ordinary General Meeting of Societas Europaea Herpetologica. Book of Abstracts, p. 78.
24. Golubović, A., Arsovski, D. & **Tomović, Lj.** (2012). Habitat configuration affects jumping behavior of the Hermann's tortoise (*Testudo hermanni*). 4<sup>th</sup> Congress of Ecologists of the Republic of Macedonia, Book of Abstracts, p. 36.
25. Sterijovski, B., **Tomović, Lj.** & Ajtić, R. (2012). Contribution to the knowledge of the Reptile fauna and diversity of Macedonia. 4<sup>th</sup> Congress of Ecologists of the Republic of Macedonia, Book of Abstracts, p. 55-56.
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28. Djordjević, S., Golubović, A., Simović, A., Sterijovski, B., Arsovski, D., Vujović, A., Iković, V., Ajtić, R. & **Tomović, Lj.** (2012). Hermann's tortoise in the central Balkans: basic demographic features and anthropogenic influences. 4<sup>th</sup> Congress of Ecologists of the Republic of Macedonia, Book of Abstracts, p. 78-79.
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32. Gvozdenović, S., Pešić, V. & **Tomović, Lj.** (2013). Preliminary population study of dice snake – *Natrix tessellata* (Laurenti, 1768) from Skadar Lake. 5<sup>th</sup>

- International Symposium of Ecologists of the Republic of Montenegro, Book of Abstracts and Programme, p. 112-113.
33. Golubović, A. & **Tomović, Lj.** (2014). Stuck with rigid armour in a jungle of grass and shrubs – how do tortoises manage? 10<sup>th</sup> "Ecology & Behaviour" Meeting. Book of Abstracts, p. 43.
  34. **Tomović, Lj.**, Krizmanić, I., Đorđević, S., Golubović, A. (2015). Results of project of DNA sampling of *Emys orbicularis* in Serbia – conservation issues. 5<sup>th</sup> International Symposium on *Emys orbicularis*. Book of Abstracts, pp. 39-40.
  35. **Tomović, Lj.**, Urošević, A., Vukov, T., Ajtić, R., Ljubisavljević, K., Krizmanić, I., Jović, D., Labus, N., Đorđević, S., Kalezić, M. L., Džukić, G. & Luiselli, L. (2015). Threatening levels and extinction risks based on distributional, ecological and life-history datasets (DELH) versus IUCN criteria – example of Serbian reptiles. 1<sup>st</sup> Balkan Herpetological symposium. Book of Abstracts, p. 74.
  36. Šukalo, G., Đorđević, S. & **Tomović, Lj.** (2015). Sexual dimorphism, diet and reproduction of the grass snake (*Natrix natrix*) in the region of the marshy-pond ecosystem Bardača (Republic of Srpska, Bosnia and Herzegovina). 1<sup>st</sup> Balkan Herpetological symposium. Book of Abstracts, pp. 193-194.
  37. Šukalo, G., Malidža, S., Golub, D., Dmitrović, D., Đorđević, S. & **Tomović, Lj.** (2015). Populaciona istraživanja šarenog daždevnjaka (*Salamandra salamandra*) na području Banja Luke. III Simpozijum biologa i ekologa Republike Srpske, Book of Abstracts, pp. 161-162.
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  39. Miličić, D., Trajković, J., Pavković-Lučić, S., Savić, T. & **Tomović, Lj.** (2016). Morphological analysis of *Branchipus* sp. from area of Stara Planina Mountains and Pannonian lowlands in Serbia. International Conference of Zoology and Zoonoses, Book of Abstracts, p. 93.

#### ZBORNICI SKUPOVA NACIONALNOG ZNAČAJA:

##### M64 – SAOPŠTENJE SA SKUPA NACIONALNOG ZNAČAJA ŠTAMPANO U IZVODU

1. Mrdak D., Simonović, P. & **Tomović, Lj.** (2001). Ecological characterization of nearshore fish communities at south Adriatic. Naučni skup "Prirodni potencijali kopna, kontinentalnih voda i mora Crne Gore i njihova zaštita. Plenarni referati i izvodi iz saopštenja sa naučnog skupa, p. 127.
2. Ajtić, R., **Tomović, Lj.** & Krizmanić, I. (2004). Contribution to Batrahofauna and Herpetofauna of Beljanica Mountain in the Eastern Serbia. 1<sup>st</sup> International Symposium of Ecologists of the Republic of Montenegro, Book of Abstracts, p. 71-72.
3. Crnobrnja-Isailović, J., Ajtić, R. & **Tomović, Lj.** (2004). Contribution to Batrahofauna and Herpetofauna of Pčinja River in the Southern Serbia. 1<sup>st</sup> International Symposium of Ecologists of the Republic of Montenegro, Book of Abstracts, p. 72.
4. Crnobrnja-Isailović, J., Ajtić, R. & **Tomović, Lj.** (2005). Prilog poznavanju herpetofaune Stare planine sa okolinom. 8<sup>th</sup> Symposium on Flora of Southeastern Serbia and neighbouring regions, Book of Abstracts, p. 141.



#### **ODBRANJENA DOKTORSKA DISERTACIJA (M71)**

**Tomović, Lj.** (2005). Sistematika i biogeografija poskoka (*Vipera ammodytes* Linnaeus, 1758) (Viperidae, Serpentes). Biološki fakultet Univerziteta u Beogradu, Beograd.

#### **ODBRANJENA MAGISTARSKA TEZA (M72)**

**Tomović, Lj.** (2000). Morfološke odlike poskoka (*Vipera ammodytes*) centralnog dela Balkanskog poluostrva. Biološki fakultet Univerziteta u Beogradu, Beograd.

#### **OSTALE NAUČNE AKTIVNOSTI**

##### **RUKOVOĐENJE PROJEKTIMA BILATERALNE SARADNJE:**

1. Projekat: "Impact of habitat-changes on reptile populations". Bilateralni projekat Srbija-Francuska (MNTR-CNRS). Rukovodioci: dr Xavier Bonnet (CNRS, Centre d'Etudes Biologiques de Chizé) & **dr Ljiljana Tomović** (Biološki fakultet Univerziteta u Beogradu), 2009.-2010.

##### **UČEŠĆE NA MEĐUNARODNOM PROJEKTU:**

1. Projekat: "Population structure, threats and protection of Orsinii viper (*Vipera ursinii macrops*) on Bjelasica Mountain (Montenegro)". SEH Grant "Award In Herpetology 2003". Rukovodilac: dr Jelka Crnobrnja-Isailović. Societas Europaea Herpetologica, 2003.

##### **RUKOVOĐENJE NACIONALNIM PROJEKTOM:**

1. Projekat: "Sakupljanje DNK uzoraka strogo zaštićenih i zaštićenih vrsta gmizavaca koje su predmet ilegalnog sakupljanja iz prirode, nedozvoljenog uzgajanja i trgovine". Rukovodilac: **dr Ljiljana Tomović**. Ministarstvo energetike, razvoja i zaštite životne sredine Republike Srbije, 2014.-2015.

##### **UČEŠĆE U NACIONALNOM PROJEKTU:**

1. Projekat: "Populaciono-biološki aspekti procesa specijacije". Rukovodilac: prof. dr Nikola Tucić. Ministarstvo za nauku Republike Srbije, 1999.-2000.
2. Projekat: "Integrativna istraživanja vodozemaca i gmizavaca centralnog Balkana". Rukovodilac: prof. dr Miloš Kalezić. Ministarstvo za nauku, tehnologiju i razvoj 1623 Republike Srbije, 2002.-2005.
3. Projekat: "Monitoring metapopulacionog sistema zelenih žaba (*Rana synklepton esculenta*) u jugoistočnom delu Panonske nizije". Rukovodilac: dr Ana Ivanović. Ministarstvo za zaštitu prirodnih bogatstava i životnu sredinu, 2003.-2004.
4. Projekat: «Izrada programa istraživanja riba, vodozemaca i gmizavaca za predeo izuzetnih odlika «Veliko ratno ostrvo»». Rukovodilac: dr Predrag Simonović. JKP «Zelenilo», Beograd, 2007.-2009.
5. Projekat: "Evolucija u heterogenim sredinama". Rukovodilac: dr Aleksej Tarasjev. Ministarstvo nauke i zaštite životne sredine, 2006.-2010.
6. Projekat: "Metodologija poboljšanja tehnologije uzgoja poskoka (*Vipera ammodytes*) radi potrebe eksploatacije zmijskog otrova kao strateške sirovine". Rukovodilac: dr Jelka Crnobrnja-Isailović. Ministarstvo za nauku i tehnološki razvoj, 2008.-2009.
7. Projekat: "Diverzitet vodozemaca i gmizavaca Balkana: evolucionni aspekti i konzervacija". Rukovodilac: dr Miloš Kalezić. Ministarstvo prosvete i nauke, 2011.-

#### RECENZIJIA PUBLIKACIJE KATEGORIJE M11/M12/M41:

Recenzent istaknute nacionalne monografije «Fauna repatih vodozemaca Srbije»  
autori: dr Georg Džukić, dr Tanja Vukov & dr Miloš Kalezić.

#### RECENZIJIA (UZ DOKAZ) PUBLIKACIJE KATEGORIJE M20/M50/M60:

Acta Zoologica Bulgarica (za 2015, 2016)	3
Amphibia-Reptilia (za 2014, 2015, 2016)	4.5
Biodiversity and Conservation (za 2016)	1.5
Endangered Species Research (za 2015)	1.5
Herpetologica (za 2016)	1.5

### IZBORNI USLOVI

#### 1. Stručno-profesionalni doprinos

##### 3. Predsednik ili član organizacionog ili naučnog odbora na naučnim skupovima nacionalnog ili međunarodnog nivoa

- Član naučnog odbora 3<sup>rd</sup> Biology of the Vipers Conference održanog u gradu Calci (Pisa, Italija), od 31. 03. do 02. 04. 2010. godine.
- Član naučnog odbora 3<sup>rd</sup> Symposium of Biologists and Ecologists of Republika Srpska održanog u Banjoj Luci (Republika Srpska) od 12. 11. do 14. 11. 2015. godine.
- Član naučnog odbora 5<sup>th</sup> Congress of Ecologists of the Republic of Macedonia with International Participation održanog na Ohridu (Republika Makedonija) od 19. 10. do 22. 10. 2016. godine.

#### 2. Doprinos akademskoj i široj zajednici

##### 2. Predsednik ili član organa upravljanja, stručnog organa ili komisija na fakultetu ili univerzitetu u zemlji ili inostranstvu

###### Član komisije za izbor u naučno zvanje:

- Biljane Stojković, Biološki fakultet, Univerzitet u Beogradu, 2008
- Sonje Đorđević, Biološki fakultet, Univerzitet u Beogradu, 2012

Član Veća doktorskih studija Biološkog fakulteta Univerziteta u Beogradu  
(Odluka Nastavno-naučnog veća Biološkog fakulteta 15/407 od 05. 09. 2016. godine, mandat tri godine).

###### Član komisije za izbor u istraživačko zvanje:

- Marka Anđelkovića, Institut za biološka istraživanja „Siniša Stanković“, Univerzitet u Beogradu, 2014

###### Član komisije za izbor u naučno zvanje:

- Ane Golubović, Biološki fakultet, Univerzitet u Beogradu, 2015
- Tanje Vukov, Institut za biološka istraživanja „Siniša Stanković“, Univerzitet u Beogradu, 2015

###### Član komisije za izbor u zvanje nastavnika:

- Biološki fakultet, Univerzitet u Beogradu, 2013
- Biološki fakultet, Univerzitet u Beogradu, 2015

### **3. Saradnja sa drugim visokoškolskim, naučnoistraživačkim ustanovama, odnosno ustanovama kulture ili umetnosti u zemlji i inostranstvu**

#### 1. Postdoktorsko usavršavanje ili studijski boravci u inostranstvu

Bugarska – 3 nedelje – 2000, 2002 – Nacionalni Prirodno-naučni muzej u Sofiji

Makedonija – 3 nedelje – 2000, 2002 – Nacionalni Prirodno-naučni muzej u Skoplju

Slovenija – 2 nedelje – 2002 – Prirodoslovni muzej u Ljubljani

Austrija – 4 nedelje – 2003, 2006 – Naturhistorisches Museum Wien

Bosna i Hercegovina – 2 nedelje – 2002 – Zemaljski Muzej u Sarajevu

Francuska – 2 nedelje – 2008, 2009, 2010 – Centre d'Études Biologiques de Chizé – Centre National de la Recherche Scientifique

#### 3. Radno angažovanje u nastavi ili komisijama na drugim visokoškolskim ili naučnoistraživačkim ustanovama u zemlji ili inostranstvu, ili zvanje gostujućeg profesora, ili istraživača.

Angažovanje u nastavi (docent) na Univerzitetu Crne Gore, na Prirodno-matematičkom fakultetu u Podgorici, na Studijskom programu Biologija, na predmetima Sistematika i uporedna anatomija kičmenjaka I i Sistematika i uporedna anatomija kičmenjaka II, u školskoj 2007/2008. godini.

Angažovanje u nastavi (vanredni profesor) na Univerzitetu u Banjoj Luci, na Prirodno-matematičkom fakultetu u Banjoj Luci, na Studijskim programima Biologija i Ekologija i zaštita životne sredine, na predmetima Zoologija hordata I i Zoologija hordata II, u školskoj 2014/2015. godini.

#### Član komisije za izbor u zvanje docenta:

- Poljoprivredni fakultet, Univerzitet u Beogradu, 2007
- Prirodno-matematički fakultet, Univerzitet u Prištini, 2012

#### Član komisije za izbor u zvanje saradnika u nastavi:

- Prirodno-matematički fakultet, Univerzitet u Banjoj Luci, 2012

#### Član komisije za izbor u zvanje asistenta:

- Prirodno-matematički fakultet, Univerzitet u Novom Sadu, 2014

#### Član komisije za izbor u zvanje vanrednog profesora:

- Prirodno-matematički fakultet, Univerzitet u Prištini, 2012

#### **CITIRANOST:**

**Broj citata (bez autocitata) u časopisima sa SCI liste: 208**

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- Veenvliet, P. & Veenvliet, J. K. (2008). Amphibians of the Eastern Julian Alps (Slovenia) with special attention to endemic forms of the Alpine newt (*Mesotriton alpestris*). *Zeitschrift für Feldherpetologie* 15: 49-60.
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**Univerzitet Crne Gore**

adresa / address: Cetinjska br. 2  
81000 Podgorica, Crna Gora  
telefon / phone: +00382 20 414 255  
fax: +00382 20 414 230  
mail: rektorat@ucg.me  
web: www.ucg.ac.me

**University of Montenegro**

Broj / Ref: 03-2272

Datum / Date: 03. 07. 2018

Na osnovu člana 51, 52 i 53 Zakona o naučnoistraživačkoj djelatnosti ("Službeni list Crne Gore", br. 080/10 40/11 i 057/14 od 26.12.2014) i člana 32 stav 1 tačka 9 Statuta Univerziteta Crne Gore, Senat Univerziteta Crne Gore, na sjednici održanoj 03.07. 2018.godine, donio je

**ODLUKU  
O IZBORU U ZVANJE**

**Dr MILICA MANDIĆ** bira se u naučno zvanje viši naučni saradnik za oblast lhtioplankton i marikultura u Institutu za biologiju mora, na period od 5 godina.



**SENAT UNIVERZITETA CRNE GORE  
PREDSJEDNIK**

**Prof.dr Danilo Nikolić, rektor**

## Dr Milica Mandić – Biografija

Rođena sam u Kotoru, 31.08.1980. godine, gdje sam završila osnovnu i srednju školu (Gimnaziju) 1999. godine. Prirodno-matematički fakultet u Podgorici –odsjek Biologija upisala sam školske 1999/00 godine, a diplomirala 2005. godine sa prosječnom ocjenom 8.45. pri čemu sam stekla zvanje diplomiranog biologa.

Doktorske studije - Studijski program: Ekologija, biogeografija i zaštita biodiverziteta upisala sam u februaru 2007. godine na Biološkom fakultetu Univerziteta u Beogradu i završila ih sa prosječnom ocjenom 9.9.

Doktorsku disertaciju pod nazivom: »Sezonski aspekti diverziteta ihtioplanktona u Bokokotskom zalivu« odbranila sam 29. novembra 2011. godine na Biološkom Fakultetu Univerziteta u Beogradu, pri čemu sam stekla zvanje doktora bioloških nauka. Diploma doktora bioloških nauka nostrifikovana je od strane Ministarstva prosvjete i sporta Crne Gore dana 15.02.2015. godine.

Tokom 2009. i 2010. godine pohađala sam kurs engleskog jezika *Oxford language Educational Center*- nivo *Upper intermediate 2*, uspješno ga završila, pa tečno govorim i pišem engleski jezik. 2009. godine sam imenovana za naučno odgovornu osobu u Institutu za biologiju mora za primjenu CITES konvencije u Crnoj Gori (za marinske vrste); 2012 godine sam imenovana za naučno odgovornu osobu u Crnoj Gori u Komitetu za akvakulturu Sredozemnog mora (GFCM-CAQ); 2017. godine sam imenovana za člana radne grupe za sprovođenje Jadransko-Josnke strategije za oblast Kvalitet životne sredine. Član sam radne grupe za pregovore Crne Gore sa Evropskom Unijom za poglavlje 13 – Ribarstvo, kao i Član radne grupe za izradu Zakona o morskome ribarstvu i marikulturi.

Od 01.03.2006. godine sam zaposlena u Institutu za biologiju mora, prvo kao saradnik u istraživanju, a nakon izbora u zvanje naučnog saradnika (Odluka br.08-1712 od 01.10.2012 g.), imenovana sam za rukovodioca Laboratorije za razvojna istraživanja i marikulturu (Odluka Instituta za biologiju mora broj 49/12 od 13.02.2012.godine). 03.07.2018. godine stičem zvanje višeg naučnog saradnika za oblast ihtioplankton i marikultura (Odluka Senata UCG br 03-2272 od 03.07.2018.).

## **Bibliografija**

### **Aktivni i završeni nacionalni i međunarodni projekti (učesće u zadnjih 5 godina):**

- Monitoring i biomonitoring kvaliteta voda na uzgajalištima školjki i riba u Bokotorskom zalivu – program financiran od strane Ministarstva poljoprivrede i ruralnog razvoja Crne Gore (2012 – do danas) – rukovodilac programa;
- FAO AdriaMed (2004-do danas). Scientific Cooperation to Support Responsible fisheries in the Adriatic Sea. – saradnik na projektu;
- FAO InDAM (2012-do danas) - Indicators for Sustainable Development of Aquaculture and Guidelines for their use in the Mediterraneanss - saradnik na projektu;
- Zaštita uzgajališta mušulja (*Mytilus galloprovincialis*, L.) i kamenica (*Ostrea edulis*) od predatora – orade (*Sparus aurata*) – Projekat financiran od strane Ministarstva poljoprivrede i ruralnog razvoja Crne Gore (2012-2014) – rukovodilac projekta;
- Bioraznovrsnost i struktura priobalnih zajednica riba i drugih morskih životinja na istočnoj strani Jadrana: poređenje između hrvatskog i crnogorskog priobalja. Bilateralni projekat između Crne Gore i Hrvatske (2015-2016) – saradnik na projektu;
- IPA ADRIATIC STRATEGIC – “Derelict fishing gear management system in the Adriatic Sea” - DeFishGear - Upravljanje napuštenim ribarskim alatima u Jadranskoj regiji (2013-2016) – rukovodilac;
- BALMAS (2013-2016) - Ballast water management System in the Adriatic Sea – saradnik na projektu;
- IPA Adriatic 4 PILLARS (2016)- “For Promoting an Innovative multi-Level governance System of EUSAIR” – rukovodilac projekta
- IPA Adriatic ADRIATIC + (2016)- „Sharing Marine and Coastal cross management experiences in the Adriatic basin” – saradnik na projektu
- Bilateralni projekat između Crne Gore i Srbije (2016-2018)– “Potencijalna primjena ljuštura dagnji i kamenica kao biosorbenata za uklanjanje teških metala” – rukovodilac projekta sa crnogorske strane.
- BIO-ICT (2014-2017) – Centre of Excellence of Montenegro. – saradnik na projektu.
- IPA »Experimental farming of great Mediterranean scallop (*Pecten jacobaeus*) in the area of Boka Kotorska Bay« (2016-2017) – rukovodilac
- IPA Interreg “WELCOME” projekat - „WatEr Landscapes sustainability through reuse of Marine litter“ – rukovodilac
- IPA Sustainable and innovative Agro food and fisheries value chain for SME’s cross border market” - Food4Health - rukovodilac

### **Organizacija simpozijuma i radionica:**

- AdriaMed Workshop on Daily Egg Production Method for the appraisal of small pelagic fisheries resources in the Adriatic Sea. Kotor, Montenegro 27-29.09.2010 - Organizator obuke i predavač.

### Učešće na kursevima:

- Training Course for Operators in Fish Markets and Fishing – Adriatic Fishing Observatory – AFO (Interreg III A). 10th-12th October 2006, Duress (Albania) and 25th-27th October 2006, Ancona (Italy).
- Advanced training in Laboratoria di Biologia Marina- Fano, University of Bologna, Italia In the frame of the project "OASIS" which was realized between Italian region Abruzzo, Montenegro and Albania, 22.11-20.12.2006
- Training Course on the use of Global Information Systems (GIS) in Fisheries and Aquaculture – FAO Regional Project "Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea". 3-13 July 2007, Split, Croatia.
- „Programme promotion of an inter-Adriatic space for producing quality fruit and vegetables and livestock“. Province Forli – Cesena, Italy. 19- 30 November 2007. Adria Food Quality.
- Training Course on the Daily Eggs Production Method (DEPM) for the Appraisal of Small Pelagic Fisheries Resources– FAO Regional Project "Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea". 11-15 September 2007, Kotor, Montenegro.
- AdriaMed training course on Virtual Population Analysis (VPA) methods in Fish Stock Assessment. Rome, Italy, 22-26 November 2010
- PESCAMED Training course on „A shared policy for sustainable fishing in the Mediterranean sea“. Mediterranean agronomic Institute of Bari (Italy). 29 November – 11 December 2010.
- Workshop „Bivalve safety management“. Saranda, Albania, 26-28 June 2012. FAO and EUROFISH.

### **Recenzentske aktivnosti**

- Recenzent u nekoliko naučnih časopisa: Aquaculture and Forestry; Blue Ocean Institute; Journal of Marine Biological Association of United Kingdom, Acta Adriatica, Cahiers de Biologie marine, Turkish Journal of Fisheries and Aquatic Sciences.

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8. **Mandić, M.**, Pešić, A., Joksimović, A. & Đurović, M. (2008). Main characteristic of population dynamic of hake (*Merluccius merluccius*, Linnaeus 1758) in the open sea of the Montenegrin coastal waters. *Natura Montenegrina* 7(3): 529-536.
9. **Mandić, M.** & Regner, S. (2009). Length-weight relationship, sex ratio and length at maturation of *Merluccius merluccius* (Linnaeus 1758) from the montenegrin shelf. IV International Conference "Fishery", May 27-29, 2009, Belgrade, Serbia. Conference proceedings: 268-274.
10. **Mandić, M.**, Pešić, A., Đurović, M., Mandić, S. & Joksimović, A. (2009). Application of DEP method for estimating biomass of pelagic resources in bio-ecological conditions of Montenegrin coast 2008. The 38 annual Conference of Yugoslav Water Pollution Control Society »WATER 2009«. June 8-10, 2009. Zlatibor, Serbia. Conference proceedings: 301-306.
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# УНИВЕРЗИТЕТ ЦРНЕ ГОРЕ

Ул. Цетинска бр. 2  
П. фах 99  
81000 ПОДГОРИЦА  
ЦРНА ГОРА  
Телефон: (020) 414-255  
Факс (020) 414-230  
E-mail: rektor@uc.me



# UNIVERSITY OF MONTENEGRO

Ul. Cetinjska br. 2  
P.O. BOX 99  
81 000 PODGORICA  
MONTENEGRO  
Phone: (+382) 20 414-255  
Fax: (+382) 20 414-230  
E-mail: rektor@uc.me

Број: 01-8452  
Датум, 17. 12. 2009 г.

CRNA GORA  
UNIVERZITET CRNE GORE  
METALURŠKO-TEHNOLOŠKI FAKULTET

Ref. \_\_\_\_\_  
Date \_\_\_\_\_

Primijeno: 24. 12. 2009

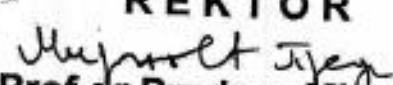
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Na osnovu člana 75 stav 2 Zakona o visokom obrazovanju (Sl.list RCG br. 60/03.) i člana 18 Statuta Univerziteta Crne Gore, Senat Univerziteta Crne Gore, na sjednici održanoj 17.12.2009. godine, donio je

## ODLUKU O IZBORU U ZVANJE

Dr NADA BLAGOJEVIĆ bira se u akademsko zvanje **redovni profesor** Univerziteta Crne Gore za predmete: Ispitivanje zagađivača u životnoj sredini i Analitička hemija I na **Metalurško-tehnološkom fakultetu** i Instrumentalne metode na Samostalnom studijskom programu Farmacija.

REKTOR

  
Prof. dr Predrag Miranović

**Prof. dr Nada Blagojević**

*Mjesto i godina rođenja:* Sarajevo, 1962.

*e-mail:* nadab@ac.me

*Nastavničko zvanje:* redovni profesor

*Datum posljednjeg izbora:* 17.12.2009.

*Naučna oblast interesovanja:* Instrumentalne metode hemijske analize, Analitička hemija, Hemija životne sredine

*Osnovne studije:* Prirodno–matematički fakultet, Odsjek hemija, Sarajevo,1984.

*Magistarska teza:* „Ponašanje crvenog mulja pri obradi mineralnim kiselinama“, Prirodno–matematički fakultet, Sarajevo, 1990.

*Doktorska disertacija:* „Analitičko određivanje malih količina metala u legurama primjenom elektrohemijskih tehnika“, Centar za multidisciplinarnu studije Univerziteta u Beogradu, Beograd, 1998. god.

**Radovi**

**Godina; Kategorija; Autor(i); Naziv; Izvor; Volume; Stranice; ISSN/ISBN**

- 2019; SCI, SCIE, SSCI, A&HCI; Brašanac-Vukanović Snežana, Tadić Vanja M., Blagojević Nada, Vukašinić-Pešić Vesna, Đurđić Sladana, Stanković Milica, Mutić Jelena; Element accumulation capacity of *Vaccinium myrtillus* from Montenegro: Comparison of element contents in water and ethanol extracts of bilberry plant parts. *Archives of Biological Sciences, Volume 71; Issue 1; 145-157*
- 2018; SCI, SCIE, SSCI, A&HCI; Snežana Brašanac-Vukanović, Jelena Mutić, Dalibor M. Stanković, Ivana Arsić, Nada Blagojević, Vesna Vukašinić-Pešić and Vanja M. Tadić; Wild Bilberry (*Vaccinium myrtillus* L., Ericaceae) from Montenegro as a Source of Antioxidants for Use in the Production of Nutraceuticals; *Molecules; 23(8), 1864*
- 2017; SCI, SCIE, SSCI, A&HCI; Pešić V., Blagojević N., Vukanović S., Savić A., Pešić V.; Heavy Metal Concentrations in Different Tissues of the Snail *Viviparus marmoratus* (Kuster, 1852) from Lacustrine and Riverine Environments in Montenegro; *Turkish Journal of Fisheries and Aquatic Sciences; 7(3):557-563; 1303-2712*
- 2015; SCI, SCIE, SSCI, A&HCI; Grudić Veselinka V., Blagojević Nada Z., Vukašinić-Pešić Vesna L., Brašanac Snežana R.; Kinetics of degradation of ascorbic acid by cyclic voltammetry method; *Chemical Industry and Chemical Engineering Quarterly; 21 (2) 351–357; 1451-9372*
- 2014; SCI, SCIE, SSCI, A&HCI; Kastratović, V., Krivokapić, S., Bigović, M., Đurović, D., Blagojević, N.; Bioaccumulation and translocation of heavy metals by *Ceratophyllum demersum* from Skadar Lake, Montenegro.; *Journal of Serbian Chemistry Society; 79 (0): 1-24; 0352-5139*
- 2014; SCI, SCIE, SSCI, A&HCI; Nada Z. Blagojević, Vesna L. Vukašinić-Pešić, Veselinka V. Grudić, Vladimir M. Pešić; The endemic freshwater snails as an environmental indicator of metal pollution of the Zeta river; *Montenegro; The Journal of Environmental Protection and Ecology; 15(1); 210-216; 1311-5065*
- 2013; SCI, SCIE, SSCI, A&HCI; Roganović D, Djurović D, Blagojević N. and Vujacic A.; Investigation of the Heavy Metals content in Cypress Tree bark (*Cupressus sempervirens* L. var. *pyramidalis*) on the Territory of the Central and Southern part of Montenegro; *Research Journal of Chemistry and Environment; 17(2); 3-7; 0972-0626*
- 2013; SCI, SCIE, SSCI, A&HCI; Veselinka V. Grudić, Dina Perić, Nada Z. Blagojević, Vesna L. Vukašinić-Pešić, Snežana Brašanac, Bojana Mugošar, Pb(II) and Cu(II) sorption from aqueous solutions using activated red mud – evaluation of kinetic, equilibrium and thermodynamic models; *Polish Journal of Environmental Studies; 22(2); 377-385; 1230-1485*



- 2013; SCI, SCIE, SSCI, A&HCl: Kastarović, V., Krivokapić, S., Durović, D., Blagojević, N.; Seasonal changes in metal accumulation and distribution in the organs of Phragmites australias (common reed) from Lake Skadar, Montenegro.; *Journal of Serbian Chemistry Society*; 78 (8); 1241-1258; ISSN 0352-5139 (Print) ISSN 1820-7421 (Online)
- 2013; SCOPUS; Veselinka V. Grudić, Snežana Brašanac, Vesna L. Vukašinić-Pešić, Nada Z. Blagojević; Sorption of cadmium from water using neutralized red mud and activated neutralized red mud; *ARPN Journal of Engineering and Applied Sciences*; 8; 933-943; 1819-6608
- 2012; SCI, SCIE, SSCI, A&HCl: V.L. Vukašinić-Pešić, V.N. Rajaković-Ogjanović, N.Z. Blagojević, V.V. Grudić, B.M. Jovanović, Lj.V. Rajaković; Enhanced arsenic removal from water by activated red mud based on hydrated iron(III) and titanium(IV) oxides.; *Chemical Engineering Communications*; 199(7); 849-864; 0098-6445
- 2012; SCI, SCIE, SSCI, A&HCl: Vlatko Kastarović, Sladana Krivokapić, Dijana Durović, Nada Blagojević; Seasonal changes in metal accumulation and distribution in the organs of Phragmites australias (common reed) from Lake Skadar, Montenegro; *J.Serb. Chem. Soc.*; 77(0); 1-25; 0352-5139
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- 2009; SCI, SCIE, SSCI, A&HCl: N. Blagojević, B. Damjanović-Vratnica, V. Vukašinić-Pešić, D. Djurović; Heavy metal contents in leaves and extracts of wild-growing *Salvia officinalis* from Montenegro; *Polish Journal of Environmental Studies*; 18(2); 167-173; 1230-1485
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- 2008; SCI, SCIE, SSCI, A&HCl: N.Z. Blagojević, V.L. Vukašinić-Pešić, D.D. Djurović; Migration and total Concentration of Heavy Metals in Soil Samples from the Zeta Valley, Montenegro; *Journal of Chemistry and Environment*; 12(4); 76-81; 0972-0626
- 2008; SCI, SCIE, SSCI, A&HCl: Mujčić V., Jokanović V., Kostić-Gvozdenović L., Krgović M., Blagojević N., Janaković D.; "Synthesis of nanostructured boehmite powder by sol-gel method from industrial Na-aluminate solution"; *INDUSTRIAL CERAMICS*; 23; 3; 1121-7588
- 2008; SCI, SCIE, SSCI, A&HCl: I. Nikolić, D. Blečić, N. Blagojević; The influence of tartaric acid on the phenomena of Al(OH)<sub>3</sub> crystallization from the caustic soda solution; *Chemical Industry & Chemical Engineering Quarterly*; 14(1); 39-45; 1451-9372
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- 2004; SCI, SCIE, SSCI, A&HCl: M. M. Krgović, N. Z. Blagojević, N. Blagojević; Comparative possibilities of using limestone Visočica and dolomite Virpazar as fillers in paper production; *Chemical Industry*; 58(5); 201-258; 2047-6329
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- 2003; SCI, SCIE, SSCI, A&HCl: L.B. Pfenđ, V.L. Vukašinić, N.Z. Blagojević, M.P. Radjojević; "Second order derivative spectrophotometric method for determination of vitamin C content in fruits, vegetables and fruit juices"; *European Food Research and Technology*; 217; 269-272; 1438-2377
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- 2001; SCI, SCIE, SSCI, A&HCI; N.Z. Blagojević, R.M. Zejnilović and M.K. Krgović; "Examination of acid lye reaction of red mud from the Alumina factory in Podgorica"; *Res. J. Chem. Environ.*; 5(4); 7-12; 0972-0626
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- 1996; SCI, SCIE, SSCI, A&HCI; R.M. Zejnilović, N. Blagojević, V.D. Jović, A.R. Despić; "Direct stripping voltammetric method for the determination of small concentrations of one component in binary alloys"; *Analytica Chimica Acta*; 327; 107; 0003-2670

УНИВЕРЗИТЕТ ЦРНЕ ГОРЕ

Ул. Цетињска бр. 2  
П. бр. 99  
81000 ПОДГОРИЦА  
ЦРНА ГОРА  
Телефон: (020) 414-255  
Факс: (020) 414-230  
E-mail: rektor@ucg.me



UNIVERSITY OF MONTENEGRO

Ul. Cetinjska br. 2  
P.O. BOX 99  
81 000 PODGORICA  
MONTENEGRO  
Phone: (+382) 20 414-255  
Fax: (+382) 20 414-230  
E-mail: rektor@ucg.me

Број: 08-701  
Датум, 29.04.2010 г.

Ref: \_\_\_\_\_  
Date: \_\_\_\_\_

УНИВЕРЗИТЕТ ЦРНЕ ГОРЕ  
Универзитет Црне Горе  
Бр. 1019  
Подгорица, 29.04.2010 год

Na osnovu člana 75 stav 2 Zakona o visokom obrazovanju (Sl.list RCG br. 60/03) i člana 18 Statuta Univerziteta Crne Gore, Senat Univerziteta Crne Gore, na sjednici održanoj 29.04.2010. godine, donio je

## ODLUKU O IZBORU U ZVANJE

Dr DRAGO MARIĆ bira se u akademsko zvanje redovni profesor Univerziteta Crne Gore za predmete: Evolucija, Biogeografija i Metode u ekološkim istraživanjima na Prirodno-matematičkom fakultetu.

  
REKTOR  
Prof.dr Predrag Miranović

## CURRICULUM VITAE

### Of Full Professor Dr Drago S. Marić

#### DATE AND PLACE OF BIRTH

October 10th, 1954 in Bosansko Grahovo (Bosna and Hercegovina).

#### ADDRESS

Faculty of Sciences, G. Washington Street, PoBox 5455.Tel./Fax: ++ 381/81/243-816;

E-mail: dragomrc@yahoo.com

#### NATIONALITY

Montenegro

#### EDUCATION

1. High School (Gymnasium) in Bosansko Grahovo.
2. Faculty of Sciences (Biology), Sarajevo, 1973.
3. Postgraduate studies and Master Degree, Faculty of Sciences, Novi Sad, 1994.
4. Doctor Scientiae, Faculty of Sciences Kragujevac, 1998.

#### OFFICIAL INTERNATIONAL SCIENTIFIC MISSIONS

##### USA

- Auburn University, Faculty of Agriculture -1986

##### France

- Universite des Sciences et Techniques du Languedoc, Montpellier –2003.
- Universite de Provanse, Laboratoire de hydrobiologie. Marseille-2001, 2002, 2003.

##### Germany

- Bundesforschungsanstalt für fischerei (BFA), Hamburg, 1982, 1983, 1985.
- University of Heidelberg, Department of Zoology, 2002

##### Greece

- University of Thessaloniki, Greece – 2000
- University of Ioannina, Department Messolonghi, 2008

#### KNOWLEDGE OF LANGUAGES

1. English (speak, read,)
2. Russian (read, speak and write slightly)

#### EMPLOYEMENT RECORD

1978.- assistant at the Institute of Medical and Biological Research (IBMI), Podgorica, Montenegro

1984.- senior assistant at IBMI, Podgorica, Montenegro

1993.- senior assistant at the University of Montenegro, Podgorica, (Faculty of Sciences).

1998.- Assistant Professor at the University of Montenegro, Podgorica, (Faculty of Sciences).

1998 - 2003. - Head, Department of Biology, Faculty of Sciences, Podgorica, Montenegro

2004. Associated Professor at the University of Montenegro, Podgorica, (Faculty of Sciences).

2010. Full Professor at the University of Montenegro, Podgorica, (Faculty of Sciences).

#### ENGAGEMENTS IN THE SCIENTIFIC PROJECTS

In the last 10 years, engaged as follows.

1. as assistant - 2 projects (2 international - cooperation with Germany).

2. as assistant - 1 projects (international - cooperation with France).

3. as assistant - 2 projects (international - cooperation with Greece)

The main topics of projects: fish biology and ecology, Aquaculture, living resources and its protection.

## MEMBERSHIPS IN THE SCIENTIFIC ASSOCIATIONS

International:

1. European Ichthyological Union (EIU)

2.

## OTHER ACTIVITIES

Committee for Flora and Fauna (Montenegrin Academy of Sciences)

Committee for Encyclopedia Montenegrina (Montenegrin Academy of Sciences)

National Committee for Biological safety, Federal Government

## PUBLICATIONS -major publications

### Doctoral thesis

Adaptacija introdukovanog srebrnog karaša (*Carassius auratus gibelio* Bloch,1783.) u Skadarskom jezeru [Adaptation of Introduced German Carp (*Carassius auratus gibelio* Bloch,1783) in Skadar Lake]. Doktorska disertacija, pp 268. Kragujevac, 1998.

### Papers

MARIĆ, D. 1989. The species revision of genus *Rutilus* Rafinesque, 1820 (Pisces) from western part of Balkan peninsula. *Glasnik Republičkog zavoda za zaštitu prirode*, 21: 55 - 79.

KRIVOKAPIĆ, M. and MARIĆ, D. 1993. Fishes of the Tara River. *Ichthyologia*, 25 (1): 41-49.

MARIĆ, D. (1995). Endemic fish species of Montenegro. *Biological Conservation*, 72: 187-194.

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MARIĆ, D. 2004. Distribution and abundance of introduced german carp *Carassius auratus gibelio* (Bloch) in the Lake Skadar in period 1972-1992. *Glasnik Republičkog zavoda za zaštitu prirode*. 27-28: 113-126.

MARIĆ, D. 2004. Meristic characters of introduced german carp (*Carassius auratus gibelio* Bloch, 1783) from Skadar Lake (Montenegro). *Glasnik Republičkog zavoda za zaštitu prirode*. 27-28: 151-164.

MARIĆ, D. & PAVLOVIĆ, V. 2006. First records and description of *Cobitis elongata* Heckl & Kner, 1858 (Cobitidae) in Montenegro. *Natura montenegrina*, 6: 125-134.

Talevski T, Milosevic D, **Maric D**, Petrovic D, Talevska M, Talevska A. 2009. Biodiversity of ichthyofauna from Lake Prespa, Lake Ohrid and Lake Skadar, *Biotechnology and Biotechnological Equipment*. Special Edition (XI anniversary scientific conference 120 years of academic education in biology, 45 years faculty of biology), 23 (2): 400-404. ISSN 1310-2818.

Talevski T, Milosevic D, **Marić D**, Petrovic D, Talevska M, Talevska A 2009. Antropogenic Influence on Biodiversity of ichthyofauna and Macrophyte Vegetation from Lake Ohrid and Lake Skadar. *J. Int. Environmental Application & Science*, Vol. 4 (3): 317-324.

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Gilles, A., Costedoat, C., Barascud, B., Voisin, A., Banarescu, P., Bianco, P. G., Economidis, P. S., **Marić, D.** & Chappaz, R. 2010. Speciation pattern of *Telestes souffia* complex (Teleostei, Cyprinidae) in Europe using morphological and molecular markers. *Zoologica Scripta*, 39 (3): 225–242.

Marić, S. D., Rakočević, V. J. & **Marić, S. D.** 2010. Diversity and distribution of species from the genus *Barbus* in waters of Montenegro. *Natura Montenegrina*, 9 (2): 169-182.

Zupančić, P., **Marić, D.** Naseka, M. A & Bogutskaya, G. N. 2010. *Squalius platyceps*, a new species of fish (Actinopterygii: Cyprinidae) from the Skadar Lake basin. *Zoosystematica Rossica*, 19 (1): 154–167.

Marić, D. & Milošević, D. 2010. First records and description of the Goldside loach *Sabanijevia balcanica* (Cobitidae) in Montenegro. *Periodicum Biologorum* 112 (2): 149–152.

Marić, D. 2010. *Rutilus albus* sp. N. (Cyprinidae) from Skadar Lake. *Periodicum Biologorum*, 112 (2): 153–158.

Milošević D, Winkler KA, **Marić D**, Weiss S. 2011. Genotypic (genetic) and phenotypic evaluation of *Rutilus* sp. from Skadar, Ohrid and Prespa Lakes supports revision of endemic as well as taxonomic status of several taxa. *Journal of Fish Biology* 79: 1094-1110.

Milošević, D & **Marić, D.** 2012. Length-Weight Relationship and Conditions factor of *Cyprinus carpio* from Lake Skadar (Montenegro) during spawning period. *Agriculture & Forestry*, vol 52 (06) (1-4): 53-60.

Milošević, D., Pešić, V., Petrović, D., Pavićević, A. and **Marić, D.** 2012. Length-Weight Relationship and Conditions factor of two sympatric *Rutilus* (Rafinesque, 1820) species from Lake Skadar (Montenegro). *Arch. Biol. Sci.*, Belgrade, 64 (3), 991-994.

**Marić, D.**, Rakočević, J. 2014: Some Life-History Traits of the Adriatic Brown Trout, *Salmo farioides* (Karaman, 1938) (Salmonidae) from the Morača River (Montenegro). *Acta zoologica bulgarica*, 66 (4): 539-546

Rakocevic, J., Sukovic, D., **Marić, D.** 2018. Distribution and Relationships of Eleven Trace Elements in Muscle of Six Fish Species from Skadar Lake (Montenegro). *Turkish Journal of Fisheries and Aquatic Sciences*, 18: 647-657.

### Books and Monographs

Marić, D. 2009. Bibliography on fishery-ichthyological investigations in Montenegro (150 years of research) JU "Prirodnjački muzej Crne Gore", posebno izdanje No 5 140 p.

**Marić, D. and Milošević, D. (2011).** Katalog slatkovodnih riba (Osteichthyes) Crne Gore Crnogorska akademija nauka i umjetnosti. Katalozi 5, Knjiga 4. Podgorica. pp 114.

Marić, D., Rakočević, J. 2010. Biodiversity. Montenegro in the 21st century - the era of competitiveness: Environment and Sustainable Development ed. Mihailo Burić. Montenegrin Academy of Science and Art, book 73/2 pp 113-150.

#### **University textbooks**

Marić, D., Rakočević, J. Hydrobiology. University of Montenegro. 352 p.

#### **Participated in scientific research projects (=fishery-ichthyology)**

1. "Limnološka istraživanja akumulacionog jezera Piva" [**„Limnology studi artifical Lake Piva”**] (1976-1980).
2. "Proučavanje mogućnosti razvoja ribarstva u akumulacijama Krupac i Slano i njihovom užem slivnom području" [**“The study possibilities of development of fisheries in reservoirs Slano and Krupac and their narrow catchment area”**] (1978-1980).
3. "Izučavanje mogućnosti razvoja i unapredjenja ribolova na Skadarskom jezeru" [**“Studying the possibilities of development and improvement of fishing on Lake Skadar”**] (1977-1980).
4. Hematološka i parazitološka istraživanja riba Skadarskog jezera i Bokokotorskog zaliva kao značajnih parametara za zaštitu životne sredine i "akvakulturu" [**“Hematological and parasitological studies of fish Skadar Lake and the Bay of Kotor as important parameters for environmental protection and aquaculture ”**] International Project, Međunarodni projekat, Univerzitet u Hamburgu. (1979-1983).
5. "Hidrobiološke karakteristike rijeke Morače i njenog sliva" [**“Hydrobiological characteristic of the drainage basin of Morača”**] (1980-1983).
6. "Hidrobiološka, antropološka i genetička istraživanja u basenu Skadarskog jezera i problemi njegove zaštite" [**“Hydrobiological, anthropological and genetic studies in the basin of Lake Skadar and the problems of its protection”**] (1982-1984).
7. "Biološka proučavanja rijeka Tare s posebnim osvrtom na mogućnosti prirodnog i industrijskog zagadjenja" [**“Biological studies of Tara, with special emphasis on the possibilities of natural and industrial pollution ”**] (1981-1985).
8. "Biološka i ekonomska valorizacija hidroakumulacija i njihovog slivnog područja u Crnoj Gori" [**“Biological and economic evaluation of hydro reservoirs and their catchment areas in Montenegro”**] (1981-1985).
9. "Iskorišćavanje prirodnih potencijala Skadarskog jezera kao izvora hrane i vode za piće i problemi zagadjenja i zaštite" [**“The exploitation of natural resources of Lake Skadar as a source of food and drinking water and pollution problems and protect”**] (1981-1985).
10. "Biološka i hemijska proučavanja voda sliva Čehotine s posebnim osvrtom na akumulaciju "Otilovići" u uslovima regionalne industrijalizacije" [**“Biological and chemical studies of water catchment Čehotina with special emphasis on the accumulation of" Otilovići "in terms of regional industrialization”**] (1983-1987).
11. "Mogućnosti razvoja akvakulture na Skadarskom jezeru" [**„Possibilities of aquaculture development in the Skadar Lake ”**] (1984-1987). (Međunarodni projekat, USA-Univerzitet u Auburnu). International Project, University of Auburn).
12. "Hidrobiološka proučavanja životnih zajednica i hidrohemijska istraživanja rijeke Tare i njenih pritoka" [**“Hydrobiological study of living communities and hydrochemical studies of the Tara River and its tributaries”**] (1987-1990).
13. "Integralni sistem za kaveznu proizvodnju salmonidnih riba" [**“Integrated cage system for breeding salmonid fish”**] (1990-1994).
14. "Biološka proučavanja u slivu rijeke Morače" [**“Biological studies in the basin of the river Moraca”**] (1990-1994).

15. "Istraživanja prirodnih karakteristika bazena Skadarskog jezera, u cilju njegove zaštite unapredjenja i racionalnog iskorišavanja" ["**Studies on the natural characteristics of the Skadar Lake basin, in order to improvement its protection and rational utilization**"] (1991-1994).
16. Praćenje endemičnih, rijetkih i ugroženih vrsta riba u slivu Skadarskog jezera u cilju zaštite biodiverziteta i genofondova Nacionalnog parka ["**Monitoring the endemic, rare and endangered fish species in the basin of Lake Skadar to protect biodiversity and gene pool of the National Park**"] (1996-1998).
17. Integrated Monitoring of Skadar Lake/Lake Shkoder (2000-2003), **International Project**, međunarodni projekat u saradnji sa Univerzitet u Haidelbergu i Univerzitet u Skadru.
18. Connaissance de la Biodiversite Ichthyque Endemique du systeme Ohrid-Drim-Lac Skadar 2001-2003) **International Project**, saradnja sa Francuskom i Albanijom (Međunarodni projekat).
19. "EULIMNOS – Integrated Monitoring of Skadar Lake" (HRK-the project leader institution) <http://www.eulimnos.org> (2002-2004) **International Project**.
20. "Comparative study of fish parasites biodiversity from Kavala (Aegean sea), Messolonghi bay (Ionian sea) and coast of Montenegro (Adriatic Sea). (2006-2008) **International Project**, saradnja sa Grčkom, međunarodni projekat -"Uporedna istraživanja biodiverziteta parazita riba sa područja Kavale (Egejsko more), zaliva Messolonghi (Jonsko more) i crnogorskog primorja (Jadransko more)".
21. "Fauna Crne Gore- katalog slatkovodnih riba Crne Gore"["**Catalogue of freshwater fishes of Montenegro**"] (2007-2008).
22. "Istraživanja bioindikatora kontinentalnog akvatorijuma Crne Gore" ["**Studies on bio-indicators of continental aquatorium of Montenegro**"] (2007-2010).
23. Fauna Crne Gore: 'Katalog slatkovodnih riba Crne Gore [**Fauna of Montenegro- "Catalogue of freshwater fishes of Montenegro"**] (2008-2009).
24. Crna Gora u XXI stoljeću-u eri kopetitivnosti: Projekat- Životna sredina i održivi razvoj (Rukovodilac M. Burić), Biodiverzitet ["**Montenegro in the 21st century - the era of competitiveness: Environment and Sustainable Development, Biodiversity**"]. Montenegrin Academy of Science and Art (2009-2010).
25. "Fauna Crne Gore- Fauna slatkovodnih riba Crne Gore" ["**Fauna of Montenegro- Freshwater fish fauna of Montenegro**"] (2010-2011).
26. Monitoring Biodiverziteta u Crnoj Gori za 2012 . Prirodnjački muzej Crne Gore – Agencija za zaštitu životne sredine (2013) ["**Monitoring biodiversity of Montenegro for 2012.**"].

#### Scientific and technical expertise (fishery-ichthyology)

1. „Stanje ribljeg fonda akumulacije Krupac na koti 12” ["**State of fish stocks Krupac reservoir at elevation 612**"] (1979).
2. "Mogućnost razvoja ribarstva u vodama Nikšića ["**Possibility of Development of Fisheries in water of Nikšić**"] (HE "Peruica" - Nikšić, 1981).
3. "Ribarska osnova za vode NP "Durmitor" ["**Possibility of Development of Fisheries (Fisheries assessment) in waters of the NP "Durmitor"**] Žabljak (1982).
4. "Hemijski i biološki kvalitet voda rijeke ehotine i nekih njenih pritoka" TE "Pljevlja" ["**Chemical and biological quality of rivers Čehotina and some of its tributaries "Pljevlja"**] (1981-1982).
5. "Ribarska osnova sa analizom hemijskog i biološkog kvaliteta voda rijeke ehotine i njenih pritoka" ["**Fisheries assessment with the analysis of chemical and biological water quality of the river and its tributaries Čehotina**"] (SO Pljevlja, 1983).
6. "Program studijskih istraživanja i idejnih rješenja HE "Tara" (profil Tepca) - polazna studija, tema: "Neke biološke karakteristike životnih zajednica" ["**The program of study and research of general solutions HE" Tara "(profile Tepca) - initial studies, the topic:" Some biological characteristics of living communities "**] (1985).



7. "Studija životnih zajednica i životnih uslova sliva rijeke Morače u svjetlu izgradnje novog izvora električne energije na rijeci Morači" ["**The study of living communities and living conditions of the river Moraca in the light of building a new power source on the river Moraca**"] (1985).
8. "Kompleksno stanje vodotoka i obalnog područja nizvodno od brane HE "Piva" do akumulacije HE "Baina Bašta" ["**A complex state of watercourses and coastal areas downstream of the dam, " Beers "the accumulation of HPP Bain Garden**"] (1978-1986).
9. "Program zaštite, unapredjenja i razvoja prirodnih bogatstava i dobara NP "Skadarsko jezero". Bazna studija-ichtiofauna ["**Program protection, improvement and development of natural resources and potential of NP Skadar Lake. " Base Study-ichthyofauna**"] (1987).

**Manager and principal investigator= head and chief researcher**

1. "Ribarska osnova Pivskog jezera sa pritokama" ["**Possibility of Development of Fisheries (Fisheries basis, fisheries assessment) of Piva Lake and its tributaries**"] (1995).
2. "Ribarska osnova sliva rijeke Tare i jezera NP "Durmitor" ["**Possibility of Development of Fisheries (Fisheries assessment) in River Tara Watershed and Lakes of NP "Durmitor"**] (1996).
3. "Mogućnost razvoja ribarstva u vodama Nikšića (jezera Krupac, Slano, Liverovići i rijeka zeta)" ["**Possibility of Development of Fisheries (Fisheries assessment) in water of Nikšić (Lakes Krupac, Slano, Liverovići and river Zeta)**"] (2003).
4. "Formiranje salmonidnih reprocentara za proizvodnju mlađa autohtonih ribljih vrsta" ["**Establishment of centers for the reproduction and production of fry of native species of salmonids**"] 2003-2005.
5. "Ribarska osnova eliva rijeke Morače" ["**Possibility of Development of Fisheries (Fisheries assessment) in River Morača Watershed**"] (2004).
6. "Ribarska osnova rijeke Lim i njenog slivnog područja" ["**Possibility of Development of Fisheries (Fisheries assessment) in River Lim Watershed**"] (2006).
7. "Biološko-ekološka istraživanja endemičnih i ugroženih vrsta salmonida u vodama Crne Gore" ["**Biological and ecological studies of endemic and endangered salmonids in the waters of Montenegro**"] (2005-2007).
8. "Ribarska osnova sliva rijeke Čehotine" ["**Possibility of Development of Fisheries (Fisheries assessment) in River Čehotina Watershed**"] (2007).
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27. **Marić, D.** (*Plenarni referat*) Izgradnja hidrosistema na rijeci Morači i moguće implikacije na ihtiofaunu. Međunarodni naučni skup zaštita prirode u XXI vijeku. Žabljak, 20-23. septembar 2011. godine.
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32. Rakočević, J., Šuković, D., **Marić, D.** 2017. Bioaccumulation of trace elements in muscle tissue of six fish species from Skadar Lake (Montenegro). VII International Symposium of the Ecologists in Montenegro (ISEM7), September 04-07. 2017. Sutomore, Abstract Book, pp 165.

### **Učeše u naučno-istraživačkim projektima**

1. "Limnološka istraživanja akumulacionog jezera Piva" (1976-1980).
2. "Proučavanje mogućnosti razvoja ribarstva u akumulacijama Krupac i Slano i njihovom užem slivnom području" (1978-1980).
3. "Izučavanje mogućnosti razvoja i unapredjenja ribolova na Skadarskom jezeru" (1977-1980).
4. Hematološka i parazitološka istraživanja riba Skadarskog jezera i Bokokotorskog zaliva kao značajnih parametara za zaštitu životne sredine i "akvakulturu" (1979-1983). Međunarodni projekat, Univerzitet u Hamburgu.

5. "Hidrobiološke karakteristike rijeke Morače i njenog sliva" (1980-1983).
6. "Hidrobiološka, antropološka i genetička istraživanja u basenu Skadarskog jezera i problemi njegove zaštite" (1982-1984).
7. "Biološka proučavanja rijeka Tare s posebnim osvrtom na mogućnosti prirodnog i industrijskog zagadjenja" (1981-1985).
8. "Biološka i ekonomska valorizacija hidroakumulacija i njihovog slivnog područja u Crnoj Gori" (1981-1985).
9. "Iskorišavanje prirodnih potencijala Skadarskog jezera kao izvora hrane i vode za pje i problemi zagadjenja i zaštite" (1981-1985).
10. "Biološka i hemijska proučavanja voda sliva ehotine s posebnim osvrtom na akumulaciju "Otilovići" u uslovima regionalne industrijalizacije" (1983-1987).
11. "Mogućnosti razvoja akvakulture na Skadarskom jezeru" (1984-1987). (Međunarodni projekat, USA- Univerzitet u Auburnu).
12. "Hidrobiološka proučavanja životnih zajednica i hidrohemijska istraživanja rijeke Tare i njenih pritoka" (1987-1990).
13. "Integralni sistem za kaveznu proizvodnju salmonidnih riba" (1990-1994).
14. "Biološka proučavanja u slivu rijeke Morače" (1990-1994).
15. "Istraživanja prirodnih karakteristika bazena Skadarskog jezera, u cilju njegove zaštite unapredjenja i racionalnog iskorišavanja" (1991-1994).
16. Praćenje endemičnih, rijetkih i ugroženih vrsta riba u slivu Skadarskog jezera u cilju zaštite biodiverziteta i genofondova Nacionalnog parka (1996-1998).
17. Integrated Monitoring of Skadar Lake/Lake Shkoder (2000-2003), međunarodni projekat u saradnji sa Univerzitet u Heidelbergu i Univerzitet u Skadru.
18. Connaissance de la Biodiversite Ichthyque Endemique du systeme Ohrid-Drim-Lac Skadar 2001-2003) saradnja sa Francuskom i Albanijom (Međunarodni projekat).
19. "EULIMNOS – Integrated Monitoring of Skadar Lake" (HRK-the project leader institution) <http://www.eulimnos.org> (2002-2004)
20. "Comparative study of fish parasites biodiversity from Kavala (Aegean sea), Messolonghi bay (Ionian sea) and coast of Montenegro (Adriatic Sea). (2006-2008) saradnja sa Grčkom, međunarodni projekat - "Uporedna istraživanja biodiverziteta parazita riba sa područja Kavale (Egejsko more), zaliva Messolonghi (Jonsko more) i crnogorskog primorja (Jadransko more)".
21. "Fauna Crne Gore- katalog slatkovodnih riba Crne Gore" (2007-2008).
22. "Istraživanja bioindikatora kontinentalnog akvatorijuma Crne Gore" (2007-).
23. Crna Gora u XXI stoljeću-u eri kompetitivnosti: Projekat- Životna sredina i održivi razvoj (Rukovodilac M. Burić), Biodiverzitet (2009-2010) CANU.
24. "Fauna Crne Gore- Fauna slatkovodnih riba Crne Gore" (2010-2012).
25. Monitoring Biodiverziteta u Crnoj Gori za 2012 . Prirodnjački muzej crne Gore – Agencija za zaštitu životne sredine (2013)

### Naučno-stručne ekspertize

1. "Stanje ribljeg fonda akumulacije Krupac na koti 612" (1979).
2. "Ribarska osnova voda Nikšića" (HE "Peruica" - Nikši, 1981).
3. "Ribarska osnova Nacionalnog parka "Durmitor" Žabljak (1982).
4. "Hemijski i biološki kvalitet voda rijeke ehotine i nekih njenih pritoka" TE "Pljevlja" (1981-1982).
5. "Ribarska osnova sa analizom hemijskog i biološkog kvaliteta voda rijeke ehotine i njenih pritoka" (SO Pljevlja, 1983).
6. "Program studijskih istraživanja i idejnih rješenja HE "Tara" (profil Tepca) - polazna studija, tema: "Neke biološke karakteristike životnih zajednica" (1985).
7. "Studija životnih zajednica i životnih uslova sliva rijeke Morače u svijetlu izgradnje novog izvora električne energije na rijeci Morači" (1985).
8. "Kompleksno stanje vodotoka i obalnog područja nizvodno od brane HE "Piva" do akumulacije HE "Baina Bašta" (1978-1986).
9. "Program zaštite, unapredjenja i razvoja prirodnih bogatstava i dobara NP "Skadarsko jezero". Bazna studija-ihtiofauna (1987).



## Rukovodilac i istraživač u studijama i ekspertizama

01. "Ribarska osnova Pivskog jezera sa pritokama" (1995).
02. "Ribarska osnova sliva rijeke Tare i jezera NP "Durmitor" (1996).
03. "Ribarska osnova voda nikšikog regiona (jezera Krupac, Slano, Liverovići i rijeka Zeta) (2003).
04. Formiranje salmonidnih reprocentara za proizvodnju mlada autohtonih ribljih vrsta (2003).
05. "Ribarska osnova sliva rijeke Morače (rijeka Morača, Cijevna i Zeta)" (2004).
06. "Ribarska osnova sliva rijeke Lim (sa Plavskim jezerom i pritokama)" (2006).
07. "Biološko-ekološka istraživanja endemičnih i ugroženih vrsta salmonida u vodama Crne Gore" (2005-2007).
08. "Ribarska osnova sliva rijeke Čehotine" (2007).
09. "Ribarska osnova sliva rijeke Pive" (2008-2009).
10. "Ribarska osnova za područje opštine Nikšić" (2013).
11. „Rinarska osnova za sliv gornjeg toka rijeke Tare (opštine Kolašin i Mojkovac)" (2014)

## Druge stručne aktivnosti:

- Davanje mišljenja i predloga vezanih za ribolov i ribarstvo u Crnoj Gori,
- Davanje mišljenja o zaštiti vodenih ekosistema,
- Učestvovao na izradi zakona o slatkovodnom ribarstvu
- Stručni konsultant kod Ministarstva poljoprivrede, šumarstva i vodoprivrede, Zavoda za zaštitu prirode, JP Nacionalni park "Skadarsko jezero" po pitanjima ribarstva i zaštite životne sredine,
- Stručni saradnik na izradi Crnogorskog riječnika, CANU,
- Izrada tehničko-tehnoloških projekata za uzgoj pastrmki, šaranskih i morskih vrsta riba,
- Predsjednik komisija za utvrđivanje ispunjenosti uslova ribnjaka za komercijalni rad,
- Radio na izradi više projektnih zadataka vezanih za iskorišavanje prirodnih resursa.
- Bio Predsjednik ili član komisija za ocjenu projekata za izdavanje koncesija,
- Predsjednik ili član komisija za ocjenu planova i porograma u ribarstvu,
- Izrada (član ekipe) elaborata o uticaju na životnu sredinu i sl.
- Član komisije za ocjenu opravdanosti izgradnje hidroelektrane „Buk Bijela“ – 2004.
- Član većeg broja komisija za ocjenu studija o uticaju na životnu sredinu.
- Ekspert – konsultant na Projektu: EAR Project in Montenegro 05mon02: Suport to the Fishery Sector (2007/08)
- Član stručnog tima za izradu prostornog plana crne Gore,
- Član Odbora za faunu i floru CANU 1998-)
- Član redakcije časopisa "Natura Montenegrina" ( 2001 - )
- Član naučnih i organizacionih odbora međunarodnih i domaćih simpozijuma i kongresa,
- Recenzent u više naučnih radova u domaćim i međunarodnim časopisima
- Član naučnog savjeta JU NP Crne Gore (2007 - )
- Saradnik u više naučno-popularnih časopisa.
- Član komisije za ocjenu Studija o procjeni uticaja na životnu sredinu za izgradnju hidroelektrana „Buk Bijela“ i „Foča“ na rijeci Drini republika Srpska i hidroelektrana „Brodarevo 1“ i „Brodarevo 2“ na rijeci Limu republika Srbija -2013. godina.
- Član stručne ekipe za izradu studije strateška procjena uticaja na životnu sredinu DSL "Mihailovići" – Skadarsko jezero
- Rukovodioc ili član ekspertskih ekipa za utvrđivanje „nultog stanja vodenih ekosistema”,
- Rukovodioc ili član ekspertskih ekipa za monitoring na vodenim ekosistemima,
- Član komisije za inoviranje planova i programa na Studijskoj grupi za biologiju (bečelor, specijalističke, master i doktorske studije) po novom „Bolonjsko" programu.
- Član komisije za akreditaciju postdiplomskih specijalističkih studija Zaštita životne sredine na metalurško-tehnološkom fakultetu u Podgorici.
- Profesor, nastavnik, na osnovnim, specijaliističkim i doktorskim stunijama na PMF, univerzitet Crne Gore,
- Profesor, nastavnik, na PF, Univerzitet Crne Gore (predmet Ribarstvo),
- Mentor, diplomcima, postdiplomcima i doktorandima,
- Predsjednik ili član u komisijama za odbranu diplomskih, specijalističkih i doktorskih radova (teza),
- Recezent - udžbenika i knjiga,
- Recezent pri izboru zvanja za nastavnike i stručna i naučna zvanja,
- Predsjednik ili član komisija za polaganje stručnih i državnih ispita (u nastavi i nauci),
- Intervjui i naučna mišljenja u sredstvima javog informisanja (radio, TV i štampani mediji)
- Zvanični sudski vještak iz oblasti biologije (2008 -)

# УНИВЕРЗИТЕТ ЦРНЕ ГОРЕ

Ул. Цетинска бр. 2  
П. факс 99  
81000 ПОДГОРИЦА  
ЦРНА ГОРА  
Телефон: (020) 414-255  
Факс: (020) 414-230  
E-mail: rektor@uc.me



# UNIVERSITY OF MONTENEGRO

Ul. Cetinjska br. 2  
P.O. BOX 99  
81 000 PODGORICA  
MONTENEGRO  
Phone: (+382) 20 414-255  
Fax: (+382) 20 414-230  
E-mail: rektor@uc.me

Број: 08-2694  
Датум: 19.12.2013 г.

УНИВЕРЗИТЕТ ЦРНЕ ГОРЕ  
Природно-математички факултет  
Број: 1981  
Подгорина, 19.12.2013 год.

Ref: \_\_\_\_\_  
Date: \_\_\_\_\_

Na osnovu člana 75 stav 2 Zakona o visokom obrazovanju (Sl.list RCG, br. 60/03 i Sl.list CG, br. 45/10 i 47/11) i člana 18 stav 1 tačka 3 Statuta Univerziteta Crne Gore, Senat Univerziteta Crne Gore, na sjednici održanoj 19.12.2013. godine, donio je

## ODLUKU O IZBORU U ZVANJE

Dr VLADIMIR PEŠIĆ bira se u akademsko zvanje **redovni profesor** Univerziteta Crne Gore za predmete: Invertebrata I, Invertebrata II i Ekologija životinja I na Prirodno-matematičkom fakultetu.

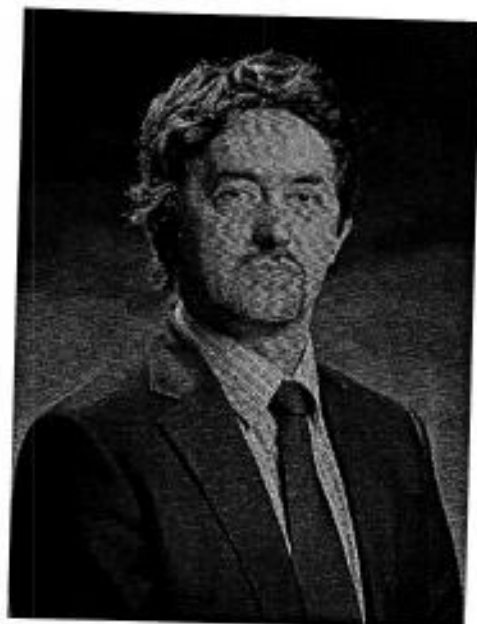


REKTOR

*Miranović*  
Prof. dr Predrag Miranović

# CURRICULUM VITAE

EUROPEAN FORMAT



## PERSONAL INFORMATION

Name, Surname	Vladimir, Pešić
Address House number, street name, postcode, city, country	Faculty of Natural Sciences and Mathematics, Department of Biology, University of Montenegro, Džordža Vašingtona bb, 81000 Podgorica, Montenegro
Telephone	+382 67 236 351
Fax	+382 20 244 608
E-mail	vladopesic@gmail.com
Website	<a href="http://www.ucg.ac.me/objava/blog/17454/objava/1-biografija-pesic-vladimir">http://www.ucg.ac.me/objava/blog/17454/objava/1-biografija-pesic-vladimir</a> <a href="https://www.researchgate.net/profile/Vladimir_Pesic">https://www.researchgate.net/profile/Vladimir_Pesic</a>
Place and Date of birth	Podgorica, 06.09.1973

## WORK EXPERIENCE

<i>[Dates (from – to)</i>	06.06.1973	Born in Podgorica, Montenegro.
	1980-1988	Primary school in Podgorica
	1988-2002	Gymnasium "Slobodan Škerović" in Podgorica
	2003-2008	Undergraduate studies from general biology at the Department of Biology, University of Montenegro
<i>[Add separate entries for each relevant post occupied, starting with the most recent.]</i>	1998-2003	Work as Assistant at Department of Biology of the University of Montenegro in Podgorica
	2001	Master thesis at the Faculty of Biology of the University of Belgrade, Serbia
	2003	PhD thesis at the Faculty of Biology of the University of Belgrade, Serbia: "Taxonomical, ecological and zoogeographical study on water mites of the central part of Balkan Peninsula"
	2004-2008	Work as Assistant Professor at Department of Biology of the University of Montenegro at the academic courses: "Zoology of

	2009 –2013	Invertebrates" and "Ecology of Animals" and master courses: "Conservation Biology", "Principles of Sustainable Development" and "Crenobiology and Ecology of Groundwater".
	2007 – 2013	Work as Associate Professor at Department of Biology of the University of Montenegro
	Since 2013 – Cont.	Head of Department of Biology of the University of Montenegro
	2014– 2017	Work as Full Professor at Department of Biology of the University of Montenegro President of Scientific Board of University of Montenegro
Name and address of employer	University of Montenegro	
Type of business or sector	Public	
Occupation or position held	Full Professor	

### EDUCATION AND TRAINING

Dates (from – to)	2003	PhD thesis at the Faculty of Biology of the University of Belgrade, Serbia
Add separate entries for each relevant course you have completed, starting with the most recent.	2001	Master thesis at the Faculty of Biology of the University of Belgrade, Serbia
	2003-2008	Undergraduate studies from general biology at the Department of Biology, University of Montenegro
Name and type of organisation providing education and training	University of Belgrade	
Principal subjects occupational skills covered	Ecology and Biodiversity Research	
Title of qualification awarded	PhD	
/ Level in National classification	Level VIII	

### RESEARCH ACTIVITIES

Research sectors	<p>There are four avenues of research in which I am mainly interested and which are partly interlinked:</p> <ol style="list-style-type: none"> <li>1 Biodiversity, ecology, taxonomy and zoogeography of aquatic invertebrates, with special regard to water mites (Hydrachnidia) and freshwater gastropods;</li> <li>2 Ecological research in springs ecosystem;</li> <li>3 Ecology of Intermittent Rivers and Ephemeral Streams.</li> <li>4 Environmental Monitoring</li> </ol>
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I described more than 300 species new for science from all parts of the world.

List of articles available at [https://www.researchgate.net/profile/Vladimir\\_Pesic](https://www.researchgate.net/profile/Vladimir_Pesic)

## Books and Articles

## Books

- Pešić, V., Karaman G., Kostianoy, A. (2018) (Eds.) Lake Skadar/Shkodra Environment. The Handbook of Environmental Chemistry, vol 80. **SPRINGER, Cham** 508 pp. ISBN 978-3-319-99249-5. DOI 10.1007/978-3-319-99250-1
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#### Plenary lectures at International Symposia

- Pešić, V., Hadžlablahović, S. & Pavićević, A. (2012) Skadar Lake – biodiversity of an young ancient lake. In: Dursun, S., Zuchetti, M., Vosniakos, F & Mankolii, H. (2012) *Abstract Book Essays on Ecosystem and Environmental Research*, International Conference of Ecosystems (ICE), Tirana, Albania, June 1-6, 2012, p.17.
- Pešić, V. & Hadžlablahović, S. (2006) Biodiversity of Montenegro – a challenge for Ecology, Protection of the Environment and Sustainable Development. In: Pešić, V. & Hadžlablahović, S. (Eds.) *The Book of Abstracts and Programme, II International Symposium of Ecologists of Montenegro*. Kotor, 20-25.09.2006, p.26

#### Invited lectures

- Pešić, V. (2012) Diversity of water mites. Minisymposium: Biodiversity of Invertebrate in Korea & World. Hanyang University, Seoul, South Korea, 13.04.2013

#### Projects

- 2010: Scientific Cooperation and Technology Transfer for the Development of a Fish-based Assessment Method of surface Waters Ecological Status. Institution: Hellenic Centre for Marine Research (Greece) and University of Montenegro (Montenegro). Project Leader.
- 2008-2011: Aquatic Coleoptera as bioindicator of freshwater ecosystems of Montenegro. Project financed by Ministry of Science of Montenegro. Project Leader.
- 2012-2015: Impact of climatic changes on Biodiversity of the freshwater ecosystems of Montenegro. Project financed by Ministry of Science of Montenegro. Leader of Project.
- 2012-2014: Systematic and conservational assessment of freshwater biodiversity of Montenegro. Institution: University of Natural Resources (BOKU), Vienna (Austria), and University of Montenegro (Montenegro). Leader of Montenegrin team.
- 2015-2016: Meiofauna as an environmental bio-indicator in marine ecosystems of Montenegro and Turkey. University of Montenegro (Montenegro) and University of Sinop (Turkey). Leader of Montenegrin team.
- 2016-2018: The first study of ecology and biology of species the snail genus *Montenegrina* in Montenegro. Natural History Museum Vienna, Austria and University of Montenegro. Leader of Montenegrin team.
- 2019-2020: DNA barcode reference library as a tool for sustainable management of freshwater ecosystems in the highly threatened Lake Skadar Basin. Project financed by Ministry of Science of Montenegro. Project Leader.
- 2019: Monitoring of the Benthos of River Tara – Impact of Bar-Bojare highway. Project financed by Ministry of Sustainable Development and Tourism. Leader and Principal investigator.



### University Book

- Pešić, V., Crnobrnja-Isailović, J. & Tomović, Lj. (2009) Principles of Ecology. University of Montenegro, 191 pp. ISBN: 978-86-7664-073-7.
- Pešić, V. & Tomović, Lj. (2010) Ecology Practicum. University of Montenegro, 108 pp. ISBN: 978-86-7664-094-2.

### Books

- Andrijašević, Ž., Vojvodić, R., Stanišić, P., Pešić, V. (2017) In Defense of Autonomy of the University of Montenegro. 93 days of combat. Why? DOO OKF, Cetinje ISBN: 978-9940-36-071-9

### Mentorship and Editorial work

#### PhD Dissertation

1. Ana Pavičević: Sezonska dinamika makroinvertebrata Mreze I Rimanča sa posebnim osvrtom na vodene Coleoptera. *Univerzitet Crne Gore, Prirodno-matematički fakultet*. December 2011.
2. Lidija Polović: Morfološke odlike i karakteristike reprodukcije endemičnog gubera *Algyroides nigropunctatus* (Duméril et Bibron, 1839) (Lacertina: Lacertidae) sa Skadarskog jezera. *Univerzitet Crne Gore, Prirodno-matematički fakultet*. November 2012.
3. Miloje Šundić, Diverzitet i ekologija terestričnih Parasitengona (Acari: Prostigmata) Crne Gore. *Univerzitet Crne Gore, Prirodno-matematički fakultet*. 2014.
4. Bogić Gligorović, Faunistička i ekološka studija izvora u slivu Skadarskog jezera, sa posebnim osvrtom na faunu Odonata i Hemiptera. *Prirodno-matematički fakultet*. 2019.

#### Editor-in-Chief

ECOLOGICA MONTENEGRINA  
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#### Member of Editorial Bord of the Journals

ZOOTAXA (Editor for Hydrachnidia)(SCIE)  
ZOOKEYS (Editor for Hydrachnidia)(SCIE)  
ACAROLOGIA (indexed by SCIE)  
ZOOLOGY OF THE MIDDLE EAST (SCIE)  
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MARINE BIOLOGICAL JOURNAL  
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EURASIAN JOURNAL OF BIOSCIENCES  
PERSIAN JOURNAL OF ACAROLOGY  
ECOLOGIA BALKANICA  
BIOLOGICA NYSSANA  
JOURNAL OF ECOSYSTEMS AND ECOLOGY SCIENCE  
NATURA MONTENEGRINA  
TURKISH JOURNAL OF ZOOLOGY (2010-2015, SCIE)

- Pešić, V. (2004) (Ed). The Biodiversity of the Biogradska Gora National Park. Monographies I, Department of Biology, University of Montenegro & Centre for Biodiversity of Montenegro, 150pp.
- Pešić, V. & Hadžialahović, S. (Eds) Proceedings of the Symposium, II International Symposium of Ecologists of Montenegro, Kotor, 20-25.09.2006, 500 pp. ISBN 86-908743-0-5.
- Pešić, V. & Hadžialahović, S. (Eds) The Book of Abstracts and Programme, II International Symposium of Ecologists of Montenegro, Kotor, 20-25.09.2006, 146 pp. ISBN: 86-908743-1-3.
- Pešić, V. (Ed) The Book of Abstracts and Programme, III International Symposium of Ecologists of Montenegro, Herceg Novi, 08-12.10.2008, 196 pp. ISBN 978-86-908743-2-3.
- Pešić, V. (Ed) The Book of Abstracts and Programme, VI International Symposium of Ecologists of Montenegro, Budva, 06-10.10.2010, 166 pp. ISBN 978-86-908743-3-0.
- Pešić, V. (Ed) The Book of Abstracts and Programme, V International Symposium of Ecologists of Montenegro, Tivat, 02-05.10.2013, 150 pp. ISBN: 978-86-908743-4-7
- Pešić, V. & Hadžialahović, S. (Editori) The Book of Abstracts and Programme, VI International Symposium of Ecologists of Montenegro, Ulcinj, 15-18.10.2015, 81 ppr. ISBN: 978-86-908743-5-4.
- Pešić, V. & Hadžialahović, S. (Eds) The Book of Abstracts and Programme, VII International Symposium of Ecologists of Montenegro, Sutomore, 4-7.10.2017, 81 ppr. ISBN: 978-86-908743-7-8

### Awards

- 2014: Award from Ministry of Sciences in the category: Best Montenegrin scientist in 2014.  
2014: Award from University of Montenegro in the category: Best scientist in 2014.

### New species named after me

- Bithynia pesici* Glöer & Yildirim, 2006 (Turkey)  
*Lanzala pesici* Glöer, Grego, Erdős & Fehér, 2015 (Montenegro)  
*Gordius pesici* Schmidt-Rhaesa, 2010 (Montenegro)  
*Galumna vladopesici* Ermilov & Corpuz-Raros, 2015 (Philippines)  
*Arrenurus pesici* Smit, 2010 (Australia)  
*Empitrombium pesici* Saboori & Hakimitabar, 2009 (Iran)  
*Trachyuropoda pesici* Kontschan, 2011 (St. Lucia, Caribbean Sea)  
*Hydraena pesici* Skale & Jäch, 2011 (Iran)  
*Hydraena vladimiri* Jäch & Diaz, 2016 (Greece)  
*Isoperla pesici* Murányi, 2011 (Montenegro)  
*Atyaephyra vladoi* Jablonska et al. 2018 (Montenegro)

### Popular story

The New York Times  
[http://www.nytimes.com/2014/07/22/science/newly-found-mite-is-jenny-from-the-ref.html?\\_r=0](http://www.nytimes.com/2014/07/22/science/newly-found-mite-is-jenny-from-the-ref.html?_r=0)

Discover Magazine  
<http://discovermagazine.com/2015/jan-feb/101-new-species>  
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Signature

Vladimir Pešić