This project is funded by the European Union

Prevencija onečišćenja mora zajedničkim djelovanjem
Joint Actions for Sea Pollution Prevention „JASPPer“

Cross-Border Programme Croatia - Montenegro

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JASPPer

THE BROCHURE OF THE PROJECT JASPPer
BROŠURA PROJEKTA JASPPer

PREKOGRANIČNI EFEKTI ISPUSTA OTPADNIH VODA U MORE U OPĆINAMA KONAVLE (HRVATSKA), HERCEG NOVI, TIVAT I KOTOR (CRNA GORA)

TRANSBOUNDARY EFFECTS OF THE WASTEWATER DISCHARGE INTO THE SEA IN THE MUNICIPALITIES OF KONAVLE (CROATIA), HERCEG NOVI, TIVAT AND KOTOR (MONTENEGRO)

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Projekt su sproveli Hrvatski hidrografski institut i Zavod za hidrometeorologiju i seizmologiju Crne Gore i njihovi partneri Sveučilište u Dubrovniku – Institut za more i priobalje i Univerzitet Crne Gore - Institut za biologiju mora – Kotor.

This project is implemented by Croatian Hydrographic Institute and Institute of Hydrometeorology and Seismology of Montenegro with project partners University of Dubrovnik-Institute for Marine and Coastal Researches and University of Montenegro-Institute of Marine Biology.

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Izdavač
Zavod za hidrometeorologiju i seizmologiju Crne Gore

Urednici
- Zavod za hidrometeorologiju i seizmologiju Crne Gore
- Hrvatski hidrografski institut
- Sveučilište u Dubrovniku – Institut za more i priobalje
- Univerzitet Crne Gore - Institut za biologiju mora – Kotor

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1. UVOD

„Prevencija zagađenja mora zajedničkim djelovanjem - JASPPer“ je IPA projekat iz komponente II - Prekogranična saradnja, mjera 1.1. - Zajedničke mjere za zaštitu životne sredine, prirode i kulturne baštine. Projekat se realizovao u saradnji Hrvatskog hidrografskog instituta iz Splita (HHI) kao funkcionalnog vodećeg partnera i Zavoda za hidrometeorologiju i seizmologiju Crne Gore (ZHMSCG) kao vodećeg partnera u Crnoj Gori. Sveučilište u Dubrovniku – Institut za more i priobalje (IMP) i Univerzitet Crne Gore – Institut za biologiju mora-Kotor (IBMK) bili su partneri vodećim institucijama u pripadnim državama.

Ukupna vrijednost projekta iznosila je 598.339,17 €. Hrvatskim partnerima je bilo predviđeno 251.327,49 €, a crnogorskim partnerima 254.541,00 € bespovratne pomoći iz EU.

Područje koje je obuhvaćeno projektom nalazi se u Dubrovačko-neretvanskoj županiji u Hrvatskoj (Opština Konavle) i Opštinama Herceg Novi, Kotor i Tivat u Crnoj Gori. Projekat se sprovodio 24 mjeseca (1.5.2013. - 30.4.2015).

Opšti cilj projekta bio je doprinos smanjenju zagađenja pograničnog akvatorijuma dvaju država i uspostavljanje saradnje nadležnih institucija u zaštiti životne sredine. Specifični cilj projekta bilo je stvaranje preduslova za dugoročnu saradnju institucija lokalne uprave i drugih u pograničnom području, u oblasti upravljanja otpadnim vodama i monitoringa kvaliteta mora.

Očekivani rezultati projekta su: uspostavljanje modela za praćenje parametara zagađenja mora u pograničnom području Hrvatske i Crne Gore i jačanje kapaciteta nadležnih institucija u pograničnom području u monitoringu kvaliteta mora i korišćenju EU fondova.

1. INTRODUCTION

„Joint Actions for Sea Pollution Prevention - JASPPer“ is an IPA project from the Component II – Cross-border cooperation, measure 1.1. – Joint measures in the protection of the environment, nature and cultural heritage. The project was realized through the cooperation of the Croatian Hyddrographic Institute – Split (HHI) as the functional leading partner and the Institute of Hydrometeorology and Seisomology of Montenegro (ZHMSCG) as the leading partner in Montenegro. The University of Dubrovnik – Institute for Marine and Coastal Research (IMP) and The University in Montenegro – Institute for Marine Biology – Kotor (IBMK) were the associated partners to the leading partners in the belonging countries.

The total value of the project equalled 598.339,17 €. The grant reserved for the partner institutions in Croatia equalled 251.327,49 €, while the grant of 254.541,00 € was reserved for the Montenegrin partner institutions.

The area of interest in the project was Dubrovnik-Neretva County in Croatia (Municipality of Konavle) and Montengrin coastline (Municipalities of Herceg Novi, Kotor i Tivat). The project was executed throughout 24 months (1st May 2013 – 30th April 2015).

The aim of the project, in general, was to stimulate the reduction of the pollution in bordering aquatories of two countries and to establish the cooperation between the competent institutions on the topics in the environment protection. The specific goal of the project was to create the preconditions for the long-term cooperation of the institutions in the bordering area on the topics of wastewater management and monitoring of the seawater quality.

The expected results of the project were: the establishment of the model for the monitoring of the parameters of the sea pollution in the bordering area of Croatia and Montenegro and the strengthening of the capacities of the competent institutions in the bordering area in the monitoring of the seawater quality and the usage of the EU funds.

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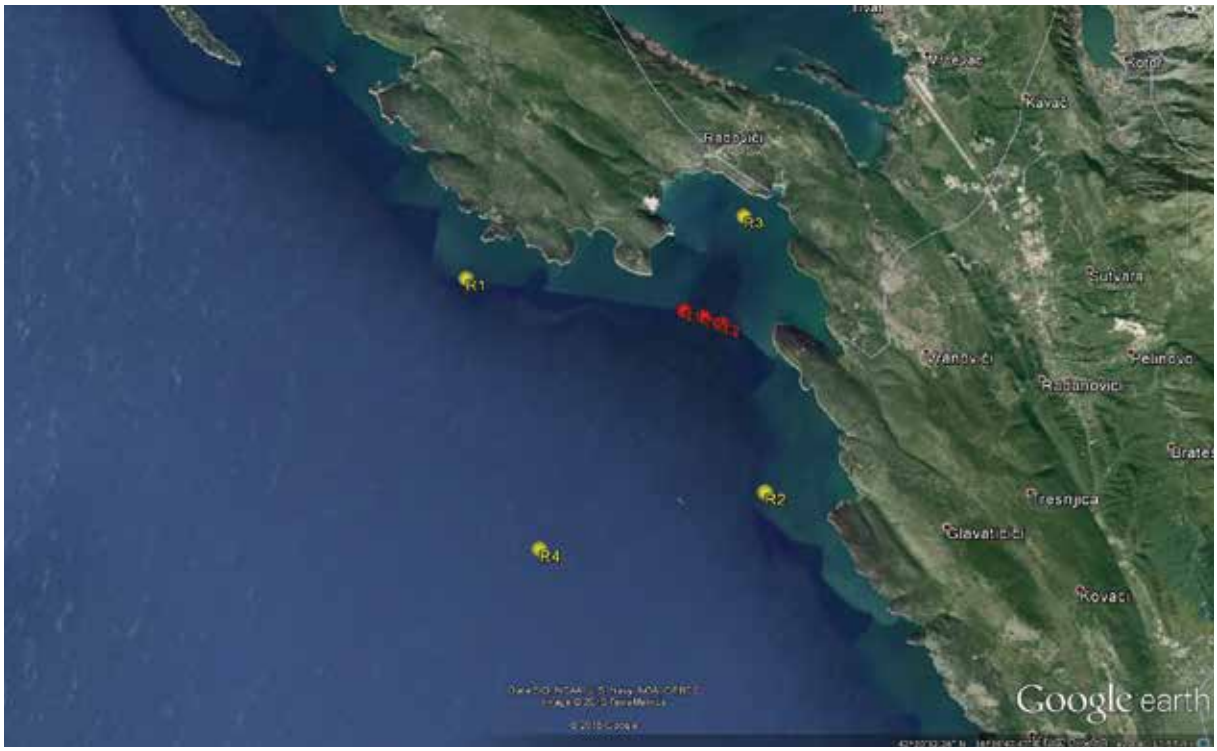
2. Područje istraživanja

2. The Study area



Slika 1.
Pozicija istraživačkih stanica oko Ispusta Cavtat (na vrhu) i Trašte (dolje)

Figure 1.
The position of the research stations around Outfall Cavtat (OC) (on top) and Trašte (OT) (down).

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3. Parametri istraživanja

4. The parameters of the research

Sezona – Season Medij - Medium	Ljeto – Summer Parametri – The parameters		Zima – Winter Parametri – The parameters	
Lokacija The location	Cavtat	Trašte	Cavtat	Trašte
Vodeni stub	1. Parametri uključeni u proračun indeksa eutrofikacije TRIX; 2. Termohalina svojstva; 3. Abundancija bakterija štetnih po ljudsko zdravlje	1. Parametri uključeni u proračun indeksa eutrofikacije TRIX; 2. Termohalina svojstva; 3. Abundancija bakterija štetnih po ljudsko zdravlje; 4. Ukupni organski ugljenik; 5. Teški metali	1. Parametri uključeni u proračun indeksa eutrofikacije TRIX; 2. Termohalina svojstva; 3. Abundancija bakterija štetnih po ljudsko zdravlje; 4. Ukupni organski ugljenik	1. Parametri uključeni u proračun indeksa eutrofikacije TRIX; 2. Termohalina svojstva; 3. Abundancija bakterija štetnih po ljudsko zdravlje; 4. Ukupni organski ugljenik; 5. Teški metali
Seawater column	1. Parameters involved in the calculation of the index of eutrophication TRIX; 2. Thermohaline properties; 3. Abundance of the bacteria harmful to the human health	1. Parameters involved in calculation of the index of eutrophication TRIX; 2. Thermohaline properties; 3. Abundance of the bacteria harmful to the human health; 4. Total organic carbon; 5. Heavy metals	1. Parameters involved in the calculation of the index of eutrophication TRIX; 2. Thermohaline properties; 3. Abundance of the bacteria harmful to the human health; 4. Total organic carbon	1. Parameters involved in the calculation of the index of eutrophication TRIX; 2. Thermohaline properties; 3. Abundance of the bacteria harmful to the human health; 4. Total organic carbon; 5. Heavy metals
Morski sediment Marine sediment		Teški metali Heavy metals	Ukupni organski ugljenik Total organic carbon Teški metali Heavy metals	Ukupni organski ugljenik Total organic carbon Teški metali Heavy metals

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Pregled funkcionalnosti podmorske infrastrukture kanalizacijskih ispusta The check of the functionality of the submarine infrastructure of the sewage outfalls		1. Višesnopnim dubinomjerom broda HIDRA snimljena je trasa položene podmorske cijevi Ispusta Cavtat. 2. Daljinski upravljanom ronilicom je snimljeno stanje dužinom cijele podmorske cijevi Ispusta Cavtat. 1. The multibeam sonar employed at the research vessel HIDRA was used to record the route of the submarine pipe of the Outfall Cavtat. 2. Remotely operated vehicle was employed to record the state along the full lenght of the submarine pipe of the Outfall Cavtat.	1. Višesnopnim dubinomjerom broda HIDRA snimljena je trasa položene podmorske cijevi Ispusta Trašte. 2. Daljinski upravljanom ronilicom je snimljeno stanje dužinom cijele podmorske cijevi Ispusta Trašte. 1. The multibeam sonar employed at the research vessel HIDRA was used to record the route of the submarine pipe of the Outfall Trašte. 2. Remotely operated vehicle was employed to record the state along the full lenght of the submarine pipe of the Outfall Trašte.
Obraštajni organizmi na završecima podmorskih cijevi kanalizacijskih ispusta i makrozoobentos u blizini završetaka podmorskih cijevi kanalizacijskih ispusta The fouling organisms at the ends of the submarine pipes and macrozoobenthos in the vicinity of the ends of the submarine pipes of the sewage outfalls		Zadatak povjeren profesionalnom roniocu – biologu The assignment was entrusted to the professional diver – biologist	Zadatak povjeren profesionalnom roniocu – biologu The assignment was entrusted to the professional diver – biologist
Morske struje Sea currents	Mjerenja su izvršena u visokoj frekvenciji od 27. avgusta 2014. do 28. februara 2015. kod Ispusta Cavtat The measurements were performed in high frequency from 27th August 2014 till 28th Februry 2015 near Outfall Cavtat	Mjerenja su izvršena u visokoj frekvenciji od novembra 2014. do marta 2015. kod Ispusta Trašte The measurements were performed in high frequency from November 2014 till March 2015 near Outfall Trašte	

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4. Kupljena oprema

4. The purchased equipment

Hrvatski hidrografski institut – Split kupio je daljinski upravljanu ronilicu –
Croatian Hydrographic Institute – Split purchased the remotely operated vehicle (ROV)

Zavod za hidrometerologiju i seizmologiju Crne Gore kupio je analizator ukupnog organskog ugljika –
The Institute of Hydrometeorology and Seisomology of Montenegro purchased the total organic carbon (TOC) analyzer

Niskin crpci s pripadajućim glasničkim utezima jednako su podijeljeni između hrvatskih partnera u JASPPer-u –
The Niskin samplers with the belonging messengers were equally shared among the croatian partners in JASPPer

Zavod za hidrometerologiju i seizmologiju Crne Gore kupio je multiparametarsku sondu za oceanografska mjerenja - The Institute of Hydrometeorology and Seisomology of Montenegro purchased the multiparametric probe for the oceanographic measurements

Institut za more i priobalje je kupio CTD sondu - Institute for Marine and Coastal Research purchased the CTD probe

Institut za biologiju mora - Kotor nabavio je spektrofotometar - Institute for Marine Biology – Kotor has acquired the spectrophotometer

*Kupljeno je još opreme putem JASPPer-a. Samo je dio prezentiran na slikama poviše -
More equipment was purchased via JASPPer. Only the part of it was presented in the figures above.

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5. Promocija projekta i razmjena znanja i vještina

Pres konferencija u Dubrovniku u vezi sa lansiranjem projekta JASPPer (Decembar 2013) -
Press conference in Dubrovnik regarding the launch of the project JASPPer (December 2013)

Konzultacije s lokalnim vlastima u Kotoru (decembar 2014.)
The consultation with the local authorities in Kotor (December, 2014)?

Stijepo Ljubimir (IMP) je prezentirao projekt JASPPer u Ohridu u sklopu konferencije SEE SDEWES 2014.
Stijepo Ljubimir (IMP) has presented the project JASPPer in Ohrid at the conference SEE SDEWES 2014.

Predstavnici svih partnerskih institucija sudjelovali su na konferenciji SEE SDEWES 2014 u Ohridu
The representatives of all partner institutions have attended the conference SEE SDEWES 2014 in Ohrid

5. The promotion of the project and the exchange of the knowledge and skills

Konzultacije s lokalnim vlastima u Dubrovniku (studeni 2013.
The consultation with the local authorities in Dubrovnik (November, 2013)

Obuka studenata i mladih istraživača u Podgorici (mart, 2015.)
Training for the students and young researchers in Podgorica (March, 2015)

Marko Mlinar (HHI) je prezentirao u Opatiji na 10. međunarodnom i 50. hrvatskom kongresu agronoma prve rezultate istraživanja u projektu JASPPer
Marko Mlinar (HHI) has presented the first results of the research associated to the project JASPPer at the 10th international and 50th croatian conference of the agronoms in Opatija

Predstavnici svih partnerskih institucija sudjelovali su na konferenciji SA2015 u Opatiji
The representatives of all partner institutions have attended the conference SA2015 in Opatija

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6. Rezultati istraživanja

6. The results of the research

Sezona – Season Medij - Medium	Ljeto – Summer Parametri – The parameters		Zima – Winter Parametri – The parameters	
Lokacija – The location	Cavtat	Trašte	Cavtat	Trašte
Vodeni stub	More je izuzetno oligotrofnog karaktera. Koncentracije nutrijenata su povećane u pridnenom sloju ispod termokline. Sloj slatke hladnije površinske vode relativno bogat nutrijentima detektovan je na stanici 1800 DBK. Abundancija bakterija štetnih po ljudsko zdravlje najveća je u srednjem sloju na poziciji Ispusta, a na stanici 1800 CG nestaje uticaj Ispusta u odnosu na bakterijsko zagađenje mora.	More je umjereno eutrofno, što je posljedica značajnog unosa nutrijenata i relativnu zatvorenost vode u zalivu. Abundancije bakterija štetnih po ljudsko zdravlje bile su najveće u pridnenom sloju na obalnoj stanici R3.	More je oligotrofnog karaktera bez statistički značajne razlike ($p < 0.05$) indeksa TRIX u odnosu na ljeto. Abundancija bakterija štetnih po ljudsko zdravlje ukazuje na nepostojanje značajnog potencijala za njihov prenos prema crnogorskoj obali, dok je maksimalni broj kolonija nađen u srednjem sloju stanice 300 DBK vjerojatno pod značajnim uticajem morskih struja sjeverozapadnog smjera. Koncentracija ukupnog organskog ugljenika blago je veća u odnosu na stanice u zalivu Trašte.	More je umjereno eutrofno bez statistički značajne razlike ($p < 0.05$) indeksa TRIX u odnosu na ljeto. Abundancija bakterija štetnih po ljudsko zdravlje bila je najveća pridnenom sloju na stanici transekta T1. Zimi je prisustvo metala u vodenom stubu bilo češće i veće, naročito žive (T, R2, R3,R4), kadmijuma (R3), olova (T). Jedino je sadržaj hroma bio znatno manji, ispod granice mjerljivosti. Dok je sadržaj metala ljeti bio raspoređen pretežno u donjim slojevima vode, u zimu je to bio slučaj u gornjim slojevima.
Seawater column	The sea has notably oligotrophic character. The concentrations of the nutrients are elevated in the near-bottom layer under the thermocline. The abundance of the bacteria harmful to the human health is the highest in the middle layer near the Outfall, while its impact, concerning the bacterial pollution of the sea, dissapears at the station 1800 CG.	The sea is moderately eutrophicated, which implies significantly higher concentrations of the nutrients in comparison to the aquatory of Cavtat. The abundances of the bacteria harmful to the human health were the highest in the near bottom layer at the coastal station R3.	The sea has oligotrophic character with no significantl difference ($p < 0.05$) TRIX in comparison to the summer. The abundance of the bacteria harmful to the human health showed no potential for its transfer towards the montenegrin coast, while the highest number of colonies was detected in the middle layer of the station 300 DBK, probably under the notable influence of the NW sea currents. TOC concentration is slightly higher in comparison to the values detected in the Bay of Trašte.	The sea is moderately eutrophicated without significantl difference in statistics ($p < 0.05$) TRIX in comparison to the summer. The abundance of the bacteria harmful to the human health had a maximum in layer near bottom at station of transect T1. During winter, the presence of metal in water column was more frequent and bigger, especially for the mercury (T, R2, R3, R4), cadmium (R3), lead (T). Only the content of chrome was significantly lower, under the measuring limit. While metal content in summer was distributed mostly in lower layers of water, this was the case in upper layers during winter.
Morski sediment		TOC je tokom ljeta bio ujednačen, za nijansu veći u gornjim slojevima vode i na obalnoj stanici R3.	Koncentracije „TOC“ odgovaraju oligotrofnoj sredini.	Koncentracije „TOC“ odgovaraju oligotrofnoj sredini. Zimi je TOC bio znatno veći, sa većim varijacijama duž vodenog stuba, sa takođe većim vrijednostima u gornjim slojevima vode. Najveće vrijednosti TOC su bile na stanici R2 i R4. Teški metali u vodi se javljaju mjestimično i najčešće su ispod granice detekcije.
		TOC was equalized during summer, slightly higher in upper layers of water and in coastal station R3.	TOC concentrations match the oligotrophic environments.	TOC concentrations match the oligotrophic environments. During winter, TOC was signficantly highe, with higher variations along water column, with also higher values in upper water layers. The highest values of TOC were at R2 and R4 stations. Heavy metals in water appear in places and they are often under detection limit.
Marine sediment		Teški metali su tokom ljeta imali malo povećane vrijednosti, iznad A1 klase, izmjerene za živu i olovo na transektu (T2), kao i hrom na stanici R1.	Ispitani teški metali (Cd, Hg, Pb) imali su koncentracije karakteristične za izuzetno oligotrofnu sredinu.	Detaljni izvještaj je dostupan po zahtjevu (ZHMSCG).
		During summer, the values of heavy metals are slightly increased, above A1 class, measured for mercury and lead at transect (T2) as well as for chrome at R1 station.	Investigated heavy metals (Cd, Hg, Pb) had concentrations commonly found in oligotrophic environments.	Detailed report is available on demand (ZHMSCG).

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Pregled funkcionalnosti podmorske infrastrukture kanalizacijskih ispusta The check of the functionality of the submarine infrastructure of the sewage outfalls	Trasa podmorske cijevi odstupila je od projektnog plana. Snimak omogućuje ucrtavanje cijevi u pomorske karte. Ronilica nije snimila ikakva oštećenja podmorske infrastruktura Ispusta. The route of the submarine pipe deviated from the plan. The record enables the drawing of the pipe in the maritime maps. ROV recorded no damages of the submarine infrastructure of the Outfall.	Trasa podmorske cijevi odstupila je od projektnog plana. Snimak omogućuje ucrtavanje cijevi u pomorske karte. Na oko pola dužine cijevi, ronilicom je utvrđen nedostatak od preko 100 m cijevi. Ispust se smatra nefunkcionalnim u odnosu na projektovane uslove stanju. The route of the submarine pipe deviated from the plan. The record enables the drawing of the pipe in the maritime maps. ROV recorded the missing of more than a hundred metres of the pipe. The Outfall is considered as non-functional at the present state.
Obraštajni organizmi i makrozoobentos The fouling organisms and macrozoobenthos	Detaljni izvještaj je dostupan po zahtjevu (IMP). Kraća verzija je dio konačnog izvještaja projekta. Detailed report is available on demand (IMP). Shorter version is a part of the final project report.	Detaljni izvještaj je dostupan po zahtjevu (IBMK). Kraća verzija je dio konačnog izvještaja projekta. Detailed report is available on demand (IBMK). Shorter version is a part of the final project report.
Morske struje Sea currents	Generalni tok struja ispred Trašte u periodu novembar 2014 – mart 2015, imao je pravac NW, prosječnu brzinu 21-36cm/sec, a maksimalnu brzinu 51cm/s. General currency course in front of Traste in period November 2014 – March 2015, it had NW direction, average velocity 21-36cm/sec, maximal velocity 51cm/s.	Vektorska srednja vrijednost morskih struja izmjerenih na lokaciji ispusta Cavtat u periodu avgust 2014 - februar 2015 na 5 m dubine iznosi 8 cm/s u smjeru sjeverozapada. Brzina struja opada s dubinom (1 cm/s na dubini od 53 m), a smjer ostaje približno isti. Morske struje jako zavise od vjetra pa se u vremenu jakog juga njihova brzina povećala i do 83 cm/s pri površini (takođe u smjeru sjeverozapada). Vector average value of sea currencies measured at location of outfall Cavtat in period August 2014- February 2015 at 5m of depth is 8 cm/s NW. The currency velocity goes down along with depth (1 cm/s at 53 m deep), direction is pretty the same. Sea currencies strongly depend on the wind so when the south is strong, their velocity increases (up to 83 cm/s) near surface (also in NW direction).

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7. Zaključci i preporuke

Cavtat: Infrastruktura podmorskog ispusta Cavtat je neoštećena. Usta cijevi i difuzori/konfuzori su začepljeni, osim jednog koji se nalazi 25 m prije usta cijevi. Nakupine materijala ispred usta cijevi i difuzora/konfuzora ukazuju da mehanička rešetka na kopnu prije podmorskog ispusta nije u funkciji. Ispust je obrastao uobičajenim organizmima za dubine ~ 65 m – preovladavaju školjkaši vrste *Neopycnodonte cochlear* i meduze iz grupe Hydrozoa. Bentoska zajednica oko ispusta je određena kao cirkalitoralna zajednica pokretnih dna i to kao prelazna zajednica između biocenoze obalnih detritusnih dna i biocenoze obalnih terigenih muljeva. Ne uočava se primjetni uticaj na bentoske zajednice u široj okolini ispusta, a uticaj je ograničen na dno u neposrednoj blizini ispusta. Navedeni nalazi su u skladu s rezultatima analiza hemijskih parametara u vodenom stubu i sedimentu, koji ukazuju na oligotrofni karakter mora pod direktnim uticajem ispusta otpadne vode. Tokom turističke sezone tj. ljeti su detektovane značajno veće abundancije bakterija štetnih po ljudsko zdravlje na poziciji Ispusta, ali bez utvrđenog potencijala za prenos prema crnogorskom akvatoriijumu. U zimskom periodu su zabilježene značajnije abundancije bakterija štetnih po ljudsko zdravlje samo na stanici udaljenoj 300 m od kraja Ispusta prema Dubrovniku, a što je vjerovatno posledica značajno bržih sjeverozapadnih morskih struja. Preporučuje se čišćenje začepljenih usta cijevi i difuzore/konfuzore Ispusta i popravka procjedne rešetke u glavnom objektu kanalizacionog sistema prije turističke sezone. Treba nastaviti monitoring akvatorijuma neposredno izloženog ispustu otpadnih voda prema parametrima istraživanja u projektu, a u skladu sa finansijskim mogućnostima partnerskih institucija i opština uključenih u projekat JASPPer.

Trašte: Treba temeljno sanirati podmorsku infrastrukturu kanalizacionog ispusta. Poslije sanacije podmorskog dijela ispusta, treba ispravno održavati mehaničku rešetku na kopnu. U bližoj budućnosti, obradu otpadnih voda treba unaprijediti biološkim prečišćavanjem. TRIX indeks je odgovarao umjereno eutrofnom stanju vode. Teški metali se povremeno javljaju a njihova koncentracija u vodi I sedimentu nije zabrinjavajuća. Na osnovu mjerenih rezultata nije uočen transfer zagađenja prema sjeverozapadu. Najopterećenije zagađenje su zona transekta I obalne stanice (R3). Biološka zajednica oko vrha ispusta je vrlo siromašna, a sediment ima mineralnu strukturu, što je logična posledica kvara na ispusnoj cijevi. Preporučuje se uključivanje po jedne stanice u oba projektna područja u redovni monitoring, u cilju prevencije eventualnog akcidentnog zagađenja. Izrazito se preporučuje propisano obilježavanje ispusta na čitavoj trasi, što je predviđeno zakonom, a u cilju bezbjednosti ispustne infrastrukture. Preporučuje se formiranje baze podataka u području Trašte - Cavtat kao I održavanje zajedničkih godišnjih tematskih sastanaka predstavnika 4 prekogranične opštine. Očekuje se poboljšanje stanja kvaliteta vode u zalivu Trašte poslije izgradnje postrojenja za prečišćavanje otpadnih voda.

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7. Conclusions and recommendations

Cavtat. The submarine infrastructure of the Outfall Cavtat is undamaged. The mouth of diffusers/confusers are cloged, except the one positioned 25 m from the mouth of the pipe. The deposits of the material in front of the mouth of the pipe and diffusers/confusers indicate that the mechanic grid at the mainland, before the submarine release, is out of function. The Outfall is fouled by the common organisms at depths ~ 65 m – dominantly shellfish of species *Neopycnodonte cochlear* and Cnidaria from the group of Hydrozoa. The benthic community around the sewage outlet is determined as a circalittoral community of sediment bottoms and it can be classified as a transition between the biocenosis of the coastal detritic bottoms and the biocenosis of the coastal terrigenous muds. There are no observed impacts on the benthic communities in the surrounding of the discharge. The impact is limited to the bottom near the Outfall. The mentioned findings are in the accordance with the results of the analyses of the chemical parameters in the water column and sediment, which indicated the oligotrophic character of the sea directly exposed to the discharge of the wastewater. Significantly greater abundances of the bacteria harmful to the human health were detected at the position of the Outfall during tourist season i.e. summer, but without confirmed potential for the transfer towards montenegrin aquatory. The only significant abundances of the bacteria harmful to the human health were detected at the position 300 m distant from the end of the Outfall in direction of Dubrovnik, which was probably the consequence of markedly faster north-west sea currents. It is recommended to clean the clogged mouth of the pipe and diffusers/confusers and to fix the mechanic grid at the mainland before the tourist season. The monitoring of the aquatory directly exposed to the discharge of the wastewaters should be continued taking into account the financial possibilities of the partner institutions and the municipalities involved in the project JASPPer.

Trašte. The thorough repair of the submarine infrastructure of the sewage outfall is mandatory. After the repair, the mechanic grid at the mainland should be properly maintained. The improvement of the wastewaters' treatment should be performed by the involvement of the biological methods of the purification. TRIX index suited the moderately eutrophic state of water. Heavy metals appear in places and their concentration in water and sediment is not concerning. Based on measured results, the transfer of pollution has not been detected towards NW. The most loaded pollution are transect zone and coastal station (R3). Biological community around the outfall top is pretty poor, and sediment has mineral structure, which is logical consequence of damage on outfall pipe.
Inclusion of each station is recommended in both project areas into regular monitoring, so to prevent possible accident pollution. It is strongly recommended regulated marking of outfall on the whole route, which is prescribed by law, aimed at securing outfall infrastructure. It is recommended to establish data base in area Traste - Cavtat as well as holding common annual topic meetings with representatives from 4 cross border municipalities. The improvement of water quality is expected in Traste Bay after waste water treatment plant is constructed.

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