

# »Neretva Science Week« revisited – maintaining momentum on a conservation mission from river to catchment in the Upper Neretva River valley, Bosnia and Herzegovina

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## ABSTRACT

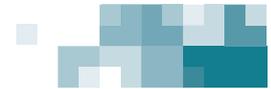
The Blue Heart of Europe campaign keeps publishing updates about the development of hydropower projects on the Balkan peninsula. It is one thing to see a map of thousands of threats to hundreds of rivers, but it is another thing to actually witness when one river gets lost before your eyes. In an act of stubbornness and unbroken optimism, despite ongoing construction of hydropower infrastructure for Ulog and Upper Horizon projects, the Blue Heart of Europe's Scientists for Balkan Rivers Network once more organised a Science Week at the Neretva River. Between 30 May and 7 June 2023 almost 70 scientists and students from 17 countries and a once more diversified array of scientific disciplines joined forces to expand our knowledge on the biodiversity of the Neretva River catchment. Our mission was to document the biodiversity of the river, its hidden tributaries, underground rivers, mountain springs and the terrestrial valley sides. The 11 contributions published in this second special issue of *Natura Sloveniae* dedicated to the Neretva demonstrate once again the extraordinary biodiversity residing in this remote part of Europe. The many documented species encourage us to keep fighting for this exceptional natural heritage in spite of all difficulties.

## IZVLEČEK

### Ponovno »Znanstveni teden Neretve« – ohranjanje zagona za varstveno misijo od reke do porečja v zgornji dolini reke Neretve, Bosna in Hercegovina

Kampanja »Blue Heart of Europe« še vedno objavlja novice o načrtovanih hidroenergetskih projektih na Balkanskem polotoku. Toda eno je videti zemljevid tisočernih groženj za stotine rek, drugo pa je dejansko spremljati izginitje reke z lastnimi očmi. Znanstveniki mreže Balkan Rivers Network so kot vztrajni in neomajni optimisti ponovno organizirali Znanstveni teden na reki Neretvi, ne glede na nadaljevanje gradnje hidroenergetske infrastrukture za projekte Ulog in Gornji Horizonti. V času od 30. 5. do 7. 6. 2023 se je skoraj 70 znanstvenikov in študentov iz 17 držav, in še enkrat toliko različnih disciplin, združilo, da bi izboljšali poznavanje biotske raznovrstnosti porečja reke Neretve. Naša naloga je bila dokumentirati biotsko raznovrstnost reke, njenih skritih pritokov, podzemnih rek, gorskih izvirov in kopenskih pobočij doline. Enajst prispevkov, objavljenih v pričujoči drugi posebni izdaji revije *Natura Sloveniae*, posvečeni reki Neretvi, ponovno osvetljuje izjemen zaklad biotske raznovrstnosti, ki se nahaja v tem oddaljenem delu Evrope. Številne dokumentirane vrste nas opominjajo, da moramo kljub vsem težavam nadaljevati boj za to edinstveno naravno dediščino.





#### KEY WORDS:

Blue Heart of Europe, Scientists for Balkan Rivers, public outreach, hydropower, environmental protection, biodiversity conservation, scientific advocacy

#### KLJUČNE BESEDE:

Blue Heart of Europe, znanstveniki za balkanske reke, ozaveščanje javnosti, hidroenergija, varstvo okolja, ohranjanje biotske raznovrstnosti, znanstveno zagovarjanje

#### KLJUČNE RIJEČI:

Plavo srce Evrope, Naučnici za balkanske rijeke, javno informisanje, hidroenergija, zaštita životne sredine, očuvanje biodiverziteta, naučno zagovarjanje

#### APSTRAKT

**Ponovljena »Sedmica nauke na Neretvi« – održavanje zamaha za misiju zaštite prirode od rijeke do sliva u gornjem toku rijeke Neretve, Bosna i Hercegovina**

Kampanja »Plavo srce Evrope« nastavlja objavljivati novosti o razvoju hidroenergetskih projekata na Balkanskom poluostrvu. Jedno je videti mapu sa hiljadama pretnji stotinama rijeka, ali je nešto sasvim drugo biti svjedok trenutka kada jedna rijeka nestaje pred vašim očima. U činu tvrdoglavosti i nepokolebljivog optimizma, uprkos izgradnji hidroenergetske infrastrukture za projekte »Ulog« i »Gornji horizonti«, mreža »Plavo srce Evrope-Naučnici za balkanske rijeke« ponovo je organizovala Sedmicu nauke na rijeci Neretvi. Od 30. 5. do 7. 6. 2023. godine, gotovo 70 naučnika i studenata iz 17 zemalja, uz još raznovrsniji spektar naučnih disciplina, udružilo je snage kako bi proširili istraživanje biodiverziteta sliva rijeke Neretve. Njihova misija bila je da dokumentuju biodiverzitet rijeke, njenih skrivenih pritoka, podzemnih tokova, planinskih izvora i obala. Jedanaest radova je objavljeno u ovom drugom specijalnom izdanju časopisa *Natura Sloveniae*, posvećenom Neretvi, te još jednom pokazuju kakvo izuzetno blago biodiverziteta postoji u ovom udaljenom evropskom području. Mnoge dokumentovane vrste podsjećaju nas da nastavimo borbu za ovo prirodno naslijeđe, uprkos svim teškoćama.

## WHAT IS THE »BLUE HEART OF EUROPE CAMPAIGN«, WHO ARE THE »SCIENTISTS FOR BALKAN RIVERS« AND WHAT IS A »SCIENCE WEEK«?

The Save the Blue Heart of Europe campaign was launched in 2012 by the NGOs EuroNatur and Riverwatch in cooperation with local partners across the Balkans to save the many ecologically outstanding Balkan rivers, the 'Blue Heart of Europe', from – at that time – more than 3,500 planned hydropower plants (<https://balkanrivers.net>). The vision of the campaign is to prevent further destruction of rivers by dam constructions or water abstractions. To this aim, a network of NGOs, activists, lawyers, artists and scientists was created – at local, regional and international scales. So far, this diverse network has helped to stop hundreds of dam projects (Riverwatch, unpublished list).

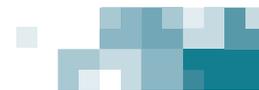
A very important part of the campaign network is the initiative Scientists for Balkan Rivers (SBR, <https://balkanrivers.net/en/scientists>) – a growing network of scholars and experts from various European countries. They assess the biodiversity and ecological processes in Balkan rivers through a range of activities including collaborative field campaigns and projects, targeted assessments of individual hydropower projects, and small individual projects by young researchers pursuing master or PhD theses. The SBR builds on the remarkable success of the 'Scientists for Vjosa', a group of scientists who contributed critically to the protection of the Vjosa River (Schiemer et al. 2018, 2020) and to the establishment of the Wild River National Park in 2023 (<https://www.vjosanationalpark.al>). The SBR network includes scientists active in many research fields ranging from hydrology to socio-ecology, at all career stages from stu-

dents to senior professors, as well as experts working outside academic institutions. What brings them together is the shared idea of acting as engaged scientists, i.e. to advocate for the protection of rivers as mandated by scientific evidence, and the realization that a network of like-minded people is more efficient than any individual as collaborative action fosters motivation and creates and maintains critical momentum.

Key events of the SBR network are 'Science Weeks' (Figs. 1, 2), which have been organised since 2017 on various Balkan Rivers starting with the Vjosa in 2017. Meanwhile, several Science Weeks were held in the Vjosa River Network: at the tributary Shushica (Schiemer & Miho 2021), in the Vjosa Delta (<https://balkanrivers.net/en/pages/2024-vjosa-delta-science-week>), and at the tributary Sarantaporos (<https://balkanrivers.net/en/pages/the-sarantaporos>). The Neretva River has seen a first Science Week in 2022 (Singer et al. 2023) and this special issue of *Natura Sloveniae* summarizes the scientific findings of the second Neretva Science Week held in 2023. If doing solid science collaboratively with others in a network in order to successfully advocate is epitomized in the 'engaged scientist', then a Science Week should enable these three pillars (Fig. 1a): (i) solid science securing evidence through publication and thereby fostering the reputation of involved scientists, (ii) networking with like-minded scholars to build momentum and capacity, (iii) engagement and advocacy by providing opportunities to interact with media and decision makers.

During a Science Week, scientists get an opportunity to do what they can do best – they (voluntarily) gather data. Close and immediate interaction with media and journalists, who are often embedded in field activities, allows skilled storytellers to make the most out of scientific expertise and daily discoveries. Perhaps most importantly, a Science Week provides a unique



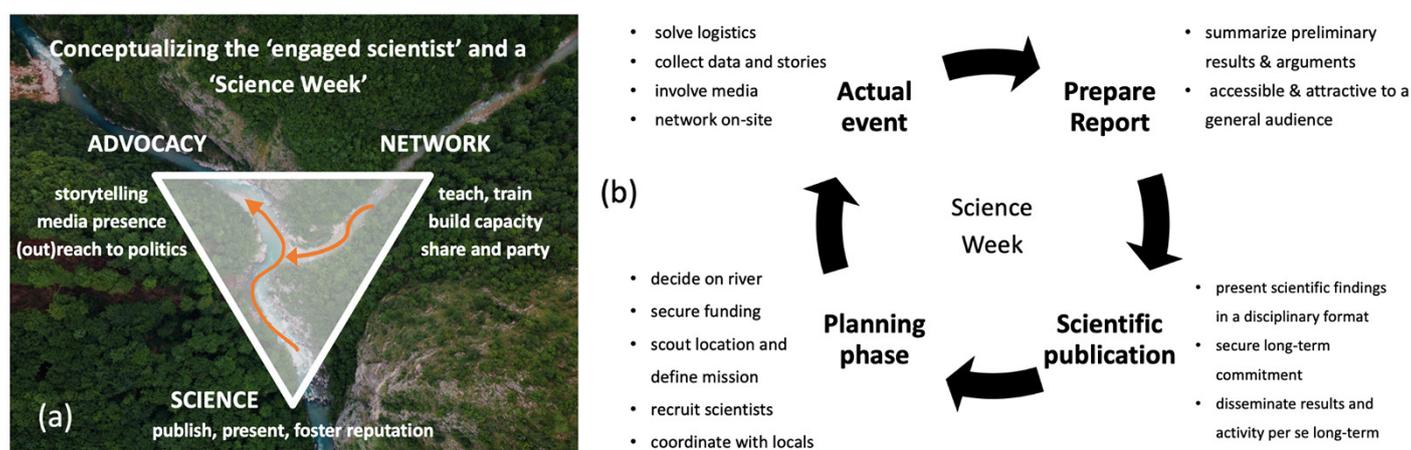


chance for networking among dedicated scientists from various nations, institutions and career stages. For senior scholars, a Science Week is a unique opportunity to offer hands-on learning to students; one may view it as fulfilling outreach duties, but, in fact, it may also be seen as assuming societal responsibility by pinpointing destructive impact and promoting conservation, while fostering careers of young, engaged colleagues. Involvement of less experienced colleagues builds additional capacity, while networking empowers scientists to build and maintain momentum in advocacy for nature protection. Lastly, a Science Week is physically present at a given place and the interaction with the local community makes them aware of their homeland as valuable natural heritage and promotes the emergence of alternative visions for their future beyond hydropower development.

From an organisational point of view, a Science Week presents several challenges associated with the various needs of the people involved and the multi-purpose nature of the activity. A typical organisational cycle (Fig. 1b) consists of (i) a prolonged planning phase including a scouting trip to identify a suitable location, ideally a pan-Balkan biodiversity hotspot, and a scientific mission, (ii) the actual event typically lasting only for a few days, (iii) the preparation of a preliminary report accessible and attractive to a general audience, and (iv) the presentation of scientific findings through disciplinary scientific publication. Choice of location is paramount as it defines attractiveness to scientists as well as the media. Luckily, many Balkan rivers present themselves as outstanding places in terms of ecology and landscape, hosting a high degree of endemic biodiversity (Griffiths et al. 2004). A scientific mission, for instance a landscape-scale gradient, may seem superfluous and even futile given the diversity of involved disciplines, yet it unites participants even if formulated in a simplified manner and makes them feel being a part of something bigger, which promotes networking.

During the short actual event it is 'all hands on deck': data collection must be highly efficient, often following 'minimum means' approaches with regard to time, money and instrumentation. Making field work possible in remote locations involves considerable logistics as the requirements of water beetle experts differ from those of mushroom specialists. Some diplomacy may be needed to convince participants to spend effort on networking across disciplinary and cultural borders. Perhaps most importantly, stories must be told on a daily basis through social media and to embedded journalists, who must not be forgotten in the field camp by all-too-eager scientists venturing into the field to collect data at 5 AM. Overall, the field setting provides unique opportunities for a once-in-a-lifetime assembly of people active in science, media, NGOs, locals and the occasional random supporter that shows up to cook for a crowd of 70.

The preparation of reports requires motivational energy in two phases: First, a preliminary report is created by media specialists and NGO representatives based on preliminary scientific findings. The preliminary report (Knook et al. 2022; Borko et al. 2023) has an attractive layout and mainly serves to attract public attention. It is ideally published within a few weeks to months after the field work. Second, scientific publications are prepared by the scientists themselves, ideally (but not exclusively) as a series of papers in a special issue of a disciplinary journal. Being the last step of many, energy may run low at that stage, yet scientific publication is critical: it secures evidence (e.g. about threatened species) in published form, but it also feeds the needs of scientific CVs and thereby maintains scientific engagement and advocacy in the long run. Perhaps not all steps are achieved in all Science Weeks, but this special issue of *Natura Sloveniae* represents the successful conclusion of one completed Science Week cycle.

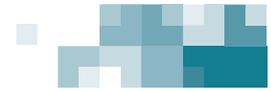


**Figure 1.** A Science Week is about bringing together engaged scientists ready to advocate for the protection of nature with professional storytellers in an outstanding ecosystem like the Neretva River. (a) Three pillars define an engaged scientist as well as a Science Week, the backdrop picture is an aerial image from the confluence of the Ljuta with the Neretva River (photo: Josh D. Lim). (b) A Science Week organisational cycle.

**Slika 1.** Teden znanosti združuje zavzete znanstvenike, ki so pripravljene zagovarjati varstvo narave, s profesionalnimi pripovedovalci zgodb v izjemnem ekosistemu, kot je reka Neretva. (a) Trije stebra opredeljujejo zavzetega znanstvenika in Teden znanosti, slika v ozadju je letalski posnetek sotočja rek Ljuta in Neretva (foto: Josh D. Lim). (b) Prikaz organizacijskega kroga Tedna znanosti.

**Slika 1.** Sedmica nauke imala je zadatak da okupi naučnike spremne da zagovaraju zaščito prirode, zajedno sa profesionalnim novinarima u izuzetnom ekosistemu poput rijeke Neretve. (a) Tri stuba definišu angažovane naučnike, kao i Sedmicu nauke; pozadinska fotografija je snimak iz vazduha ušća rijeke Ljute u Neretvu (foto: Josh D. Lim). (b) Organizacijski ciklus Sedmice nauke.





**Figure 2.** Science Week action epitomized by Ulrich Eichelmann (Riverwatch) being interviewed by CNN in the canyon of the Neretva River downstream of Ulog, while Kurt Pinter prepares for electro-fishing and eDNA-sampling targeting the threatened softmouth trout (photo: Vladimir Tadić).

**Slika 2.** Dogajanje v okviru Tedna znanosti, kjer je viden Ulrich Eichelmann (Riverwatch) med intervjujem za CNN v kanjonu reke Neretve pod Ulogom, medtem ko se Kurt Pinter pripravlja na električni ribolov in vzorčenje eDNA ogrožene mehokoustne postrvi (foto: Vladimir Tadić).

**Slika 2.** Snimanje u okviru Sedmice nauke predstavljena kroz Ulricha Eichelmann (Riverwatch) tokom intervjuja za CNN u kanjonu rijeke Neretve nizvodno od Uloga, dok se Kurt Pinter priprema za elektroribolov i eDNA uzorkovanje usmjereno na ugroženu mekosnu pastrmku (foto: Vladimir Tadić).

## WAS THERE A MISSION FOR NERETVA SCIENCE WEEK 2023? IF SO, WHAT WAS IT?

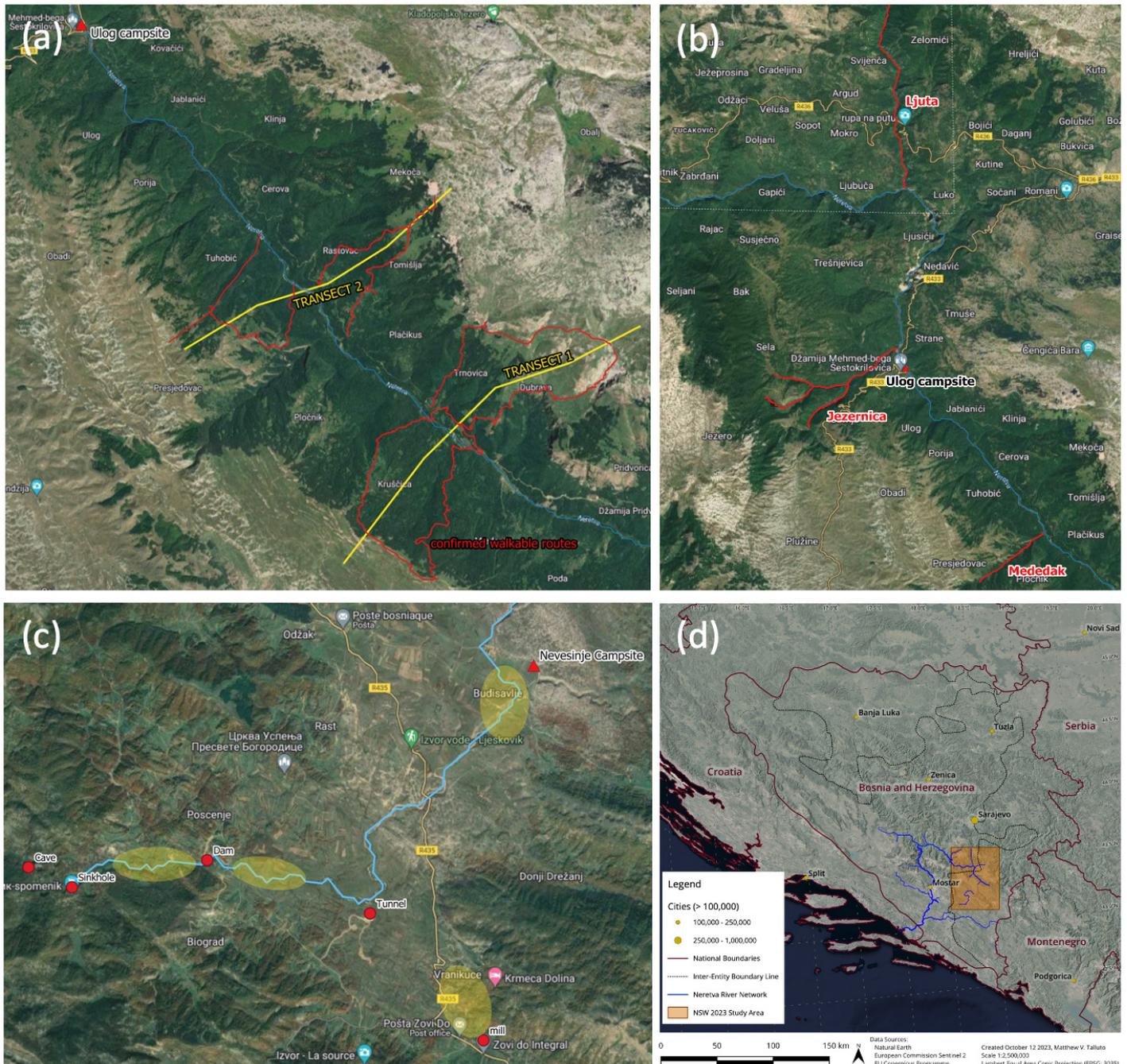
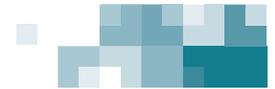
Neretva River originates in the remote and sparsely populated mountainous landscape of Bosnia and Herzegovina, from where it flows into Croatia and finally into the Adriatic Sea. While large parts of this 230 km long river are already heavily modified, the Neretva and its tributaries upstream from Konjic are – meanwhile unfortunately with a few exceptions – still mostly free-flowing. Despite the efforts of local and international activists, the construction of HPP Ulog was finished in 2024, its reservoir was filled in 2025, and its operation has already proven to be lethal with a major fish-kill incidence occurring in September 2025 (Singer et al., submitted). Gornja Neretva, the first thirty kilometres of the river from its source to Ulog village, the valley, and part of Mount Crvanj have been lined up for designation as protected area since 2021, yet the river is still under threat by seven planned dams in this area. Downstream of Ulog, the establishment of national parks is planned: on the left side of the Neretva River, Mount Prenj (the process is ongoing for part of the planned area), and on the right side, the mountains Treskavica, Visočica, and Bjelašnica – notably the river itself is included in neither. Two more large hydropower plants, namely HPP Bjelimići and HPP Glavatičev, are planned downstream of HPP Ulog, and several small HPPs are planned on tributaries such as the Ljuta (15 HPPs) and Jezernica (4 HPPs) rivers. Thus, the area is far from being safe and continuous pressure is needed to emphasise the need for its protection.

The results of the Neretva Science Week 2022 were impressive:

over 1000 species living in or along the investigated upper section of the Neretva were identified, of which 24 were new for Bosnia and Herzegovina, and eight species were new to science (Singer et al. 2023). It was clear that we barely scratched the surface with regard to the region's biodiversity. Also, while there is ongoing construction of hydropower and continued threat to rivers and forests, the Neretva River and its valley still remain natural and outstandingly biodiverse ecosystems in a unique landscape worthy of protection. But – in times of social media and ever-shortening attention spans – do these facts promise success for a second Neretva Science Week just one year later? At least, a new mission was needed to make it attractive enough for scientists as well as the media. In 2022, we focused on aquatic and terrestrial 'river-associated' biodiversity along a length continuum from the river's source to the city of Konjic, often with an eye on assessing potential direct impacts of hydropower on threatened habitat types and protected species. We achieved local assessments of flora, fauna and habitat along a series of sampling sites following a river growing in size, and, in part, managed to integrate those into an expert-based opinion on biodiversity and ecological integrity of the Neretva at a regional scale. The idea of assessments done at a 'regional scale' also drove our mission development for the Neretva Science Week 2023. A river is more than its wet channel and may be thought of as vertically extending towards groundwater (Saccò et al. 2024) and laterally transcending both its riparian zone as well as its floodplain (Gurnell et al. 2016); ultimately it must be thought together with its catchment, that feeds the river with water and resources and *vice versa*.

For 2023, our mission statement formulated three objectives (Fig. 3): (i) an assessment of biodiversity of the Neretva valley along peak-to-peak transects, ii) an exploration of remote and hard-to-access tributaries, and iii) an excursion to the Zalotka River, itself a hidden tributary to the Neretva. As the unique value of the Upper Neretva is the combination of intact forest and a living river network, our first objective was to explore biodiversity along several altitudinal transects along the slopes of the valley and the karst plateaus above: Zelengora in the north and Morine in the south. These transects were identified during scouting in April 2023; scientists were then following the transects and systematically studied the beech and oak forests on the slopes of the valley and the grasslands of the plateaus, including two lakes, Crvanj (Bosnian: Crvanjsko jezero) and Kladopolje (Bosnian: Kladopoljsko jezero). Our second objective was to explore the diversity of remote tributaries, like the canyon of Međedak and the Ljuta River. Each of those represented a unique challenge: the first demanded canyoning skills, while the latter was surrounded by areas heavily contaminated with landmines and therefore only accessible at a few points. Finally, we organised a one-day sampling trip to a hidden tributary of the Neretva River: the intermittent Zalotka River, which flows through Nevesinjsko Polje, sinks completely into a cave called Biograd Ponor and reappears again as Bregava, Buna and Bunica springs, three tributaries of the Lower Neretva River downstream of Mostar. The ongoing 'Upper Horizons' hydropower project plans to divert water away from the sinkhole, with devastating impacts on the downstream section of Neretva River.



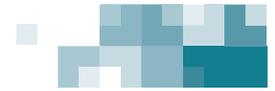


**Figure 3.** Study locations during the Neretva Science Week 2023. (a) Neretva River upstream of Ulog with predefined peak-to-peak transects; (b) the canyon tributaries Ljuta, Jezernica and Međeđak; (c) the Zalotka River in the Nevesinjsko Polje; (d) overview and location of the River Neretva and its upper section in Bosnia and Herzegovina.

**Slika 3.** Raziskovane lokacije med Tednom znanosti Neretva 2023. (a) Reka Neretva nad Ulogom z vnaprej določenimi transektnimi potmi; (b) kanjonski pritoki Ljuta, Jezernica in Međeđak; (c) reka Zalotka v Nevesinjskem polju; (d) pregled in položaj reke Neretve in njenega zgornjega dela v Bosni in Hercegovini.

**Slika 3.** Istraživani lokaliteti tokom Sedmice nauke na Neretvi 2023. (a) Rijeka Neretva uzvodno od Uloga sa unaprijed definisanim transektnima-od vrha do vrha; (b) kanjonske pritoke: Ljuta, Jezernica i Međeđak; (c) Rijeka Zalotka u Nevesinjskom polju; (d) prikaz i položaj rijeke Neretve i njenog gornjeg toka u Bosni i Hercegovini.





## OUTCOMES OF THE NERETVA SCIENCE WEEK 2023 – IN THE PRESENT SPECIAL ISSUE AND BEYOND

Immediately after fieldwork, participants might have summarized the Science Week with »It was cold and rainy, bugs were hiding, data collection remained limited, yet it seems worthwhile to protect the area.« After the publication of a preliminary report, various international presentations, and the present special issue at hand, we can acknowledge its great success despite all challenges. In a week from 30 May to 6 June 2023, almost 70 scientists from 17 countries participated in concert with 30 journalists, artists, photographers, lawyers and activists. Scientists were covering such different fields of biodiversity as forests, flora, fungi, fish, birds, amphibians and reptiles, large carnivores, bats, grasshoppers and crickets, butterflies and moths, spiders, subterranean fauna, soil fauna, aquatic beetles, stoneflies and caddisflies and other aquatic macroinvertebrates. The extension of studied taxonomic groups and research areas resulted in at least another 1000 species identified, thus doubling the taxonomic diversity discovered during the first Neretva Science Week. For the first time, scientists studied the age and structure of near-pristine forests of the Gornja Neretva. Several endangered, endemic, or protected species were newly observed. Various species potentially new to science were found in groups not studied before, like fungi, grasshoppers, and spiders. A total of 11 contributions are collected in this special issue of *Natura Sloveniae* and a few more publications based on the results of the second Neretva Science Week in 2023 may still be released in the near future.

Notably, in 2023, two socio-cultural aspects were studied for the first time: On the one hand, scientists themselves were made study subjects, as their experiences were probed to understand elements steering engagement and readiness for scientific advocacy. For the first time we thereby learned more about the personal challenges associated with creating real-world impact in the scientific life, i.e. what it takes to be an engaged scientist. Published results (Stritih et al. 2025) may help to improve future Science Weeks. On the other hand, the socio-ecological research team explored the relationships and connections of locals living in the Neretva valley with the river, the landscape and hydropower development through interviews. While results still await to be published, this research enabled us to realize an important consequence of the two Neretva Science Weeks organised at the same location: the so far underestimated effect that the events had had on the local population. Recognition of their homeland as a globally important natural heritage by foreign scientists changed their own perception of the natural value of their surroundings. Once a year, an almost abandoned settlement had come to life under the spotlight of international media. Local guides shared their knowledge with the visitors and discussed their future. One may hope that this leads locals to assume a proactive approach in shaping the future of the area – if so, this should be seen as an important contribution of the Neretva Science Weeks to the protection of this exceptional area. However, the team also documented locals stating a sense of being left

unheard between different fronts and ideas of development, while simultaneously suffering a range of never resolved constraints of everyday life, e.g. bad accessibility due to poor road maintenance. This point suggests that future campaigns may wisely invest into a more conscious involvement of the local population into a Science Week or particular river protection project to help generate development visions that will benefit people and nature.

Once again, an important factor for the success of the Neretva Science Week was the effort made to bring journalists along during the fieldwork, allowing them to experience the Neretva landscape while in direct exchange with the scientists. This enabled understandable in-depth storytelling in various media, as journalists could blend personal experience with on-site explanations that made ecological phenomena tangible. A total of 28 and 49 international and national media contributions were produced (without counting social media activities, NGO press releases and public appearances). Notable stories were published, for instance, by CNN (Lewis 2023), Re:wild (Moreno 2023) and Aljazeera (Zukić 2023). A video summarizing the week's activities remains available on the internet (<https://www.youtube.com/watch?v=YchaHwH5eWs>).

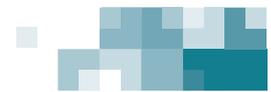
Two Science Weeks taking place in the village of Ulog over two consecutive years and the developing network of people within and around the Scientists for Balkan Rivers generated a range of activities in the wake of the Neretva Science Weeks. In 2024, the River Collective (<https://rivercollective.org>) organised a Students for Rivers Camp, i.e. a 6-day interdisciplinary summer school training students in various aspects of river protection. In collaboration with the local NGO Zeleni Neretva, the River Collective also launched the initiative 'Countermapping Neretva', a participatory mapping exercise aiming to portray the Upper Neretva River as experienced by members of the local community, including families, activists, fishermen and conservationists. The resulting map offers a counter-narrative to the extractivist view that appreciates the river solely for resource exploitation, by celebrating its cultural, ecological, and personal significance. And, finally, when Ulog HPP's operation started, causing a major fish-kill incidence in September 2025, the network that had formed during two Neretva Science Weeks jumped into action within days.

## CURRENT STATE AND OUTLOOK

At the moment of publication of this special issue, the situation in the Upper Neretva valley is already distinctly different from what could be encountered during Science Weeks in 2022 and 2023. Ulog HPP filled its reservoir, drowning a forest and a living river, and started operation in a maximally destructive hydropeaking mode that kills the threatened softmouth trout in the downstream Neretva River section. The following words of water beetle specialist Michaela Brojer on a single species epitomizes both banality and tragedy of biodiversity loss associated with such development:

»What I want to emphasize is that the locality downstream of Ulog, directly on the Neretva River (near the former Swimming Beach), was the most interesting and worthy of protection from the perspective of aquatic beetles. *Stenelmis puberula* was found there

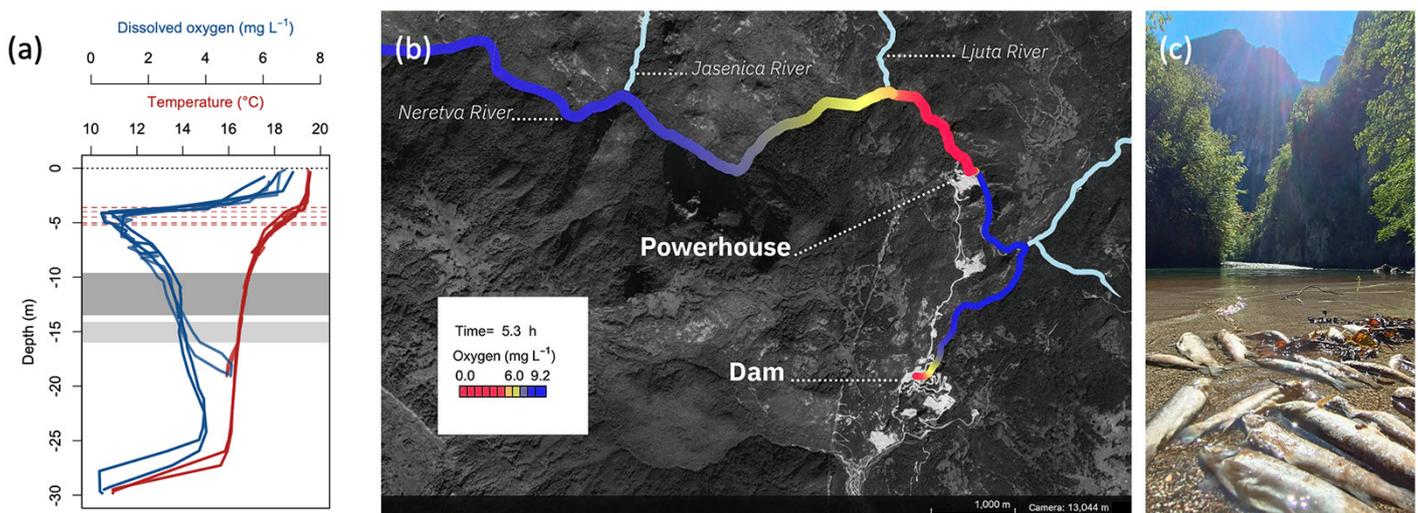




in exceptionally high abundance. This species requires fast-flowing, stony sediment with large interstitial spaces not 'blocked' by fine sediment. Species of the genus *Stenelmis* are extremely rare in both Central Europe and the Balkans, they are endangered or extinct/missing in Germany, critically endangered in Austria and the Czech Republic. The reason for their endangerment is presumably primarily the damming of upland streams, reduction of flow velocity, and the input of fine sediment – likely precisely the conditions currently occurring upstream of Ulog HPP.«

In September 2025, a major fish-kill occurred just downstream of Ulog HPP (Fig. 4), with hundreds of dead fish observed, including the critically endangered softmouth trout and white-clawed crayfish. The event followed three abrupt spikes in river discharge consistent with sudden reservoir releases ('hydropeaking'), yet authorities denied any link to the HPP. The Scientists for Balkan Rivers Network immediately reacted with an open letter that outlined the potential link to the release of oxygen-deficient water from hypolimnetic reservoir water layers and demanded prompt investigation and adaptation of Ulog HPP's operation in the ecologically sensitive river net-

work. In the following weeks, a small team assembled from the Scientists of Balkan Rivers delivered a prime example of what a network of engaged scientists is capable of doing: Less than two weeks after the fish-kill, a field mission was dispatched to collect evidence by assessing vertical stratification of the reservoir and measuring profiles of key variables (Fig. 4a) alongside downstream discharge conditions. Combining these field data with publicly available data on discharge and precipitation, remote sensing imagery from EU's Copernicus missions and past data on river morphology collected during the first Neretva Science Week allowed to clearly demonstrate that – in violation of its environmental permit – Ulog HPP operated in a hydropeaking mode, releasing oxygen-depleted deep water that caused widespread suffocation of aquatic life in the Neretva River. A reoxygenation model for the downstream river (Fig. 4b) further suggested that hydropeaking can be expected to create an ecological trap that allows trout to move into an only transiently deoxygenated river reach of several kilometres. This mechanism lets us expect far-reaching damaging effects on trout populations if hydropeaking operations persist.

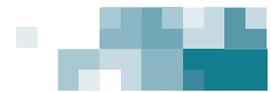


**Figure 4.** Ulog HPP's hydropeaking operations with oxygen-deficient hypolimnetic reservoir water caused a fish-kill in the Neretva River in September 2025. (a) Vertical profiles of dissolved oxygen and temperature in the reservoir at a distance of 400 m from the dam show strong temperature stratification and oxygen conditions unsuited for trout survival below ~4.5 m. Grey areas show depth windows of water intake to turbines and residual flow section. (b) A reoxygenation model demonstrates extent of 'death zone' (in red) where trout likely cannot survive. As this death zone appears and disappears transiently with hydropeaking, an ecological trap is formed. (c) Dead specimens of various species of *Salmo*, including softmouth trout (*Salmo obtusirostris*), European bullhead (*Cottus gobio*) and white-clawed crayfish (*Austropotamobius pallipes*) observed in the Neretva River section between Ulog HPP powerhouse and the tributary Jasenica on 13.–15. 9. 2025 (photo: Hrabren Kapić).

**Slika 4.** Hidroelektrarna Ulog je s svojim delovanjem in spuščanjem hipolimnične vode iz akumulacije, ki je bila osiromašena s kisikom, septembra 2025 povzročila pogin rib v reki Neretvi. (a) Vertikalni profili raztopljenega kisika in temperature v rezervoarju na razdalji 400 m od jezua kažejo močno temperaturno stratifikacijo in stanje kisika, ki niso primerne za preživetje postrvi pod ~4,5 m. Siva območja prikazujejo globinske okvire za dovod vode v turbine in preostali del pretoka. (b) Model ponovnega oksigeniranja prikazuje obseg »smrtne cone« (v rdeči barvi), kjer postrvi verjetno ne morejo preživeti. Ker se ta smrtna cona pojavlja in izginja prehodno s hidroelektrarno, se oblikuje ekološka past. (c) Mrtvi primerki različnih vrst rodu *Salmo*, vključno z mehokoustno postrvjo (*Salmo obtusirostris*), kapljem (*Cottus gobio*) in primorskim koščakom (*Austropotamobius pallipes*), opazovani v odseku reke Neretve med elektrarno Ulog HPP in pritokom Jasenice med 13. in 15. 9. 2025 (foto: Hrabren Kapić).

**Slika 4.** Hidroelektrarna Ulog je svojim djelovanjem ispuštanja hipolimetrične vode siromašne kiseonikom iz akumulacije izazvala pomor ribe u rijeci Neretvi u septembru 2025. godine. (a) Vertikalni profili rastvorenog kiseonika i temperature u akumulaciji, na udaljenosti od 400 m od brane, pokazuju snažnu temperaturnu stratifikaciju i kiseonične uslove nepogodne za opstanak pastrmke ispod približno 4,5 m dubine. Sive oblasti označavaju dubinske okvire za zahvat vode za turbine i presjek preostalog protoka. (b) Model reoksigenacije pokazuje obim »zone smrti« (označene crveno) u kojoj pastrmka vjerovatno ne može preživjeti. Kako se ova zona privremeno pojavljuje i nestaje usljed hidropeakinga, formira se ekološka zamka. (c) Uginuli primjerci različitih vrsta roda *Salmo*, uključujući mekoustnu pastrmku (*Salmo obtusirostris*), peša (*Cottus gobio*) i riječnog raka (*Austropotamobius pallipes*), zabilježeni u području rijeke Neretve između mašinske zgrade hidroelektrane Ulog i pritoke Jasenice u periodu 13.–15.9.2025. (foto: Hrabren Kapić).





These results were presented in the Bosnian parliament on 28 November 2025, alongside the demand to immediately stop hydropeaking, enforce run-of-river operation, and implement transparent continuous monitoring. The results were also published (Singer et al. 2025) in a national scientific journal, the *Acta Geographica Bosniae et Herzegovinae*, and will potentially also be published internationally. There will be a chance to see how successful these interventions were in 2026, when Ulog HPP's environmental permit will be up for renewal.

The Neretva River is challenging and instructive for the Blue Heart of Europe Campaign. For ecologists, a Science Week has so far largely been an activity on the sunny side of things – an invitation to help describe astonishing biodiversity in an outstanding landscape is hard to decline, while the fact that discovering a new or threatened species contributes to conservation of ecosystems morally reassures the excited ecologist. A Science Week attracts attention and puts the river and the scientists themselves into the spotlight, while the gathered data represent support for advocating the protection of an intact ecosystem also in legal terms. However, both Neretva Science Weeks were organised in the face of ongoing destruction, the construction of Ulog HPP was not just a threat looming on the horizon. Today, the pre-programmed defeat is real; Ulog HPP is in operation and challenges us to maintain momentum in our work for conservation despite the ecological loss we have to witness. Indeed, even if steering a boat through dead forest on a newly formed reservoir is only a fraction of the fun that it was to hike along the pristine river before, nailing down Ulog HPP as responsible for a major fish-kill and carrying evidence to the highest political levels may indeed be a worthwhile activity for the Scientists of Balkan Rivers network. After all, it is not time yet to give up on this exceptional river. Ulog HPP is a particularly destructive project, both due to its location as well as its operation – and this may be showcased again and again. The Gornja Neretva upstream of Ulog HPP is still a near-pristine landscape hosting great biodiversity in a landscape of unmatched beauty. The same applies to the canyon of the Ljuta and the Neretva River downstream of Ulog HPP, where protected area plans associated with mountain landscapes on either riverside are being developed and should include the Neretva River itself. Let us imagine a protected Neretva River from source to Konjic, where Ulog HPP may be a scar in the landscape now, optimally managed to harm the river as little as possible in the short term, and simply brought down again in the long term – like all built things, dams need to be removed one day. So, Scientists for Balkan Rivers, maintain the momentum built up through two Science Weeks with one or the other activity!

## NO DATA WITHOUT SUPPORT – ACKNOWLEDGEMENTS:

All involvement of scientists in the Neretva Science Week, including on-site participation, preparatory work before the event and analysis thereafter, happened on a completely voluntary basis without any payment. This special issue of *Natura Sloveniae* is their contribution to saving the Neretva River from further damming – Thank you! Organising the whole Science

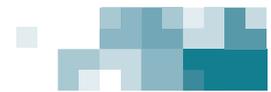
Week would not have been possible without the support of Manfred-Hermesen-Stiftung (<https://www.m-h-s.org/en/>), a long-standing partner of the Save the Blue Heart campaign. Individual scientists used their own projects and funds for further analyses of the material they gathered during the NSW23, and these funds are acknowledged in the individual contributions. The engagement of MZ was cofinanced by the Slovenian Agency for Research and Innovation through core programme P1-0184. We would like to thank the team from the Center for Environment for organisational support. The association of sports fishermen in Konjic and the fish association from Kalinovik welcomed us and supported the event. Finally, the support of the local community was crucial for the entire event. They are the first ones directly impacted by the changes in their environment. We specifically thank Boban Škrkar and his friends and family from Ulog, who helped us with logistics, opened up their houses and gardens as places to stay, and provided meals to all participants.

We dedicate this article to Toni Vorauer, a friend, colleague and participant of several Science Weeks, who passed away completely unexpectedly after short illness on 25 November 2025. Toni enriched the Scientists for Balkan Rivers network with unmatched expertise on bats and tireless motivation for their discovery in hidden sheds, tree holes and caves. He was a river conservationist and a key figure within the Blue Heart of Europe campaign thanks to his photographic skills.

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