



INSTRUMENT ZA PREDPRISTOPNO POMOČ
INSTRUMENT PREPRISTUPNE POMOČI

BIOSPELEOLOGICAL RESEARCHES WITHIN **PROJECT KUP**

(KARST UNDERGROUND PROTECTION)

Operative Program IPA Slovenia - Croatia 2007-2013

KARST
UNDERGROUND
PROTECTION

IPA CBC SLO - HR 2007 - 2013





Istrian peninsula (3476 km²) is located in southern Europe, in the northernmost part of the Adriatic Sea and the Mediterranean. Geopolitically, belongs to Italy, Slovenia and Croatia, while the geomorphologically is divided on the inner, deep limestone karst Dinaric part, because of white rocks known as *White Istria*; outdoor and low-lying coastal karst plateau covered with red soil, *Red Istria*, and between them impervious hydrological barrier, by color of flysch sediments called *Grey Istria*. Nearly 70% of Istria is covered with typical karst landscape with an underground flow of water and numerous karst features, including over 2000 known caves.

Unique biospeleological fundaments and research tradition in Istria

Project for the protection of the karst underground of Istria **KUP (Karst Underground Protection, www.project-kup.org)** starts from the premise of the uniqueness and importance of the Istrian karst underground, for Europe, but also for the whole world, and the need for its systematic research, evaluation and protection. The project is a logical continuation of a previously conducted project **Underground Istria (www.underground-istria.org)**, which was implemented during 2008th year and is also funded by the European Union. Biospeleological researches are for the first time included in the project KUP. The Istria caves and pits reside numerous endemic, rare, endangered and protected species of cave fauna, among which stand out Istrian endemic, such as snail hydrobiid snail *Istriana mirnae*; amphipod and isopod crustaceans *Niphargus echion*, *Thaumatiscellus speluncae* and *Monolistra jalzici*; millipede *Eupolybothrus obrovensis* and *Verhoeffodesmus fragilipes*; false scorpion *Troglochthonius doratodactylus*; several cave beetle species as *Leptodirus hochenwartii*, *Croatodirus bozicevici*, *Prospelaebates vrezeci*, *Pauperobythus globuliventris*.

Olm, as a symbol of the fauna of the dinaric karst, in Istria is represented by endemic Istrian olm (*Proteus anguinus* ssp. Nov.).

Biospeleological researches of Istria begin in mid 19th century by work of Croatian, German, Slovenian and Italian biologists: Gustav Joseph, Ivan Andrej Perko, Adolf Stošić, Josef Stussiner, Antonio Valle and others. In the 20th century researches are conducted by: Giuseppe Müller, Hans-Krekich Strassoldo, Karl Wilhelm Verhoeff, Karl Strasser, Albert Winkler, Egon Pretner, Christa Deeleman, Jože Bole, Boris Sket, Fabio Stoch, Fulvio Gasparo, and many others. Although research is actively continuing through the 21st century, the cave fauna of Istria has not yet been systematically explored.

Unfortunately, the activity of a numerous negative factors, cave, especially freshwater habitats, with the aquatic cave fauna, are all endangered so it is necessary to determine the causes of threats and develop an active protection measures and with monitoring control the state of caves and implementation of protection measures.

The purpose and mission of the biospeleological researches of project KUP

1. Classification and evaluation of cave habitats and cave fauna, with assessment of the population.
2. Identification and registration of new species for the fauna of Istria, as well as new to science.
3. Defining the threat of cave fauna and subterranean habitats.
4. Defining and measuring the environmental factors in the cave habitats of six selected caves in Slovenia and six on the Croatian territory.
5. Education of local population about the importance of cave habitats and fauna, and the need of protection.
6. Detailed education of cavers about the cave habitats and their fauna.
7. Shooting a documentary film about biospeleological characteristics of cave fauna of Istria.
8. Preparation and publication of scientific and popular papers on the cave fauna of Istria.

Biospeleological research methods

The international research team developed a list of the biospeleologically most interesting objects of Istria, from which is based on multiple criteria selected 6 of them in Slovenia (SLO), and 6 in Croatia (CRO) (Table 1).

Table 1: List of 12 selected caves included in the KUP project

Num.	Cave	Length (m)	Depth (m)	Remark
1.	Markova jama, Tar, CRO	291	82	Protected as a geomorphologic natural monument since the 1986 th year.
2.	Pincinova jama pit, Poreč, CRO	100	85	Protected as a zoological nature monument since the 1986 th year.
3.	Piskovica cave, Gologorica, CRO	1036	38	The largest cave in the world developed in the flysch.
4.	Jama kod Burići pit, Kanfanar, CRO	100	127	Situated close to the drive of Rovinj Tobacco Factory (TDR).
5.	Rabakova cave, Roč, CRO	100	12	Located in the heart of the village.
6.	Radota cave, Vodice, CRO	200	142	Situated on the border between Slovenia and Croatia; closest speleological object to the future speleo house in Vodice.
7.	Račiška pečina cave, Račice, SLO	304	29	The former military warehouse and paleontological site.
8.	Polina peč cave, Poljane, Obrov, SLO	365	40	Endangered cave, proposed for the protective closure of the entrance.
9.	Cave Medvedjak, Materija, SLO	1092	129	The cave with a vertical entrance of 40 m, accessible only to qualified cavers.
10.	Cave Dimnice, Materija, SLO	6020	134	Tourist cave.
11.	Jama pod krogom pit, Mlini, SLO	570	25	Spring cave located on the Slovene-Croatian border
12.	Kubik, Gradin, Koprška brda, SLO	292	10	The cave developed in the flysch

Systematic biospeleological researches are conducted through:

1. **Cabinet part:** gathering and processing of existing data, making the research plan, the development of scenarios and the book of shooting a documentary, analysis of data and collected materials generated through field research, preparation and filling of databases, periodic and final reports.
2. **Field research:** physical cave exploring, defining the cave habitats, surveying the microclimate, recording and collecting cave fauna; photographic documentation of cave habitat and the research process; macro photographing cave fauna; installation of instruments for continuous monitoring of cave climate, keeping a research diary.
3. **Presentation of results:** Public lectures and presentations, technical workshops, production of informational and educational publications and posters, publishing professional and popular articles.

Objectives of biospeleological researches

1. Establishing the historical facts, correct name of the facility and review of previous researches.
2. To determine the position of the entrance, check the topographic plan and establish the baseline condition.
3. Undertake geological, hydrological, geomorphological, paleontological and archeological screening.
4. Define the types of cave habitats and determine their environmental attributes.
5. Undertake taxonomic, ecological, biological and biogeographical analysis of cave fauna.
6. Develop biospeleological cadastre which includes the photographic documentation.
7. Define the level of threat with proposed conservation and protection measures.
8. Develop an expert study for each speleological object.
9. Develop a final feasibility study with a proposal for further research and the establishment of monitoring.
10. Raise awareness about the importance of cave fauna in the *local population, speleologists and the wider community* through educational and informative publications, professional and educational workshops, lectures and presentations, and publishing technical and popular articles.
11. Develop educational and promotional documentary about cave fauna of Istria.

Preliminary results of biospeleological researches

Researches were conducted by a four member biospeleological research team composed of: Jana Bedek¹, Roman Ozimec¹, Slavko Polak² and Valerija Zakšek³, in cooperation with the local population in Slovenia and Croatia, a number of local speleologists, and other specialists, such as experts in cave diving and underwater filming. First results of biospeleological research within the KUP project were presented during the 20th International Biospeleological Symposium in Postojna in Slovenia (20th International Symposium on Subterranean Biology in Postojna, Slovenia) in August 2010th year and in June 2011th year on 19th International Karst School of Classical Karst (19th International Karstological School "Classical Karst") in Postojna, dedicated to protection of the karst underground.

In all of the objects, with the definition of habitats and microclimate surveying with mobile instruments, were installed stationary instruments for measuring climatic factors. A very rich photographic documentation were made, which includes close-ups of cave fauna recorded in situ, for some of the species for the first time. The filming, which includes some remarkable scenes of underwater exploration and aquatic cave fauna in Pincinova jama pit, was completed. It was collected very rich cave fauna and numerous new finds for Istria, and some new species for science. For some of the endangered cave species, we have found new sites and populations. Some endangered species have been identified for the first time for the fauna of Slovenia and Croatia, and some species have been found for the first time since their scientific description. The most important fauna is presented in Table 2.



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Endangered living treasure of Istrian caves

In addition to exceptional value of Istrian endemic cave fauna was found sadly her real threats. In accordance with the Red Book of cave fauna of Croatia, many of the identified species are endangered, with the present real threats and the devastation of the habitat. Thus, the physical devastation is established for Rabakova cave, Račiška pečina cave and cave Dimnice. Accumulations of castaway were found in a Rabakova cave, Račiška pečina cave, Markova jama pit and Jama kod Burići pit. In Rabakova cave, cave Dimnice and Polina peč cave, cave fauna is endangered due to permanent set traps.

The most vulnerable are the Jama kod Burići pit near Kanfanar and Markova jama pit near Tar because of the insertion of dead cattle, which leads to a reduced percentage of oxygen and increasing the proportion of carbon dioxide. Particularly endangered cave fauna is in the Jama kod Burići pit, where conducted survey showed that the proportion of carbon dioxide is 1.73 to 2.14%, which is over 50 times higher concentration than usual and it does not only represent the devastation of cave habitats, but also a threat to researchers. It is necessary to perform a cleansing action of fill-organic waste in these pits, with the implementation of preventive activities, particularly education of local people.

Through the project KUP it was established the necessity of biospeleological researches for scientific knowledge about the values of the karst underground of Istria, but also to define the status of cave habitats, biodiversity in the karst underground, state of population, endemism, and present and potential threat and for devising and implementing protection measures. Results of biospeleological researches, realized within the project, along with photographs and documentary film and the actual publications and published works, represent a valuable scientific, educational and promotional material, and hopefully the evolutionary shift towards conservation of endangered living treasure of Istrian caves.

Table 2: List of identified important fauna of the described species (type-locality).

Num.	Cave	Significant fauna	Type locality for the species
1.	Markova jama pit, Tar, HR	<i>Zospeum spelaeum schmidti</i> , <i>Niphargus spinulifemur</i> , <i>Stalita</i> sp., <i>Laemostenus</i> sp., Sommer birth bat colony of <i>Myotis myotis</i> with over 1,000 specimens.	<i>Pauperobythus globuliventris</i>
2.	Pincinova jama pit, Poreč, HR	<i>Troglocaris planensis</i> , <i>Niphargus hebereri</i> , <i>Niphargus steueri</i> , <i>Monolistra</i> sp., <i>Sphaeromides virei</i> , <i>Hadzia fragilis</i> , <i>Laemostenus cavicola romualdi</i>	<i>Proteus anguinus</i> ssp. nov.
3.	Piskovica cave, Gologorica, HR	<i>Zospeum</i> sp., <i>Dina krasense</i> <i>Monolistra bericum hadzii</i> , <i>Niphargus krameri</i> , <i>Chthonius</i> sp., <i>Neobisium</i> sp. nov., <i>Lithobius</i> sp. nov. <i>Verhoeffodesmus gracilipes</i> , <i>Typhloiulus</i> sp.,	-
4.	Jama kod Burići pit, Kanfanar, HR	<i>Alpioniscus strasseri</i> , <i>Troglochthonius doratodactylus</i> , <i>Chthonius</i> sp. nov., <i>Stalita</i> sp.	-
5.	Rabakova cave, Roč, HR	<i>Alpioniscus strasseri</i> , <i>Chthonius</i> sp., <i>Neobisium</i> sp., <i>Niphargus krameri</i> , <i>Monolistra bericum hadzii</i> , <i>Typhlotrechus bilimeki istrus</i> , <i>Bathysciotes khevenhulleri</i> , <i>Machaerites</i> sp., <i>Typhloiulus</i> sp.	<i>Verhoeffodesmus gracilipes</i>
6.	Radota jama pit, Vodice, HR	<i>Eupolybothrus obrovensis</i> , <i>Eukoenenia</i> sp., <i>Neobisium</i> sp., <i>Chthonius</i> sp., <i>Laemostenus elongatus elongatus</i> , <i>Mesostalita</i> sp., <i>Machaerites</i> sp.	-
7.	Račiška pečina cave, Račice, SLO	<i>Typhlotrechus bilimeki istrus</i> , <i>Laemostenus cavicola</i> , <i>Leptodirus hochenwartii</i> , <i>Bathysciotes khevenhuelleri</i> , <i>Prospelaebates vrezeci</i> , <i>Niphargus stygius</i> , <i>Titanethes dahl</i> , <i>Troglochthonius doratodactylus</i>	-
8.	Polina peč cave, Poljane, Obrov, SLO	<i>Typhlotrechus bilimeki istrus</i> , <i>Anophthalmus schmidti istriensis</i> , <i>Laemostenus cavicola</i> , <i>Leptodirus hochenwartii</i> , <i>Neobisium</i> sp., <i>Chthonius</i> sp., <i>Nicoletiella</i> sp.	<i>Machaerites novissimus</i>
9.	Cave Medvedjak, Materija, SLO	<i>Zospeum</i> sp., <i>Typhlotrechus bilimeki istrus</i> , <i>Laemostenus cavicola</i> , <i>Laemostenus elongatus</i> , <i>Eukoenenia</i> sp., <i>Troglochthonius</i> sp., <i>Chthonius</i> sp., <i>Neobisium</i> sp.	<i>Prospelaebates vrezeci</i>
10.	Cave Dimnice, Materija, SLO	<i>Typhlotrechus bilimeki istrus</i> , <i>Anophthalmus spectabilis istrus</i> , <i>Laemostenus cavicola</i> , <i>Leptodirus hochenwartii</i> , <i>Oryotus schmidti subdentatus</i> , <i>Brachydesmus inferus</i> , <i>Neobisium spelaeum istriacum</i> , <i>Neobisium reimoseri histicum</i> , <i>Stalita</i> sp., <i>Niphargus krameri</i> , <i>Titanethes dahl</i> , <i>Zospeum isselianum</i> , <i>Zospeum kusceri</i>	<i>Eupolybothrus obrovensis</i> <i>Anophthalmus spectabilis istrianus</i> , <i>Oryotus schmidti subdentatus</i>
11.	Jama pod krogom pit, Mlini, SLO/HR	<i>Marifugia cavatica</i> , <i>Sphaeromides virei virei</i> , <i>Troglocaris planinensis</i> , <i>Niphargus steueri</i>	<i>Troglocaridicola istriana</i>
12.	Kubik, Gradin, Kopraska brda, SLO	<i>Zospeum</i> sp., <i>Bathysciotes khevenhuelleri</i> , <i>Niphargus krameri</i> , <i>Monolistra</i> sp.	-



Troglochthonius doratodactylus



Thaumatiscellus speluncae



Eupolybothrus obrovensis



Verhoeffodesmus gracilipes



Pauperobythus globuliventris



Proteus anguinus ssp. nov.



Leptodirus hochenwartii



Istriana mimae



Protection of speleological objects in the Region of Istria through EU projects

The Region of Istria has designed a project whose focal point is the protection of water sources which, thanks to financial assistance of European Union funding, will ensure the reduction of harmful effects of anthropogenic activities on karst landscape that characterizes most of the territory of the Region of the Istria, and also the Croatia and neighboring Slovenia and Italy. The majority of speleological objects represent a direct connection of surface and ground waters, and hence their protection has considerable significance for the community.

The project "**Underground Istria**" is one of the most successful projects financed by the European Union aimed at improving the status and protection of caves and protection of groundwater karst aquifers. Within the project it was cleared nine caves in Istria, it was made a database of speleological objects, and were held numerous workshops and lectures for local residents and middle-school population with the desire that everyone get acquainted with the importance of caves as a natural phenomenon of karst area of Istria.

Given that sustainability of karst is possible only with continuous conduction of scientific researches along with constant supervision and monitoring of their condition, the Region of Istria, at the tender of the CBC Slovenia Croatia 2007. -2013. Year, has reported a new project called **KUP (Karst Underground Protection)** as a logical continuation of the previous project. The project comprises numerous activities, with particular emphasis on the biospeleological research and education of speleologists about a scientific approach to speleology. The project will foster better collaboration of regional and public institutions in the field of environmental protection in Croatia and Slovenia in addition to recognize of the area of landscape and natural features of the karst areas in Istria. Numerous activities are planned which will influence on the prevention of pollution/contamination of underground karst aquifer.

With the inventory and planned management of speleological objects in the project area will ensure their sustainability, while the conversion of the old school into "speleo house" in the small town Vodice situated in the municipality of Lanišće, will ensure further development of speleology in the Istria.

Projekt KUP - Karst Underground protection

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cover page: Ponor Kolinasi, Roč, Čičarija, HR (Autor: Ivan Glavaš);
cover inside: Jama kod Rašpora, Čičarija, HR (Autor: Ivan Glavaš);
page 3: Dubrovska pečina, Pazin, HR (Autor: Ivan Glavaš);
page 5: Lažištipavac Troglachthonius doratodactylus, Račiška pečina, Račice, SLO (Autor: Roman Ozimec);
page 5: Kopneni jednakožni rak Thaumatoniscellus speluncae, Jama Medvedjak, Materija, SLO (Autor: Jana Bedek);
page 5: Dvojenoga Verhoeffodesmus gracilipes, Rabakova špilja, Roč, HR (Autor: Roman Ozimec);
page 5: Striga Eupolybothrus obrovensis, Gnojnica jama, Mune, HR (Autor: Jana Bedek);
page 5: Kornjaš pipalica Pauperobythus globuliventris, Markova jama, Tar, HR (Autor: Roman Ozimec);
page 5: Istarska čovječja ribica Proteus anguinus ssp. n., Izvor Nimfej, Pula, HR (Autor: Vedran Jalžić);
page 5: Vodeni puž Istriana mirnae, Izvor Žive vode, Mirna, HR (Autori: Roman Ozimec & Rajko Slapnik);
page 5: Kornjaš podzemljak Leptodirus hochenwartii, Dimnice, Materija, SLO (Autor: Roman Ozimec);
page 7: Jama Medvedjak, Materija, SLO (Autor: Roman Ozimec);
page 9: Jama Maj hahlje, Buzet, HR (Autor: Ivan Glavaš);
cover - back: Vela peč, Brest pod Učkom, HR (Autor: Ivan Glavaš)





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