
ZOO
Zagreb
ČOVJEČJA
RIBICA
Olm
Photo: Boris Krstinić

Photo: Silvio Legović

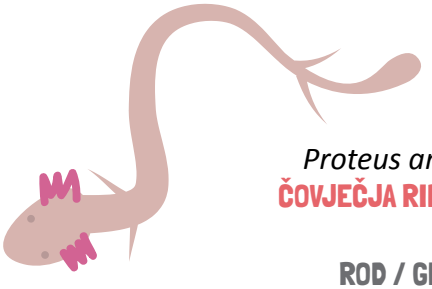
Jedno od najtajanstvenijih bića na svijetu je čovječja ribica *(Proteus anguinus).* Ovaj dugoživući vodozemac, stanovnik špiljskih sustava jedini je pravi podzemni kralješnjak Europe.

Ova je vrsta prvi put opisana 1768. godine, a nazvana je *Proteus anguinus*, prema grčkom bogu Proteusu, zaštitniku organizama koji žive u vodi te po latinskoj riječi za zmiju.

The Olm (*Proteus anguinus*) is one of the most mysterious creatures in the world. This longevous cave dwelling amphibian is the only true underground vertebrate in Europe.

The species was first described in 1768, and it was named *Proteus anguinus* after the Greek god Proteus, the protector of water organisms, and after the Latin word for snake.

SISTEMATIKA
SYSTEMATICS



Proteus anguinus
ČOVJEČJA RIBICA / OLM

ROD / GENUS

Proteus
ČOVJEČJE RIBICE
OLMS

Necturus
GLAVAŠICE
MUDPUPPIES AND WATERDOGS

PORODICA / FAMILY

Ambystomatidae
AMBISTOME ILI DAŽDEVNJACI ROVAŠI
Mole Salamanders

Amphiumidae
JEGULJASTI ŠTUROVI
Amphiumas

Cryptobranchidae
ŠTUROVI ILI DIVOVSKI DAŽDEVNJACI
Giant Salamanders

Hynobiidae
HINOBIJE ILI AZIJSKI DAŽDEVNJACI
Asiatic Salamanders

Plethodontidae
BESPLUĆNJACI
Lungless Salamanders

Rhyacotritonidae
POTOČNI DAŽDEVNJACI
Torrent Salamanders

Proteidae
GLAVAŠICE
Olms, Mudpuppies and Waterdogs

Salamandridae
DAŽDEVNJACI
Salamanders and Newts

Sirenidae
SIRENI
Sirens

RED / ORDER

Gymnophiona
BEZNOŠCI
Caecilians

Caudata
REPAŠI
Salamanders and Newts

Anura
BEZREPCI
Frogs and Toads

RAZRED / CLASS

Amphibia
VODOZEMCI
Amphibians

Iako se često govori o dvije podvrste *P. a. anguinus* i *P. a. parkelj*, neki autori se ne slažu s time te objašnjavaju tzv. crnu čovječju ribicu (*P. a. parkelj*) iz jugoistočne Slovenije kao varijaciju unutar iste vrste (morfotip).

Smatra se da u Hrvatskoj postoje tri odvojene populacije čiji taksonomski status još nije posve razjašnjen. Među njima se izdvaja istarska populacija, za koju također postoje čvrste indikacije da je zasebna vrsta.

Sve to potvrdit će ili opovrgnuti daljnja istraživanja.

Although, two subspecies are often mentioned, *P. a. anguinus* and *P. a. parkelj*, some authors disagree and consider the so-called black olm (*P. a. parkelj*) from south-east Slovenia as a variant of the same species (morphotype).

There are thought to be three separate populations living in Croatia, whose taxonomic classification is not fully resolved yet. The Istrian population stands out among the three, and there are strong indications that it is a separate species.

This shall all be confirmed or denied by further research.

RASPROSTRANJENOST
DISTRIBUTION

Čovječja ribica je endem slatkovodnih staništa dinarskog krša.

Naseljava krško podzemlje u sjevernoj Hrvatskoj, Italiji (područje Trsta), Sloveniji i Bosni i Hercegovini, a unesena je (introducirana) na lokalitete u Francuskoj i Italiji, izvan područja prirodne rasprostranjenosti. Čovječja ribica jedini je pravi podzemni kralješnjak Europe. U Hrvatskoj je prvi put zabilježena 1840. godine na izvoru Goručica u blizini Senja.

Kao što je spomenuto, smatra se da postoje dvije podvrste čovječje ribice – svijetla, troglomorfna podvrsta *Proteus anguinus anguinus* i tamno obojana, netroglomorfna *Proteus anguinus parkelj*. Predstavnici tamno obojane čovječje ribice pronađeni su samo u dva izvora na području Bele Krajine u jugoistočnoj Sloveniji, zapadno od Žumberka.

The Olm is endemic to the freshwater habitats of the karst areas of the Dinaric Alps.

It inhabits the underground karst of Croatia, northern Italy (the area of Trieste), Slovenia and Bosnia and Herzegovina, and it was brought into (introduced to) localities in France and Italy, outside the area of its natural distribution. The olm is the only true underground vertebrate in Europe. It was first recorded in Croatia in 1840 at the Goručica spring, near Sinj.

As mentioned before, research has revealed the existence of two Olm subspecies – the light, troglomorphic subspecies *Proteus anguinus anguinus* and the dark, non-troglomorphic *Proteus anguinus parkelj.* Representatives of the dark olm are found at only two sources in the Bela Krajina area in southeast Slovenia, west of the Žumberak Mountains.

TROGLOMORFIJA / TROGLOMORPHISM

je svaka morfološka i fiziološka promjena ili promjena u ponašanju životinja koja je posljedica prilagodbe na uvjete u podzemnim staništima.

is every morphological and physiological change or behavioural change in animals that occurs as a result of adjustment to conditions in underground habitats.


Photo: Silvio Legović

STANIŠTE I ŽIVOTNI UVJETI
HABITAT AND LIVING CONDITIONS

Čovječja ribica živi u podzemnim vodama vapnenačkih špilja. Iako je uglavnom nalazimo u dubljim dijelovima špilja, ponekad, u potrazi za hranom, dolazi i u plitka podzemna jezera, a pronađena je i u bunarima. Ne napušta svoje stanište, ali zna se dogoditi da ih voda izbaci na površinu kroz pukotine i rascjepe špilja zbog jakih kiša ili otapanja snijega, kada se razina podzemnih voda podiže.

Vode koje nastanjuje bogate su kisikom, a u špiljama su temperature, a posebice temperatura vode, prilično konstantne tijekom godine, što ovoj vrsti odgovara. Preferiraju temperaturu vode između 8°C i 12°C, uz vrlo male oscilacije, a o temperaturi vode ovisi i brzina njihova razvoja. U skladu sa staništem, čovječja ribica prilagodila se životu u tami brojnim receptorima jedinstvenim za ovu vrstu.

The Olm lives in the underground waters of limestone caves. Although we mostly find it in deeper parts of caves, sometimes its search for food brings it to shallow underground lakes and it has been found even in wells. It does not leave its habitat, but sometimes it gets thrown to the surface through cracks and slits in the caves after strong rains or the melting of snow, when the underground water levels rise.

Waters inhabited by olms are rich in oxygen. Temperatures in caves, and especially water temperatures, are rather constant during the year, which agrees with this species. They prefer water at temperatures between 8°C and 12°C, with very small oscillations, and the rate of their development also depends on water temperature. To harmonise with their habitat, they have adapted to life in darkness.

OVE JEDINSTVENE VODOZEMCE NALAZIMO U SLABO ILI POSVE NEOSVIJETLJENIM PODZEMNIM VODAMA.

THESE UNIQUE AMPHIBIANS LIVE IN POORLY LIT OR COMPLETELY DARK UNDERGROUND WATERS.

VANJSKI IZGLED I KARAKTERISTIKE
OUTER APPEARANCE AND CHARACTERISTICS

2 prsta na stražnjim nogama.
2 digits on hind legs.

Usko, izduženo tijelo 25 – 35 cm dužine.
Narrow, elongated body 25- 35 cm in length.

Kratki udovi s karakterističnim smanjenjem broja prstiju.
Short limbs with a characteristic reduction in the number of digits.

Snažan rep s repnom perajom.
Strong tail with a tail fin.

Photo: Boris Krstinić

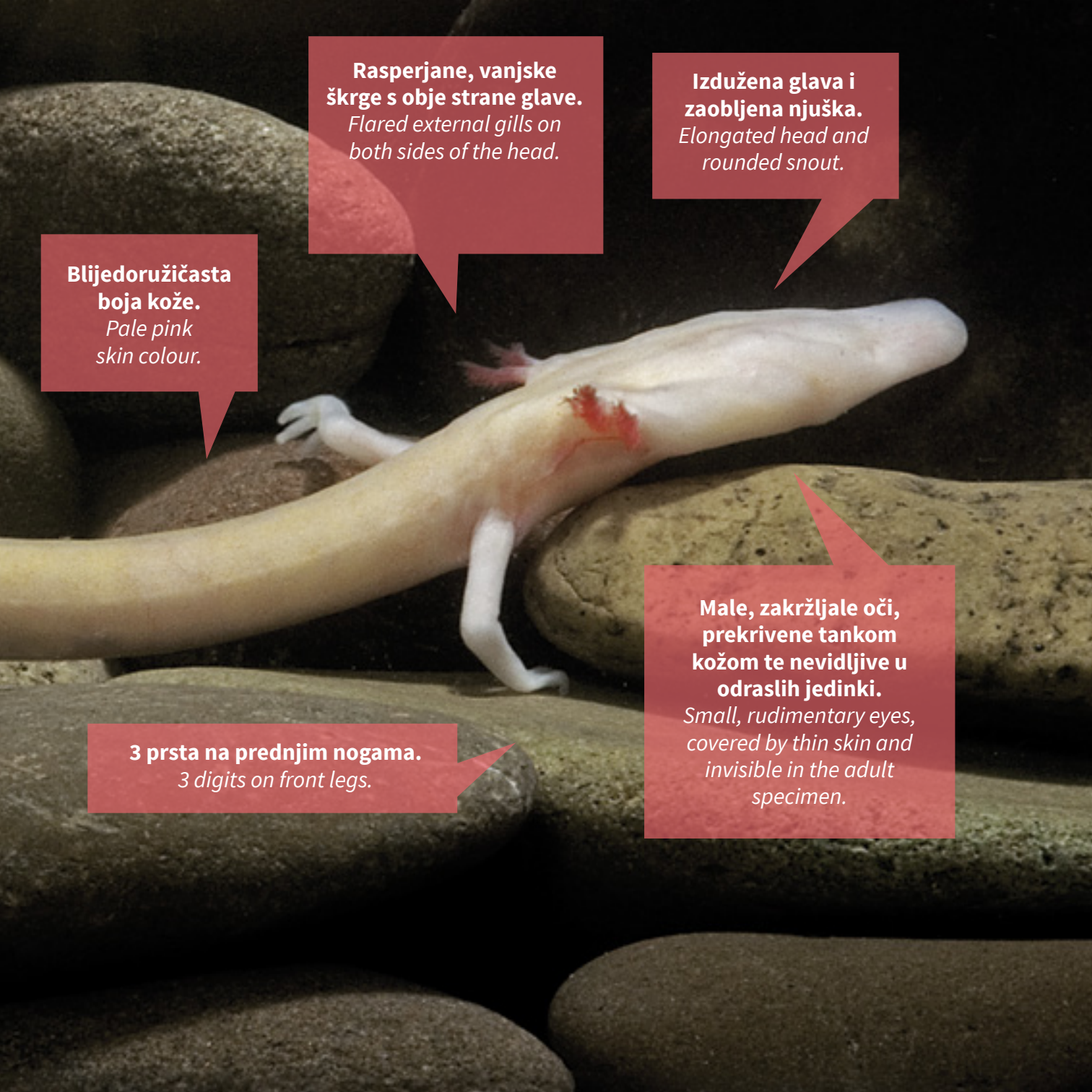
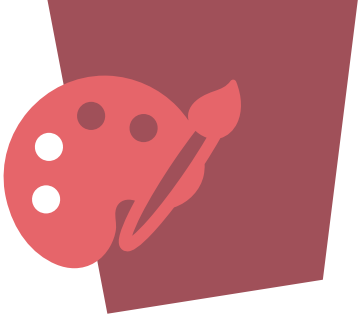

Rasperjane, vanjske škrge s obje strane glave.
Flared external gills on both sides of the head.
Izdužena glava i zaobljena njuška.
Elongated head and rounded snout.
Blijedoružičasta boja kože.
Pale pink skin colour.
Male, zakržljale oči, prekrivene tankom kožom te nevidljive u odraslih jedinki.
Small, rudimentary eyes, covered by thin skin and invisible in the adult specimen.
3 prsta na prednjim nogama.
3 digits on front legs.


Photo: Dušan Jelić

KOŽA
SKIN



Zbog male količine pigmenta riboflavina koža čovječje ribice je bijela ili blijedožuta, a zbog krvnih žila koje se protežu blizu površine tijela djeluje ružičasto. **Upravo je zbog boje, koja podsjeća na boju ljudske kože, vrsta dobila naziv.** Koža je prekrivena tankim mukoznim slojem, a s trbušne strane je gotovo prozirna te se kroz nju mogu vidjeti pojedini unutarnji organi.

Iako je obojenost slaba ili je gotovo i nema, nije riječ o albinizmu već o prilagodbi na način života u konstantnoj tami. Naime, ako je izložena svjetlu, u čovječje ribice može se pojaviti tamna pigmentacija, što znači da posjeduje melanofore – stanice koje sadržavaju pigment melanin, koji daje tamno obojenje. Postoji samo jedna populacija čovječje ribice (na području zapadne Slovenije) gdje su sve jedinke tamnosive boje te se smatra da je to prilagodba na povremene izlaske u površinske, osvijetljene dijelove špilje.

IAKO JE OBOJENOST SLABA ILI GOTOVO ODSUTNA, NE RADI SE O ALBINIZMU, VEĆ O PRILAGODBI NA NAČIN ŽIVOTA U KONSTANTNOJ TAMI.

Due to small amounts of the riboflavin pigment, olm's skin is white or pale yellow, and appears to be pink because of the proximity of blood vessels to the body's surface. **It was due to its colour, reminiscent of the human skin colour, that the species received its name 'human fish' in Croatia**. The skin is covered by a thin layer of surface mucous (mucous layer), and on its abdomen is almost transparent, showing the olm's internal organs.

Even though their colouring is mild or non-existent, this is not albinism but instead adaptation to life in constant darkness. In fact, if exposed to light, the olm may develop dark pigmentation, which means they possess melanophores – cells containing the melanin pigment which creates the dark colour. There is only one population of olm (in the area of western Slovenia) where all the specimen are dark grey in colour and this is considered be an adjustment to occasional ventures to the surface, lit, parts of the cave.

EVEN THOUGH THEIR COLOURING IS MILD OR NON-EXISTENT, THIS IS NOT ALBINISM BUT INSTEAD ADAPTATION TO LIFE IN CONSTANT DARKNESS.


Photo: Dušan Jelić

DISANJE
BREATHING

Podzemni organizmi su manje aktivni i imaju nižu stopu metaboličke potrošnje u usporedbi sa srodnim nadzemnim organizmima, što poboljšava preživljavanje u surovome podzemnom okolišu. **Zbog manje metaboličke potrošnje čovječjoj ribici nisu potrebne visoke koncentracije kisika.** Diše škrgama i preko kože, a u hipoksičnim uvjetima (nedostatak kisika) može disati i plućima. U vodama s nižim koncentracijama kisika škrge su veće i bolje prokrvljene pa su žarkocrvene boje.

Underground organisms are less active and have a lower metabolic rate than their relatives living above ground, which aids survival in the harsh underground environment. **Due to their lower metabolic rate, the olm does not need high concentrations of oxygen.** It breathes through gills and through its skin, and in hypoxic conditions (a lack of oxygen) it can breathe through its lungs. In waters with lower concentrations of oxygen the gills are bigger and more vascularised which makes them bright red in colour.

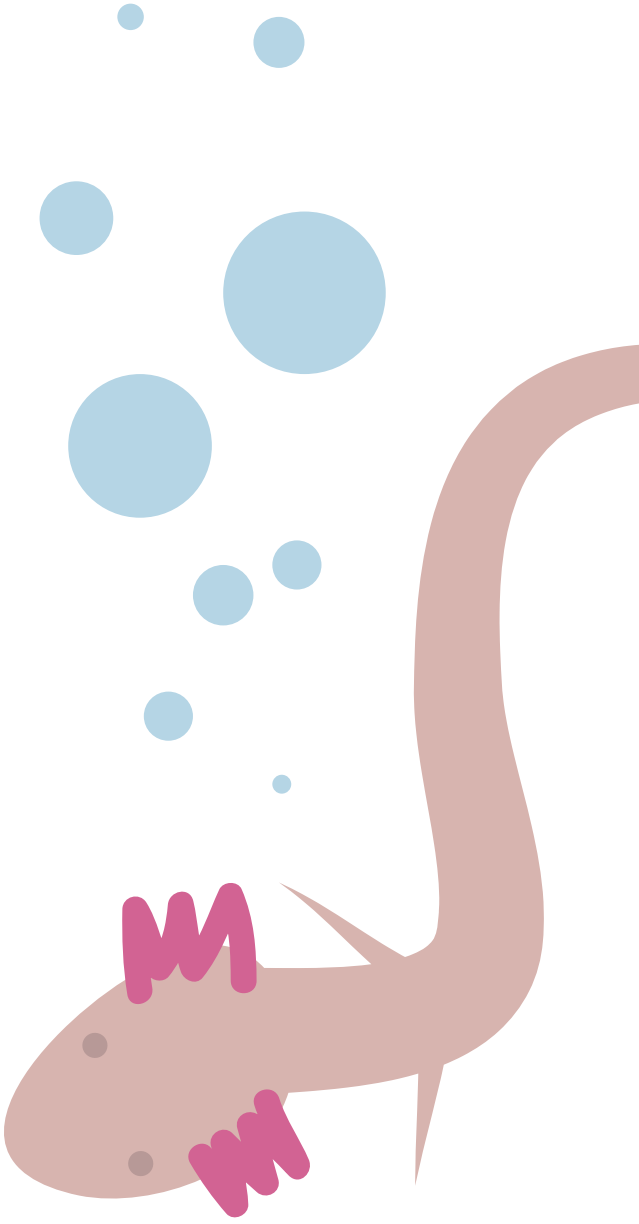



Photo: Boris Krstinić

OSJETILA
SENSES

Oči čovječje ribice su zakržljale i kod odraslih jedinki prekrivene su kožom. Važne informacije potrebne za orijentaciju, traženje hrane i lov dobiva preko drugih osjetila. Upravo zbog prilagodbe na život u tami i nerazvijen vid, ostala osjetila znatno su bolje razvijena negoli u ostalih vodozemaca.

Zahvaljujući osjetljivim receptorima čovječja ribica može osjetiti i izrazito male količine organske tvari u vodi. Putem osjeta sluha (mehanoreceptori) prima informacije iz vode, ali i vibracije tla, a optimalna osjetljivost na zvučne valove je od 10 Hz do 15 000 Hz. Male promjene u položaju vode oko sebe osjeća s pomoću bočne linije – osjetilnog organa koji drugi vodozemci imaju samo u stadiju ličinke. Na glavi posjeduje ampularni organ koji sadrži elektroreceptore, odgovorne za primanje slabih električnih impulsa. Istraživanja također pokazuju kako se čovječja ribica može orijentirati detektirajući magnetska polja Zemlje.

The olm has rudimentary eyes which are covered by skin in the adult specimen. It receives important information needed for orientation, finding food and hunting via other senses. Due to its adjustment to life in darkness and the undeveloped sense of sight, other senses are much more developed than in other amphibians.

Thanks to its sensory receptors, the olm can sense even the smallest amounts of organic substance in water. Through the sense of smell (mechanoreceptors) it receives information from water, but also from ground vibrations, and optimal sensitivity for sound waves is from 10 Hz to 15 000 Hz. It feels small changes in the position of water through its lateral line – a sensory organ that other amphibians only have in the larval phase. On its head is an ampullary organ with electroreceptors responsible for the reception of weak electrical impulses. Research has shown that the olm can detect the Earth's magnetic fields and use them for orientation.

Photo: Branko Jalžić

PREHRANA
DIET

U podzemnim ekosustavima nedostaju primarni proizvođači, a količine hrane tijekom godine su ograničene, što dovodi do duljih razdoblja gladovanja tijekom godine. Takva razdoblja ograničenih izvora hrane su sezonski događaji i organizmi tada preživljavaju trošeći zalihe pohranjene u tijelu.

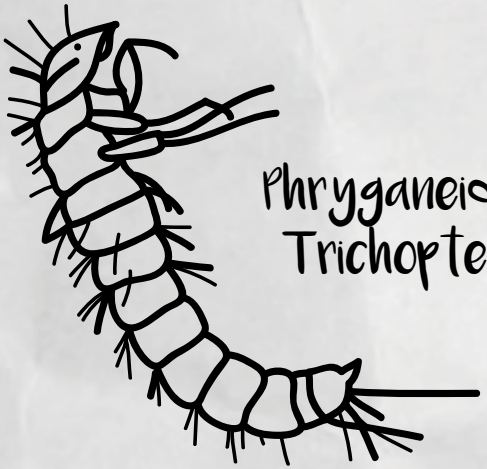
Čovječja ribica može preživjeti do 8 godina bez hrane, a da pri tom ne pokazuje nikakve znakove bolesti te je stoga odličan modelni organizam za istraživanje prilagodbi na ekstremne uvjete. Na početku razdoblja gladovanja nastupa faza stresa, čovječja ribica ubrzava lokomotorne aktivnosti i brzinu kretanja pa time i stopu potrošnje kisika, kako bi uspješnije pronašla plijen. **Nastavi li se faza gladovanja, ona pribjegava strategiji kojom troši manje energije na potragu – smanjuje lokomotorne aktivnosti te polako i sustavno pretražuje svaki dio svog teritorija.**

There are no primary producers in underground ecosystems, and the amounts of food during the year are limited, which leads to longer periods of hunger. Such periods of limited food sources are seasonal and during that time organisms survive by using the reserves stored in their bodies.

The olm can survive up to 8 years without food – without exhibiting any signs of sickness – making it an ideal model organism for the research of adaptation to extreme conditions. The beginning of a period of hunger is accompanied by a stress phase: in order to have more success in finding prey, the olm increases the locomotive activities and speed of movement, which in turn increases the rate of oxygen consumption. **If the hunger phase continues, it switches to a strategy that uses less energy for hunting – it reduces locomotive activities and slowly and systematically searches every inch of its territory.**

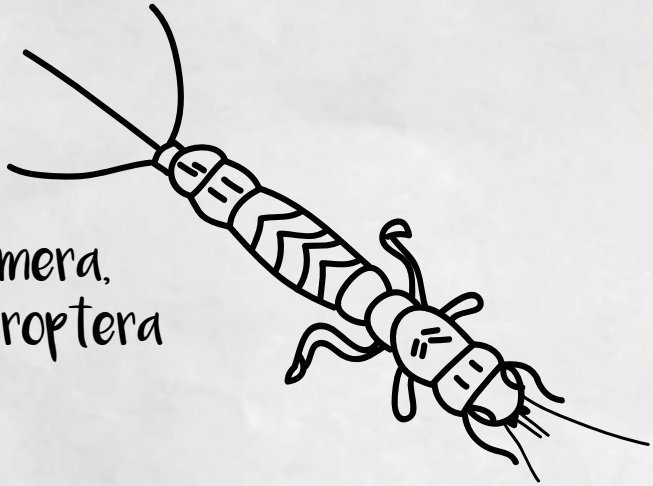
ČOVJEČJA RIBICA MOŽE PREŽIVJETI DO 8 GODINA BEZ HRANE.
THE OLM CAN SURVIVE UP TO 8 YEARS WITHOUT FOOD.

U lociranju plijena i u lovu čovječja ribica se oslanja na informacije primljene putem kemo-, mehano- i elektroreceptora. Iako će pojesti gotovo sve što joj stane u usta, primarni dio prehrane čovječje ribice čine ličinke kukaca, najčešće ličinke dvokrilaca (*Diptera*), tulara (*Trichoptera*) i vodencvijetova (*Ephemeroptera*). Hrani se, također, i mekušcima (*Belgrandiella*) i rakušcima (*Niphargus, Asellus, Synurella*). **Može konzumirati velike količine hrane odjednom, a plijen guta cijeli.**



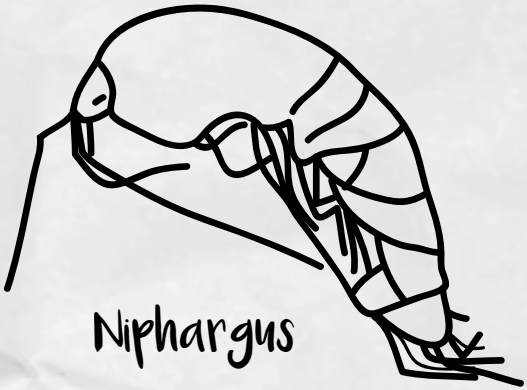
Phryganeidae,
Trichoptera

Bradysia
forficulata



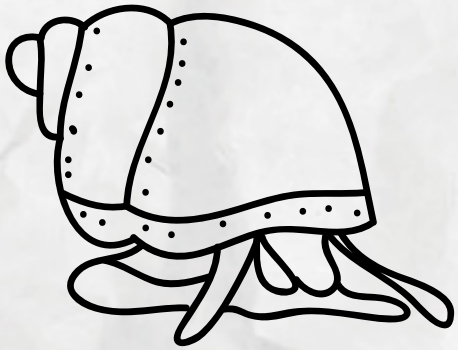
Ephemera,
Ephemeroptera

When locating its prey, the olm relies on information received through chemo-, mechano- and electroreceptors. Even though it will eat almost anything that fits in its mouth, its diet is primarily made up of insect larvae, usually larvae of true flies (*Diptera*), caddisflies (*Trichoptera*) and mayflies (*Ephemeroptera*). It also feeds on molluscs (*Belgrandiella*) and crustaceans (*Niphargus, Asellus, Synurella*). **It can consume large amounts of food at once, and it swallows its prey whole.**



Niphargus

Synurella



Belgrandiella

RAZMNOŽAVANJE
REPRODUCTION AND DEVELOPMENT

Čovječja ribica razmnožava se u prosjeku svakih 12 godina. Budući da su uvjeti staništa ove vrste izrazito stabilni, razmnožavanje ne ovisi o sezoni. Odrasle, spolno zrele jedinke okupljaju se na prikladnim mjestima – u pukotinama stijena ili ispod kamenja. U vrijeme parenja mužjaci zauzimaju teritorije koje brane od drugih mužjaka. Kada ženka uđe na teritorij mužjaka, on započinje s udvaranjem koje može biti ponovljeno više puta tijekom nekoliko sati. Uspješno udvaranje završava time da mužjak polaže paketić sperme (spermatofor), koji zatim ženka skupi svojom kloakom. Ženke mogu spremiti spermu u specijalne strukture unutar kloake, tzv. spermateke, te ju tako čuvati više mjeseci.

Mužjak se udvara tako da zamahuje repom prema ženkinoj glavi, a njuškom dodiruje njezinu kloaku (urogenitalni otvor). Ženka zatim njuškom dodiruje mužjakovu kloaku te ga slijedi dok hoda ispred nje i ostavlja spermatofore, koje ona sakuplja, pohranjuje u sebi te dolazi do unutarnje oplodnje.

On average, the olm reproduces every 12 years. Since the species lives in very stable habitats, reproduction does not depend on the season. Adult, sexually mature specimens gather at appropriate places – cracks in cave walls or under rocks. During the mating period, the males take over territories and defend them from other males. When a female enters the male's territory, he stars the courtship which may be repeated several times over the course of several hours. Successful courting ends with the male laying a sperm ampulla (spermatophore), which the female then gathers with her cloaca. The females can store the sperm for several months in special structures within the cloaca, the so-called spermatheca.

The male courts the female by swinging his tail towards her head and touching her cloaca (urogenital opening) with his snout. The female then touches the male's cloaca with her snout and follows him while he walks in front of her leaving the spermatophores which she collects inside herself. This leads to internal fertilization.

Kada napusti teritorij mužjaka, ženka pronalazi prikladno mjesto za polaganje jaja te 2 ili 3 dana nakon oplodnje počinje polagati jaja na kamenju ili ispod njega. Taj proces traje idućih 25 dana. Ukupno položi više od 70 jaja te ih ostaje čuvati.

Jaja su pravilna, okrugla, veličine 5 – 6 mm. Nemaju pigmenta i prozirna su i zbog toga se kroz opnu vidi ličinka koja se u jajetu razvija. Trajanje inkubacije ovisi o temperaturi vode te može trajati od 2 do 6 mjeseci. Jaja se razvijaju 182 dana na 8 ˚C, 140 dana na 10 ˚C, 123 dana na 11 ˚C i 86 dana na 15 ˚C.

Nakon izlijeganja ličinke su dužine 20 mm, a ženka im više ne pruža zaštitu. U probavnom sustavu sadrže žumanjak koji im omogućava život prvih mjesec dana nakon izlijeganja. U ličinki nema preobrazbe (metamorfoze) prilikom prelaska u odrasli stadij – javlja se neotenija.

Čovječja ribica je vodozemac s najduljim životnim vijekom te može doživjeti više od 60 godina, a smatra se da čak i do 100 godina.

After leaving the male's territory, the female finds a suitable place to lay her eggs, and starts laying eggs on rocks or under them 2 to 3 days after fertilisation. This process lasts for the next 25 days. She lays over 70 eggs in total and stays to guard them.

The eggs are round and 5 - 6 mm in diameter. They are transparent and without pigmentation, showing the developing larvae through the membrane. The incubation period depends on water temperature - it can last from 2 to 6 months. The eggs develop for 182 days at 8 ˚C, 140 days at 10 ˚C, 123 days at 11 ˚C and 86 days at 15 ˚C.

After hatching, the tadpoles are 20 mm long, and the female no longer protects them. They have yolk stored in their digestive system, which they live on for the first month. The tadpoles do not go through metamorphosis to develop into the adult stage – instead, neoteny occurs.

The olm has the longest life span of all amphibians and can live for more than 60 years, even reaching the age of 100 years.

NEOTENIJA

je pojava postizanja spolne zrelosti na stupnju ličinke, koja se tada može i razmnožavati. Čovječja ribica spolno zrela postaje s 14 – 15 godina te i tada zadržava karakteristike ličinke – vanjske škrge i repnu peraju. Kod drugih vodozemaca preobrazba je regulirana hormonom tiroksinom koji proizvodi žlijezda štitnjača. Kod čovječje ribice štitnjača je normalno razvijena, no preobrazba se ne javlja.

NEOTENY

is acquisition of reproductive maturity while still in the larval phase, and being then able to reproduce. The olm becomes sexually mature at the age of 14-15 years and maintains its larval characteristics – external gills and the tail fin. Metamorphosis in other amphibians is regulated by thyroxine, a hormone secreted by the thyroid gland. The olm has a normally developed thyroid, but metamorphosis does not occur.

Photo: Maja Lukač

UGROŽENOST I ZAŠTITA
ENDANGERMENT AND PROTECTION

Glavnim uzrocima ugroženosti smatraju se širenje naselja i urbanizacija, izgradnja hidrocentrala te nezakonito sakupljanje primjeraka. Na podzemnu faunu, pa tako i na čovječju ribicu, utječu i promjene režima podzemnih voda zbog izgradnje brana, crpljenja vode i drugih hidrotehničkih zahvata. Promjena razine i smjera protoka podzemnih voda te onečišćenje podzemlja pesticidima, umjetnim gnojivima, komunalnim i kemijskim otpadom, također se svrstavaju u izravne prijetnje špiljskim organizmima. Negativne učinke imaju i fragmentacija areala i prekidanje dotoka vode i hrane ispunjavanjem podzemnih šupljina velikim količinama betona pri hidrološkim zahvatima.

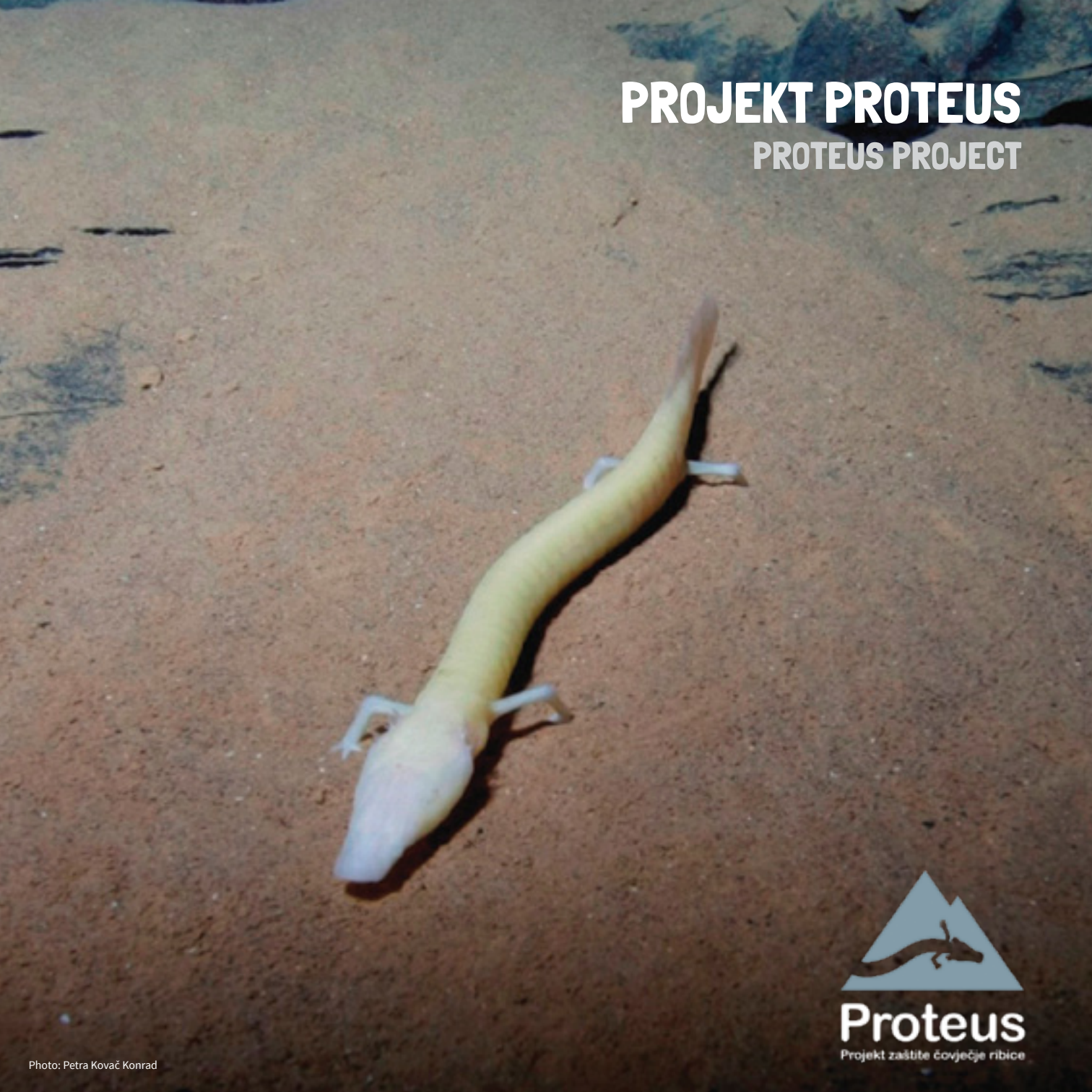
Prema IUCN-ovim kriterijima ugroženosti vrsta čovječja ribica je svrstana u kategoriju osjetljive vrste (VU). Nalazi se u Crvenoj knjizi špiljske faune Hrvatske, gdje je svoje mjesto našla kao troglobiont i stigobiont (vrsta koja primarno obitava u špiljskim staništima) te u Crvenoj knjizi vodozemaca i gmazova Hrvatske. Vrsta se nalazi na prilogu IV Direktive o staništima EU-a te na Dodatku II Bernske konvencije (konvencija Vijeća Europe o zaštiti europskih divljih vrsta i njihovih staništa). U Hrvatskoj je strogo zaštićena vrsta prema Pravilniku o strogo zaštićenim vrstama (NN 144/13) te se nalazi na popisu zaštićenih vrsta i u Sloveniji i u Italiji.

The main causes of why the species is endangered are the expansion of settlements and urbanisation, building of hydroelectric power plants and illegal collection of animals. Underground fauna, which includes the olm, is influenced by the changes in the underground water regime due to the construction of dams, extraction of water and other hydrotechnical projects. Changes in the level and direction of underground water flow and the pollution of the underground with pesticides, synthetic fertilisers, and communal and chemical waste are also considered to be direct threats to cave dwelling organisms. Fragmentation of habitat and the interruption of the water and food inflow that occurs when underground caverns are filled with large amounts of concrete during hydrological projects also have negative impacts.

According to the IUCN criteria for the endangerment of species, the olm is classified as vulnerable (VU). It is in the Red Book of Croatian Cave Dwelling Fauna, where it has found its place as a troglobite and stygobiont (species primarily residing in cave habitats) and in the Red Book of Amphibians and Reptiles of Croatia. The species is listed in Appendix IV of the EU's Habitats Directive and in Appendix II of the Bern Convention (convention of the Council of Europe on the conservation of European wildlife and natural habitats). In Croatia it is a strictly protected species according to the Ordinance on strictly protected species (NN 144/13) and it is also on the protected species' list in Slovenia and Italy.

PROJEKT PROTEUS

PROTEUS PROJECT



Proteus

Projekt zaštite čovječje ribice

Photo: Petra Kovač Konrad

Hrvatsko herpetološko društvo - Hyla i Hrvatski institut za biološku raznolikost započeli su 2014. projekt "Proteus – Projekt zaštite čovječje ribice". Cilj projekta je poboljšati općenito znanje o vrsti, koje će omogućiti izradu Plana upravljanja s akcijskim planom zaštite čovječje ribice u Hrvatskoj te povećati opću osviještenost lokalnih zajednica i dionika, kako bi se uspješno provele mjere zaštite ove vrste.

In 2014 the Croatian herpetological society - Hyla and the Croatian Institute for Biodiversity started the project "Proteus – The olm protection project". The aim of the project is to improve general knowledge about the species, which shall allow for the creation of Project Management with the olm in Croatia and increase the general awareness of local communities and co-partners, in order to successfully implement protective measures for this species.

PARTNERI / PARTNERS:

Hrvatsko herpetološko društvo / The Croatian herpetological society – Hyla
Hyla je strukovna udruga, osnovana 1997., da bi se proširilo znanje i svijest o vodozemcima i gmazovima, o njihovoj važnosti i potrebi zaštite. Hyla is a professional association founded in 1997 with the goal of expanding knowledge and awareness about amphibians and reptiles, their importance and the need for their protection.

Hrvatski institut za biološku raznolikost / Croatian Institute for Biodiversity
Znanstveno-stručna organizacija orijentirana na prikupljanje znanstveno zasnovanih dokaza za zaštitu čovječje ribice. Scientific organisation oriented on collecting scientifically proven evidence for *Proteus anginus* protection.

Prirodoslovni muzej u Budimpešti / Natural History Museum in Budapest
U sklopu projekta u molekularno-taksonomskom laboratoriju izradit će filogenetiku čovječje ribice te provesti analize za detekciju okolišne DNA (eDNA). NHM will create the phylogenetics of olm and the analysis for the detection of the environmental DNA (eDNA) in laboratory of molecular taxonomy.

Veterinarski fakultet, Zagreb / Faculty of Veterinary Medicine, Zagreb
Preventiva i liječenje ex situ životinja, mikrobiološke pretrage (bakterije, gljivice, virusi, paraziti), s naglaskom na *Batrachochytrium dendrobatidis, Batrachochytrium salamandrivorans* i Ranavirus. Prevention of diseases and treatment of animals ex situ, microbiological tests (bacteria, fungi, viruses, parasites), especially *Batrachochytrium dendrobatidis, Batrachochytrium salamandrivorans* and Ranavirus

Zoološki vrt grada Zagreba / Zagreb Zoo
Pružit će potrebnu infrastrukturu i osoblje kako bi se uspostavio Centar za razmnožavanje i oporavak ozlijeđenih jedinki. Will offer the necessary infrastructure and staff in order to set up the Centre for breeding and recovery of injured olms.

Projekt podupiru i financiraju sljedeće fondacije / The project is backed and financed by the following foundations:


ZOO
Zagreb

ČOVJEČJA RIBICA U ZAGREBAČKOM ZOOLOŠKOM VRTU

THE OLM IZ THE ZAGREB ZOO

U sklopu projekta Proteus Zoološki vrt grada Zagreba provodi zaštitu čovječje ribice izvan njezinoga prirodnog staništa (ex situ). Ovdje se nalaze čovječje ribice koje su tijekom obilnih kiša i poplava izbačene s prirodnih staništa. Osim toga, Zoološki vrt i partneri imaju dozvolu za sakupljanje jedinki te provođenje genetičkih istraživanja na ovoj vrsti. Takva istraživanja su važna jer se time poboljšava opće znanje o čovječjoj ribici, potrebno za izradu plana zaštite vrste.

Na populaciji u Zoološkom vrtu prati se zdravstveno stanje životinja i stječe se bolje saznanje o bolestima koje ugrožavaju ovu vrstu te se pokušava otkriti uspješan način poticanja razmnožavanja i održavanja populacija u zatočeništvu bude li potrebe za ponovnim naseljavanjem (reintrodukcijom) u prirodno stanište.

Within the Proteus project, the Zagreb Zoo is carrying out the protection of the olm outside its natural habitat (ex situ). The population comes from the olm who were thrown out of their natural habitats during heavy rains and floods. As well as this, the Zoo and the partners has a permit to collect specimen and conduct genetic research on this species. Such research is important because it improves the general knowledge about the olm which is necessary for the creation of a protection plan for the species.

The Zoo monitors the health of their olm population, thus obtaining a better insight into the diseases that threaten this species. It also attempts to find a suitable method of encouraging reproduction and sustaining the population in captivity, in case of the need to reintroduce them into their natural habitat.

Photo: Vinko Počanić

JAMA BAREDINE

BAREDINE CAVE

Jama Baredine speleološki je lokalitet i geomorfološki spomenik prirode, smješten u zapadnom dijelu Istre, između Višnjana i Poreča, 5 kilometara udaljen od morske obale. **To je jedino mjesto u Hrvatskoj gdje posjetitelji imaju priliku vidjeti čovječju ribicu.** Naime, od 1995. jama je uređena za turističke posjete.

Krški teren, u kojem je jama nastala, morski je sediment iz razdoblja krede, pokriven zemljom crvenicom (*terra rossa*).

Baredine cave is a speleological locality and geomorphologic natural monument located in the western part of Istria, between Višnjan and Poreč, 5 kilometres from the coast. **It is the only place in Croatia where visitors can see the olm.** The cave has been opened for tourists since 1995.

The karst terrain in which the cave was formed is made up of marine sedimentation from the Cretaceous Period and it is covered by red soil (*terra rossa*).

LITERATURA

LITERATURE

- Lukač M., Horvatek Tomić D., Cizelj I., Jelić D., Prukner-Radovčić, E. 2013. *The olm (Proteus anguinus) in Croatia – conservation research project.* Proc Int Conf Dis Zoo Wild Anim. 2013, 8-15 May. Vienna, Austria. pp. 48-52.
- Ozimec, R., Bedek, J., Gottstein, S., Jalžić, B., Slapnik, R., Bilandžija, H. i sur. 2009. *Crvena knjiga špiljske faune Hrvatske.* Ministarstvo kulture Republike Hrvatske, Državni zavod za zaštitu prirode. Zagreb.
- Gunn, J. 2004. *Encyclopedia of Caves and Carst Science.* Tylor and Francis books Inc. London.
- Jan Willem Arntzen, Mathieu Denoël, Claude Miaud, Franco Andreone, Milan Vogrin, Paul Edgar, Jelka Crnobrnja Isailovic, Rastko Ajtic, Claudia Corti. 2009. *Proteus anguinus.*
- The IUCN Red List of Threatened Species 2009: e.T18377A8173419. dx.doi.org/10.2305/IUCN.UK.2009.RLTS.T18377A8173419.en. (pristupljeno / accessed: 23. 11. 2015.)
- AmphibiaWeb: Information on amphibian biology and conservation. [web application]. 2015. Berkeley, California: AmphibiaWeb. Available: amphibiaweb.org (pristupljeno / accessed: 24. 11. 2015.)
- Proteus – Conservation Action Plan [web application]. www.proteus.hibr.hr/public_html/proteus/hr (pristupljeno / accessed: 23. 11. 2015.)
- EDGE of Existence/ZSL. www.edgeofexistence.org/amphibians/species_info.php?id=563 (pristupljeno / accessed: 23. 11. 2015.)
- Agencija za zaštitu okoliša RH – Katalog zaštićenih vrsta zasticenevrste.azo.hr (pristupljeno / accessed: 3. 2. 2015.)

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