



Univerza v Mariboru

Fakulteta za naravoslovje  
in matematiko

### UČNI NAČRT PREDMETA / COURSE SYLLABUS

<b>Predmet:</b>	<b>Izbrana poglavja iz speleobiologije</b>
<b>Course title:</b>	<b>Selected Topics in Speleobiology</b>

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Doktorski študij Ekološke znanosti, 3. stopnja		1. ali 2.;	1.- 4.;
Doctoral Study Ecological Sciences, 3rd degree		1st or 2nd	1st-4th

Vrsta predmeta / Course type: Izbirni/Elective

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Lab. vaje Laboratory work	Terenske vaje Field work	Samost. delo Individ. work	ECTS
3	3		5	9	160	6

Nosilec predmeta / Lecturer: Peter KOZEL

Jeziki / Predavanja / Lectures: slovenski / Slovene  
Languages: Vaje / Tutorial: slovenski / Slovene

**Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:**

Poznavanje organizmov in ekologije na ravni univerzitetnega programa

**Prerequisites:**

Knowledge of organisms and ecology at graduate level

**Vsebina:**

Obravnavana so izbrana poglavja iz naslednjih sklopov.  
Podzemeljski habitati so naravne in umetne votline. S slovenskega ozemlja sta opisana prvi podzemeljski vretenčar, človeška ribica, ter prvi nevretenčar, hrošč drobnovratnik. Oris zgodovine speleobiologije, ki so jo zasnovali raziskovalci na slovenskem ozemlju. Pregled značilnih fizičnih razmer v podzemeljskih

**Content (Syllabus outline):**

Selected topics in the following chapters are discussed.  
Hypogean habitats are natural and artificial cavities. In the territory of Slovenia, the first vertebrate: the olm, and the first invertebrate: the bittle slender-neck, have been described. A concise historical review of the speleobiology, which had started in the territory of Slovenia. The overview of general physical

habitatih ter pregled splošnih značilnosti podzemeljskih živih bitij. Ekološke razmere v posameznih podzemeljskih tipih habitatov (naravne in umetne votline, epikras). Troglokseni, troglofili, troglobionti; freatokseni, freatofili, freatobionti. Specifične ekološke, morfološke, fiziološke in citološke prilagoditve na podzemeljske habitate. Na terenu in v laboratoriju so prikazani vzori za ekološke raziskave podzemeljskih habitatov.

characteristics of the hypogean habitats, and the review of general characteristics of the hypogean organisms. Ecological circumstances in hypogean habitat types (natural and artificial cavities, epikarst). Trogloxenes, troglophile, troglobionts; phreatoxenes, phreatofiles, phreatobiont. Specific ecological, morphological, physiological and cytological adaptation to hypogean habitats. In field and in the laboratory, some examples of ecological investigations in hypogean habitats are presented.

### Temeljni literatura in viri / Readings:

- Culver, D. C. in Pipan, T., 2019. *The biology of caves and other subterranean habitats, second edition*. Oxford Univ. Press, Oxford, New York. 336 str.
- White, W. B., Culver, D. C. in Pipan, T. (Eds.), 2019. *Encyclopedia of caves, third edition*. Elsevier/Academic Press, Amsterdam/Boston. 1250 str.
- Moldovan, O. T., Kováč, L. in Halse, S. (Eds.) (2018). *Cave ecology*. Springer International Publishing. 545 str.
- Culver, D. C., Christman, M. C., Sket, B. in Trontelj, P., 2004. Sampling adequacy in an extreme environment: species richness patterns in Slovenian caves. *Biodiversity and Conservation*, 13: 1209- 1229.
- Gunn, J., 2004. *Encyclopedia of caves and karst science*. Taylor & Francis Books Inc., New York/London.
- Juberthie, C. in Decu, V. (Eds.), 1992-1996. *Encyclopaedia biospeologica I-III*. Societé de biospéologie, Moulis, Bukarest.
- Sket, B., Paragamian, K. in Trontelj, P., 2004. A census of the obligate subterranean fauna of the Balkan peninsula. V: Griffiths, H. I. in Kryštufek, B. (Eds.): *Balkan Biodiversity. Pattern and Process in Europe's Biodiversity Hotspot*. Kluwer Academic Publishers: 309-322.

### Cilji in kompetence:

- Podati podroben pregled tipov in značilnosti podzemeljskih habitatov
- Podati podroben pregled tipov in značilnosti podzemeljskih organizmov
- Podrobno predstaviti zgodovino speleobiologije in modernih trendov v njej
- Podrobno pojasniti osnovne ekološke razmere v podzemeljskih habitatih
- Podrobno prikazati izbrane metode ekološkega vzorcevanja v jamah

### Objectives and competences:

- To give an advanced overview of typology and characteristics of hypogean habitats
- To give an advanced overview of typology and characteristics of hypogean organisms
- To present advanced knowledge about the history and modern trends in speleobiology
- To explain in detail ecological circumstances in hypogean habitats
- To present in detail selected ecological sampling methods in caves

**Predvideni študijski rezultati:**

Študenti razumejo ključne ekološke značilnosti podzemeljskih habitatov in podzemeljskih organizmov. Podrobno poznajo zgodovino speleobiologije in trende modernih znanstvenih raziskav. Poznajo specifične vzorčevalne metode v podzemeljskih habitatih. Sposobni so natančno opredeliti specialne morfološke, fiziološke, etološke in druge prilagoditve živali v podzemeljskih habitatih. Usposobijo se za zahtevno ekološko znanstveno-raziskovalno delo v podzemeljskih votlinah.

**Intended learning outcomes:**

Students understand crucial ecological characteristics of hypogean habitats and hypogean organisms. They are able to explain in the history of speleobiology and modern trends of scientific investigations. Students gain advanced knowledge on specific sampling methods in hypogean habitats. They are able to define special morphological, physiological, ethological and other adaptations of animals to hypogean habitats. Students are trained to conduct advanced ecological scientific research in hypogean cavities.

**Metode poučevanja in učenja:**

- Predavanja
- Laboratorijske vaje
- Terenske vaje
- Individulano načrtovanje izbrane raziskave

**Learning and teaching methods:**

- Lectures
- Laboratory excersises
- Field excersises
- Individual planning of a selected investigation

<b>Načini ocenjevanja:</b>	<b>Delež (v %) / Weight (in %)</b>	<b>Assessment:</b>
• Individualni raziskovalni projekt – pisni in ustna predstavitev	50 %	• Individual project work – written, and oral presentation • Written exam
• Pisni izpit	50%	

**Reference nosilca / Lecturer's references:**

Kozel, P., Novak, T., Janžekovič, F., Lipovšek, S., 2023. Starvation hardiness as preadaptation for life in subterranean habitats. *Scientific reports*, 13: 9643. doi: 10.1038/s41598-023-36556-9

Kozel, P., Pipan, T., 2020. Specialized aquatic subterranean communities are probably most species-rich in the thickest epikarst. *Limnologia*, 81: 125756. doi: 10.1016/j.limno.2020.125756

Kozel, P., Delić, T., Novak, T., 2020. *Nemaspela borkoae* sp. nov. (Opiliones: Nemastomatidae), the second species of the genus from the Dinaric Karst. *European Journal of Taxonomy* 717: 90–107. doi: 10.5852/ejt.2020.717.1103

Kozel, P., Pipan, T., Mammola, S., Culver, D. C., Novak, T., 2019. Distributional dynamics of a specialized subterranean community oppose the classical understanding of the preferred subterranean habitats. *Invertebrate biology*, 00:e12254. doi: 10.1111/ivb.12254

Galli, L., Janžekovič, F., Kozel, P., Novak, T., 2021. Protura (Arthropoda: Hexapoda) in Slovenian

caves. *International journal of speleology*, 50 (1): 65-74. doi: 10.5038/1827-806X.50.1.2380  
Lipovšek, S., Leitinger, G., Janžekovič, F., Kozel, P., Dariš, B., Perc, M., Devetak, D., Weiland, N.,  
Novak, T., 2019. Towards understanding partial adaptation to the subterranean habitat in the  
European cave spider, *Meta menardi*: an ecocytological approach. *Scientific reports*, 9 (9121):  
1-15. doi: 10.1038/s41598-019-45291-z.