

ÉVA NAGY

A BIODIVERZITÁSI ISMERETEK MEGJELÉSE A MAGYAR OKTATÁSBAN: AZ ÉJSZAKAI ÁLLATOK BEMUTATÁSA A BIOLÓGIA TANTÁRGY KERETÉBEN.

*Neumann János Secondary School and Student Hostel, Rákóczi Street
48, Eger 3300, Hungary, ecuska79@gmail.com*

*Eszterházy Károly University, Doctoral School of Education, Eszterházy
Square 1, Eger 3300, Hungary, ecuska79@gmail.com*

Összefoglaló

A WWF Living Planet 2018. évi jelentése szerint (Living Planet index) 1970 és 2014 között a világ fajállománya 60%-kal csökkent, de a *faji diverzitás* tényleges csökkenéséről, annak részleteiről a felnövekvő generáció nem rendelkezik elegendő és naprakész információkkal a tankönyvek anyagából. Holott minél szélesebb körű ismeretek állnak rendelkezésre a fajok sokféleségéről, annál könnyebben megvalósítható a fenntarthatóság minden életforma számára, így az ember számára is. A környezeti nevelés tényeinek figyelembevételével elemeztem az iskolai tananyagot. Tanulmányomban egy tartalomelemzés eredményeit foglalom össze, amely kiterjed a 10. évfolyamos magyar középiskolai osztályok napjainkban alkalmazott tankönyveiben előforduló éjszakai állatfajok vizsgálatára, mivel a biológiai sokféleség veszteségének egyik legveszélyeztetett csoportját képezik az éjszakai életmódot folytató állatok.

Kulcsszavak: *faji diverzitás; éjszakai állatfajok; magyar biológia tankönyvek*

Elfogadva: 2020. 06. 07.

Elektronikusan megjelent: 2020.

ÉVA NAGY

BIODIVERSITY KNOWLEDGE ELEMENTS IN BIOLOGY EDUCATION: NOCTURNAL ANIMALS IN HUNGARIAN EDUCATION

*Neumann János Secondary School and Student Hostel, Rákóczi Street
48, Eger 3300, Hungary, ecuska79@gmail.com*

*Eszterházy Károly University, Doctoral School of Education, Eszterházy
Square 1, Eger 3300, Hungary, ecuska79@gmail.com*

Abstract

According to the state of the world WWF Living Planet Report 2018 the Living Planet Index has recorded an overall decline of 60% in species population sizes between 1970 and 2014. In many cases, the drastic decline in biodiversity, might even due to the fact that, young generation does not always have access to sufficient and up-to-date information from their textbooks, however, the greater species diversity knowledge a person has, the more natural sustainability is provided for all life forms, for them, humans as well. Considering these facts within environmental education, the elements in school materials were examined. This article intends to summarize the results of a content analysis, which extends to the exploration of animal species in frequently used textbooks in 10th Hungarian secondary school classes, where taxonomy, knowledge of species, should be the most extended part of the school curriculum. This work also demonstrates the number of the animal species, appeared in the most significant currently educated textbooks, and even the number of nocturnal animals, being the main victims of the biodiversity loss, because of one of the major threats, the light pollution. The current article was written as part of a tender called the effect of light pollution on wildlife, biodiversity in particular, EFOP 3.6.2-16-2017-00014, Establishing an international research environment in the field of light pollution.

Keywords: *animal species; Hungarian textbooks; Nocturnal animal species; present-day Biology education*

Accepted: 07.06.2020.

Published online: 2020

Introduction

The three most acute components of the unsustainability problem areas these days are climate change, soil degradation and the rapid decline of biological diversity. (MIKA et al., 2015) The astonishing decline in wildlife populations shown by the latest Living Planet Index – a 60% fall in just over 40 years – is a grim reminder and perhaps the ultimate indicator of the pressure we exert on the planet. (WWF Living Planet Report 2018, page 14) The biodiversity loss essentially results from overharvesting, poaching, the destruction and degradation of habitats, or climate change, (SLINGENBERG et al., 2009; BARNOSKY et al., 2011) the substantive causes in many instances may lie simply in the actual content of the education. Greater species diversity knowledge might ensure natural sustainability for all and so human life forms (MITEVA et al., 2012) In order to have this interpreted by the rising generation we need to teach them different characteristic features of the animal species to get to know the real them. Thus, the aim of this article was to discover the actual teaching elements related to biodiversity In Hungary, and since one of the most conspicuous ways we alter the natural world is to light the darkness, (http://www.seaturtle.org/PDF/Witherington_1997_InBehavioralApproachestoConservationi_p303-328.pdf), the light pollution is the most urgent area to research. (GASTON, 2012) In the light of these, this paper provides details about all the animal species that currently occur in the most frequently used textbooks in class 10th together with the list of their information about their occurrence at night. My hypothesis is that there are not so many nocturnal animal species examples in the 10th grade curriculum.

Species occurrence categories

In order to know what kind of category, nocturnal or diurnal, the given animals actually belong to, it is necessary to clarify, what the concepts exactly cover.

The adjective **nocturnal** comes from a Latin word, nocturnalis, which means “belonging to the night,” like bats and fireflies, who sleep during the day and come out when the sun goes down. The opposite of nocturnal is **diurnal**, meaning active during the daytime. (<https://www.vocabulary.com/dictionary/nocturnal>)

There is a third category called **cathemeral**, referring to an animal behavior, which describes the behavior of sleeping partly during the daytime and partly during the night. The activity of an organism may be regarded as cathemeral when it is distributed approximately evenly throughout the 24h of the daily cycle, or when significant amounts of activity, particularly feeding, occur within both the light and dark portions of that cycle. (Ankel-Simons, Friderun, 2007) many species, particularly among primates, may be classified as cathemeral. ([Tattersall, 1987](#))

Therefore, some animals might belong to all three categories. Furthermore, it is important to emphasise, that creatures, which are awake at night, are rather exposed to, as Verheijen (1985) used the term, 'photopollution' or in other words the effect of the detrimental artificial light to the environment, so the most significant aim of this work is to discover which animal species can be said nocturnal of the living organisms that occur in some form in the most widely used 10th grade Hungarian compulsory Biology Lénárd textbooks according to its night activity.

As no internationally accepted list could be found that clearly classifies living beings in any of the 3 categories, a detailed individual study of the animal species was required.

The summary table (Table 1) was compiled according to whether the characteristic feature of the given species is the nocturnal activity or not. If so, it was marked with "n", meaning **nocturnal**, but if the animal was not characterized by this property, it was marked with "d", meaning **diurnal**. The third category **catheemeral** thus becomes evident in many cases, so it is not indicated. There were a few instances, where it was impossible to decide clearly what category the organism belonged to from the available data, these cases are indicated with "nod" meaning no available data about it.

Animal species occurrence in the National experimental textbook (class 10) published in Gábor Dr. Lénárd (2019)

Species	Nocturnal (n)	Diurnal (d)	No data (nod)
<i>Ursus arctos</i>	n	d	
<i>Ursus americanus</i>	n	d	
<i>Ursus arctos beringianus</i>	n	d	
<i>Issoria lathonia</i>		d	
<i>Vulpes vulpes</i>	n	d	
<i>Sycon raphanus</i>	n	d	
<i>Spongia officinalis</i>			nod
<i>Euplectella aspergillum</i>			nod
<i>Ascaris lumbricoides</i>	n		
<i>Enterobius vermicularis</i>	n		
<i>Trichinella spiralis</i>	n		
<i>Helix pomatia</i>	n	d	
<i>Limax maximus</i>	n	d	
<i>Anodonta cygnea</i>	n	d	
<i>Sepia officinalis</i>	n		
<i>Octopus vulgaris</i>	n		
<i>Lumbricus terrestris</i>	n		
<i>Hirudo medicinalis</i>	n		
<i>Pieris brassicae</i>	n		
<i>Scorpiones sp.</i>	n		
<i>Homarus gammarus</i>	n	d	
<i>Pagurus bernhardus</i>	n		
<i>Daphnia pulex</i>	n		
<i>Coccinella septempunctata</i>		d	
<i>Apis mellifera</i>		d	
<i>Ixodes ricinus</i>		d	
<i>Araneus diadematus</i>	n		
<i>Asteroidea sp.</i>	n	d	
<i>Arbacia lixula</i>	n		
<i>Holothuria forskali</i>	n		
<i>Cephalochordata sp.</i>	n		
<i>Carcharodon carcharias</i>	n		
<i>Salmo trutta</i>	n		
<i>Barbatula barbatula</i>	n		
<i>Barbus peloponnesius</i>	n		
<i>Cyprinus carpio carpio morpha</i>	n		
<i>Carassius carassius</i>	n		
<i>Abramis brama</i>	n		
<i>Esox lucius</i>	n		

<i>Umbra krameri</i>	n		
<i>Clupea harengus</i>	n		
<i>Sardina pilchardus</i>	n		
<i>Gadus morhua</i>	n		
<i>Thunnus thynnus</i>	n		
<i>Rana esculenta</i>	n	d	
<i>Hyla arborea</i>	n	d	
<i>Pelobates fuscus</i>	n		
<i>Vipera berus</i>	n	d	
<i>Crocodylus acutus</i>	n		
<i>Emys orbicularis</i>	n		
<i>Aptenodytes forsteri</i>	n		
<i>Erithacus rubecula</i>	n		
<i>Haliaeetus albicilla</i>	n	d	
<i>Diomedidae</i>	n		
<i>Macropus rufus</i>	n		
<i>Ornithorhynchus anatinus</i>	n		
<i>Phascolarctos cinereus</i>	n	d	
<i>Pan troglodytes</i>	n	d	
<i>Pongo sp.</i>	n	d	
<i>Gorilla sp.</i>	n	d	
<i>Panthera pardus</i>	n	d	
<i>Hippopotamus amphibius</i>	n		
<i>Balaenoptera musculus</i>	n	d	
<i>Cestoda</i>	n		
<i>Hydra sp.</i>	n		
<i>Odonata sp.</i>	n		
<i>Gasterosteus aculeatus</i>	n	d	
<i>Lampropeltis triangulum</i>	n	d	
<i>Salmo salar</i>	n		
<i>Lutra lutra</i>	n		
<i>Catocala elocata</i>	n		
<i>Pavo cristatus</i>	n	d	
<i>Ptilonorhynchus violaceus</i>	n		
<i>Cichlasoma tetraacanthus</i>			nod
<i>Papio sp.</i>	n		
<i>Larus pacificus</i>		d	
<i>Tadorna ferruginea</i>		d	
<i>Turdus merula</i>	n	d	
<i>Canis lupus familiaris</i>	n	d	

Table 1. Species occurrence in the National experimental textbook (class 10)

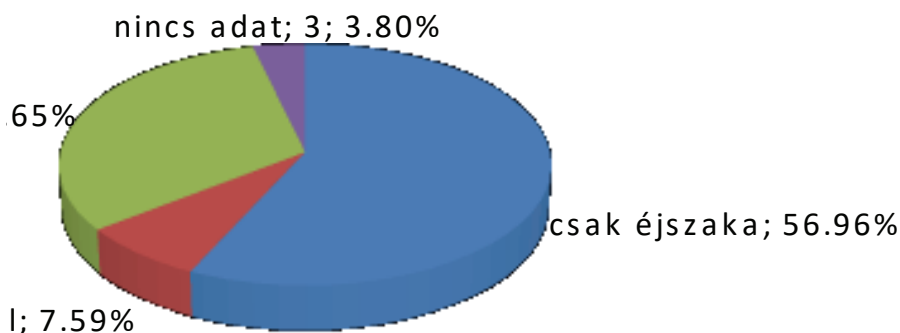


Fig. 1. The rate of the appearance of nocturnal (active at night) animals in the National experimental textbook (class 10) published in Gábor Dr. Lénárd (2019)

The test results

Despite my hypothesis, there are surprisingly many species with nocturnal activity among the organisms studied in the analyzed 10th grade Biology book, called Biology 10., written by Gábor Dr. Lénárd. As shown in **Fig. 1**, a very high proportion (**57%**) of the collected animal examples in the book contain organisms that can be said to be exclusively active mainly at night, i.e. **nocturnal** animals, and compared to the entire sample the proportion is also high also for those for which I found both the “**nocturnal**” and the “**diurnal**” feature together (**32%**). Only a fraction of the sample is typical, where I did **not** find any specific **data**, and so it is negligible (**4%**), while the proportion of animal species showing only daytime activity, i.e. **exclusively diurnal**, is quite low (**7%**) as well.

Due to the large number of occurrences great emphasis should be placed on a more detailed description of the emphasized species, as in many cases they appear only in the curriculum as an inspiring photo, or as a shorter reference to a particular topic. The more animals, children encounter in their studies, the more they can understand from the world around them, making them more effective in halting the drastic decline of species that is observed today. Especially when not only a photo or a name can be seen about it, but also a short description about what the living thing really is.

Among other things, it would be worth highlighting the exact damage caused by artificial lighting and light pollution, because there is no reference or minimal mention of this topic, as well as the importance of biodiversity, although in my opinion it would be useful for the entire curriculum. It would even be significant to initiate, or at least to suggest, the fact of the drastic decline in the number of living beings, and to begin with this, the entire 10th grade material, so that students would be able to consciously see the seriousness of the current situation and learn the other parts of the course with this in mind.

Due to this, they could better articulate how to help them determine the living conditions that determine their own lives as well. Unfortunately, in many cases, today's curriculum does not provide this adequately, and this can give us the feeling that we are teaching a false situation analysis to the next generation.

We should approach the topic as many times as possible by processing up-to-date concepts too, so that children not only experience what surrounds them from the media, but also by introducing an internationally accepted detailed part of the curriculum, supplemented by their own impressions of the outside world. The basic 3 categories outlined in the article, **nocturnal**, **diurnal**, and the **catheemeral** mentioned, also show deficiency. The search and getting to know the individual species itself would be greatly facilitated by a generally accepted list of living beings covering all known living beings, which on the one hand would make it easier for teachers and students to understand the system of known species in 10th grade. This resource could be made available even to educators in early childhood education sessions.

Following the identification of the categories, the search was further complicated by the fact that although some living beings may fall into all three categories but 2 more categories appeared, called **crepuscular** being one of the representatives of those that are **active primarily during twilight** (the periods of dawn and dusk) (EPPLEY, et al., 2015) and **vespertine** being associated with the Latin root *vesper*, which means "evening" because these animals often refer to animal species **occurring in the evening** (<https://www.merriam-webster.com/dictionary/vespertine>)

After a multidirectional interpretation of the 5 concepts, I narrowed the research to the categories **nocturnal** and **diurnal** and then it was only examined whether or not the species were indicated in the textbook showed nocturnal activity and based on this I classified the **nocturnal "n"** or the **diurnal "d"** category. In several cases, I started a word search in articles, mainly in *Google books* or in *the Digitális tankönyvtár*, or I used search engines (eg *research gate*), where I entered the Latin or rarely Hungarian names of the species, and then I paired the words with the phrases "at night", "night" or "éjszakai". I used the terms "**nocturnal**" or, if there was no reference to either, I also tried the words "**diurnal**" for exclusion. In the bibliography, I indicated the Latin name of the given organism after each reference in parentheses for the easier retrieval.

Evaluating the rate of the characteristic features can also be significant (e.g. how many species fell into the different categories). This is what diagrams serve as an indication.

In which article I found a reference specifically to daytime activity, I indicated it in the table with "n" (Table 1), but I did not look specifically for daytime "d" activity, therefore I will definitely have the opportunity to expand the list later and it is planned, too.

We must teach young people as many species as we are able to, because these pieces of information, can be decisive for their lifetime even for their descendants. If they also get additional information about the characteristics of

the species, they will more likely to become more environmentally conscious.

How can young children learn about creatures in the classrooms if they do not have enough examples or enough information only a picture or its Hungarian name about the animals being introduced to them. How can they be expected to identify and save the creatures around them in the nature without this ability? These fundamental questions should be answered before teachers and students when they start a new 10th year.

Acknowledgement

I would like to thank ERIKA PÉNZESNÉ DR. KÓNYA PhD, my doctoral advisor and the Dean of the Faculty of Natural Sciences for her comprehensive assistance and helpful comments. This work was supported by the EFOP 3.6.2-16-2017-00014 grant: „Nemzetközi kutatási környezet létrehozása a fényszennyezés területén”.

References

- ANKEL-SIMONS, FRIDERUN (2007). *Primate Anatomy* (3rd ed.). Academic Press. ISBN 978-0-12-372576-9.
- BETTS, M. G. et al. (2017). Global forest loss disproportionately erodes biodiversity in intact landscapes. *Nature* 547: 441, DOI: <https://doi.org/10.1038/nature23285>
- DR. LÉNÁRD GÁBOR (2019). *Biológia 10., Eszterházy Károly Egyetem (Oktatókutatási és Fejlesztési Intézet)*
- ENTZ GÉZA, SEBESTYÉN OLGA (1942): *A Balaton élete*, 124. kötet. A Királyi Magyar Természettudományi Társulat Könyvkiadó Vállalata, Budapest.
- EPPLEY, T. M., GANZHORN, J. U., & DONATI, G. (2015). Cathemerality in a small, folivorous primate: Proximate control of diel activity in *Haplemur meridionalis*. *Behavioral Ecology and Sociobiology*, 69, 991–1002.
- GASTON, KEVIN J.; DAVIES, THOMAS W.; BENNIE, JONATHAN; HOPKINS, JOHN (2012). REVIEW: Reducing the ecological consequences of night-time light pollution: options and developments”. *Journal of Applied Ecology*. 49 (6): 1256–1266. DOI: <https://doi.org/10.1111/j.1365-2664.2012.02212.x>, ISSN 0021-8901. PMC 3546378. PMID 23335816.
- G-TÓTH LÁSZLÓ (2000): *A planktonikus rákok táplálkozásbiológiája és szerepe a fitoplankton eliminálásában a Balatonban*. Kézirat, doktori értekezés, Tihany.
- HUTCHINSON, G. EVELYN (1967): *A Treatise on Limnology Vol. II*. John Wiley&Sons
- MIKA, JÁNOS, és ILONA PAJTÓKNÉ TARI (2015): *Környezeti nevelés és tudatformálás*, Előszó. Líceum Kiadó, Eger
- MITÉVA, DANIELA & PATTANAYAK, SUBHRENDU & FERRARO, PAUL. (2012). Evaluation of biodiversity policy instruments: What works and what doesn't? *Oxford Review of Economic Policy*. 28. 69-92. 10.1093/oxrep/grs009.

SLINGENBERG, A., BRAAT, L., VAN DER WINDT, H., RADEMAEKERS, K., EICHLER, L., AND TURNER, K. (2009). 'Study on Understanding the Causes of Biodiversity Loss and the Policy Assessment Framework', European Commission Directorate-General for Environment, available at http://ec.europa.eu/environment/enveco/biodiversity/pdf/causes_biodiv_loss.pdf.

TATTERSALL, IAN (1987). „Cathemeral Activity in Primates: A Definition”. *Folia Primatol.* 49: 200–202.

VERHEIJEN, F. J. (1985), Photopollution: artificial light optic spatial control systems fail to cope with. Incidents, causations, remedies. *Experimental Biology* 44: 1–18.

E-book references

Az MTA Balatoni Limnológiai Kutatóintézetének Honlapja: A Balaton életközösségeinek aktuális állapotáról <http://www.blki.hu/BLKI.htm>

<https://books.google.hu/books?id=KudBOfRXjWAC&pg=PA102&dq=Aptenodytes+forsteri+active+at+night&hl=hu&sa=X&ved=0ahUKEwiGjs6u7YPPAhUytYsKHUHsA6MQ6AEIMjAB#v=onepage&q=Aptenodytes%20forsteri%20active%20at%20night&f=false> p192

(*Aptenodytes forsteri*)

(Letöltés ideje: 2020. június 24.)

<https://books.google.hu/books?id=2rkHQpToi9sC&pg=PA326&dq=Balaenoptera+musculus+night&hl=hu&sa=X&ved=0ahUKEwihwtKB-4PpAhX-rplsKHUG9BI0Q6AEIRjAD#v=onepage&q=Balaenoptera%20musculus%20night&f=false> p326

(*Balaenoptera musculus*)

(Letöltés ideje: 2020. június 14.)

<https://books.google.hu/books?id=Fkg7C9mAS2wC&pg=PA280&dq=Canis+lupus+familiaris+at+night&hl=hu&sa=X&ved=0ahUKEwim3a-38zYTpAhXH-yoKHd8rDloQ6AEIKDAA#v=onepage&q=Canis%20lupus%20familiaris%20at%20night&f=false>

(*Canis lupus familiaris*)

(Letöltés ideje: 2020. június 10.)

<https://books.google.hu/books?id=nOINAAAAYAAJ&q=Catocala+elocata++NIGHT&dq=Catocala+elocata++NIGHT&hl=hu&sa=X&ved=0ahUKEwjmeW5wYTPAhUs-yoKHVLwA2IQ6AEIPzAC>

(*Catocala elocata*)

(Letöltés ideje: 2020. június 24.)

<https://books.google.hu/books?id=x6sbbVlfn4EC&pg=PA115&dq=Cestoda+night&hl=hu&sa=X&ved=0ahUKEwjN1dO3-4PpAhUjtYsKHVu3DioQ6A-ElEAI#v=onepage&q=Cestoda%20night&f=false> p115

(Cestoda)

(Letöltés ideje: 2020. június 24.)

<https://books.google.hu/books?id=9VwFvZZg7dUC&pg=PA214&lpq=PA214&dq=Crocodylus+acutus+active+at+night&source=bl&ots=x9K7w4lc-2q&sig=ACfU3U2Dq3mwj5ON9gjU5MEef9GblWuTNw&hl=hu&sa=X&ved=2ahUKEwjOjPfP6IPpAhWhwqYKHB1RDEEQ6AEwCXoECAoQA-Q#v=onepage&q=Crocodylus%20acutus%20active%20at%20night&f=false>

(Crocodylus acutus)

(Letöltés ideje: 2020. június 12.)

<https://books.google.hu/books?id=oxG9DwAAQBAJ&pg=PA14&lpq=PA14&dq=Diomedidae+night&source=bl&ots=KG5d74fB9-&sig=ACfU3U2KvgLyyvC-8jwPQsXMrbcvWGHp0yg&hl=hu&sa=X&ved=2ahUKEwig3b6R8oPpAhV-GAxAIHRb1AiwQ6AEwC3oECAkQAQ#v=onepage&q=Diomedidae%20night&f=false>

(Diomedidae)

(Letöltés ideje: 2020. június 24.)

<https://books.google.hu/books?id=xqc1AAAAMAAJ&q=Emys+orbicularis+active+at+night&dq=Emys+orbicularis+active+at+night&hl=hu&sa=X&ved=0ahUKEwif9MPC6YPPpAhWVBhAIHZWaDosQ6AEIKDAA> p140

(Emys orbicularis)

(Letöltés ideje: 2020. június 15.)

https://books.google.hu/books?id=gg5NAQAAMAAJ&q=Gasterosteus+aculeatus++NIGHT&dq=Gasterosteus+aculeatus++NIGHT&hl=hu&sa=X&ved=0ahUKEwiot_z3t4TpAhVuo4sKHVZDCRsQ6AEIUTAE p86.

(Gasterosteus aculeatus)

(Letöltés ideje: 2020. június 24.)

<https://books.google.hu/books?id=xMkOAAAAQAAJ&pg=PP47&dq=Hippopotamus+amphibius+night&hl=hu&sa=X&ved=0ahUKEwiWsbTJ-oPpAhXt-sosKHRNyCBkQ6AEIMzAB#v=onepage&q=Hippopotamus%20amphibius%20night&f=false>

(Hippopotamus amphibius)

(Letöltés ideje: 2020. június 16.)

https://books.google.hu/books?id=wSNwDwAAQBAJ&pg=PT47&dq=Hirudo+-medicinalis+at+night&hl=hu&sa=X&ved=0ahUKEwjt_pu7z4TpAhWTrIsKH-QGcANoQ6AEINDAB#v=onepage&q=Hirudo%20medicinalis%20at%20night&f=false

(Hirudo medicinalis)

(Letöltés ideje: 2020. június 24.)

<https://books.google.hu/books?id=C15jZPBegyQC&pg=PA278&dq=Holothuria+forskali+at+night&hl=hu&sa=X&ved=0ahUKEwiU9czBzoTpAhWItlsKHU-IGAb8Q6AEINDAB#v=onepage&q=Holothuria%20forskali%20at%20night&f=false>

(*Holothuria forskali*)

(Letöltés ideje: 2020. június 24.)

https://books.google.hu/books?id=JpsLAQAAlAAJ&q=Hydra+night+activity&dq=Hydra+night+activity&hl=hu&sa=X&ved=0ahUKEwjTulOw_IPpAhUEAxAl-HaPrDmkQ6AEIfzAJ

(*Hydra* sp.)

(Letöltés ideje: 2020. június 12.)

<https://books.google.hu/books?id=r-Liq4O4udsC&pg=PA284&dq=Lampropeltis+triangulum++NIGHT&hl=hu&sa=X&ved=0ahUKEwip-84SPuYTpAhXos4sKHQ6IA8IQ6AEIRjAD#v=onepage&q=Lampropeltis%20triangulum%20%20NIGHT&f=false> p284.

(*Lampropeltis triangulum*)

(Letöltés ideje: 2020. június 24.)

<https://books.google.hu/books?id=vUFJ-PB65wwC&pg=PA5&dq=Lutra+lutra++NIGHT&hl=hu&sa=X&ved=0ahUKEwj2rZy9uoTpAhUFxYsKHSr5Cuc-Q6AEIbDAH#v=onepage&q=Lutra%20lutra%20%20NIGHT&f=false>

(*Lutra Lutra*)

(Letöltés ideje: 2020. június 12.)

<https://books.google.hu/books?id=mp8sAQAAMAAJ&q=Macropus+rufus+night&dq=Macropus+rufus+night&hl=hu&sa=X&ved=0ahUKEwiQ9J-DV9oPpAhVRaxAIHX-bBO4Q6AEIKDAA>

(*Macropus rufus*)

(Letöltés ideje: 2020. június 12.)

<https://books.google.hu/books?id=asNGAQAAlAAJ&pg=PA235&dq=Pagurus+bernhardus+at+night&hl=hu&sa=X&ved=0ahUKEwia8dr-zoTpAhX-okosKHccKBfYQ6AEIRjAD#v=onepage&q=Pagurus%20bernhardus%20at%20night&f=false>

(*Pagurus bernhardus*)

(Letöltés ideje: 2020. június 24.)

<https://books.google.hu/books?id=LJu0BgAAQBAJ&pg=PT26&dq=Papio+++%C3%A9jszaka&hl=hu&sa=X&ved=0ahUKEwirtr38yoTpAhVFxosKHZGkBBIQ6AEIKDAA#v=onepage&q=Papio%20%20%20%C3%A9jszaka&f=false>

(*Papio* sp.)

(Letöltés ideje: 2020. június 24.)

<https://books.google.hu/books?id=l9YsAQAAMAAJ&q=Ptilonorhynchus+violaceus++NIGHT&dq=Ptilonorhynchus+violaceus++NIGHT&hl=hu&sa=X&ved=0ahUKEwif-FCpx4TpAhVlplsKHQAIDCQQ6AEIUTAE> p128

(*Ptilonorhynchus violaceus*)

(Letöltés ideje: 2020. június 12.)

<https://books.google.hu/books?id=HC4IAQAAMAAJ&q=Salmo+salar++NIGHT&dq=Salmo+salar++NIGHT&hl=hu&sa=X&ved=0ahUKEwisxLSI-uoTpAhVkmlsKHVTTcugQ6AEITzAE>

(*Salmo salar*)

(Letöltés ideje: 2020. június 18.)

<https://books.google.hu/books?id=BIWBIV9TQB0C&pg=PT1478&dq=Sepia+officinalis+at+night&hl=hu&sa=X&ved=0ahUKEwjU8qj8z4TpAhUqAhAIH-fC-BA8Q6AEIKDAA#v=onepage&q=Sepia%20officinalis%20at%20night&f=false>

(*Sepia officinalis*)

(Letöltés ideje: 2020. június 24.)

https://www.researchgate.net/publication/302986863_Study_of_dragonflies_and_caddisflies_Insecta_Odonata_Trichoptera_on_Batanta_Island_Indonesia_West_Papua_-_Sztatokotok_es_tegzesek_Insecta_Odonata_Trichoptera_kutatasa_Batanta_szigeten_Indonezia_Nyugat-

(*Odonata*)

(Letöltés ideje: 2020. június 24.)

https://books.google.hu/books?id=_jBkszEITMYC&pg=PT55&dq=Ornithorhynchus+anatinus+night&hl=hu&sa=X&ved=0ahUKEwjIku-S94PpAhXpAhAl-Hfs8DOoQ6AEIcTAH#v=onepage&q=Ornithorhynchus%20anatinus%20night&f=false

(Letöltés ideje: 2020. június 12.)

<https://books.google.hu/books?id=RV9CDwAAQBAJ&pg=PT191&dq=Pan+troglydytes+night&hl=hu&sa=X&ved=0ahUKEwiT56XV-IPpAhWGmlsKHd6OAh-8Q6AEIMzAB#v=onepage&q=Pan%20troglydytes%20night&f=false>

(*Pan troglodytes*)

(Letöltés ideje: 2020. június 24.)

<https://books.google.hu/books?id=sLfaAAAAMAAJ&q=Pavo+cristatus++NIGHT&dq=Pavo+cristatus++NIGHT&hl=hu&sa=X&ved=0ahUKEwiZ1f-SlwoTpAhXBs4sKHbPDDRQQ6AEIOzAC>

(*Pavo cristatus*)

(Letöltés ideje: 2020. június 20.)

<https://books.google.hu/books?id=onO2967GdPwC&pg=PA60&dq=Panthera+pardus+night&hl=hu&sa=X&ved=0ahUKEwjVnqWU-oPpAhUltosKHe-JAAcUQ6AEIMzAB#v=onepage&q=Panthera%20pardus%20night&f=false>

(*Panthera pardus*)

(Letöltés ideje: 2020. június 16.)

<https://books.google.hu/books?id=BIWBIV9TQB0C&pg=PT347&dq=Phascolarctos+cinereus+night&hl=hu&sa=X&ved=0ahUKEwjtkSPg94PpAhWEtYsKHb-vlBO0Q6AEIKDAA#v=onepage&q=Phascolarctos%20cinereus%20night&f=false>

(Phascolarctos cinereus)

(Letöltés ideje: 2020. június 24.)

<https://books.google.hu/books?id=F2s-AQAAIAAJ&q=Pongo+night&dq=Pongo+night&hl=hu&sa=X&ved=0ahUKEwiKp4HS-YPpAhXHs4sKHfiBCV4Q6A-EliAEwCQ>

(Pongo, Gorilla)

(Letöltés ideje: 2020. június 8.)

https://books.google.hu/books?id=Xuo0ywwUgsC&pg=PA241&lpg=PA241&dq=salmo+trutta+nocturnal&source=bl&ots=ZvHWkXCpPf&sig=ACfU3U0hjXALLLoXxj9P7zF3mJGJBVswuQ&hl=hu&sa=X&ved=2ahUKEwicrr-YhYPPAh-Vt_CoKHT2JBeMQ6AEwAXoECAoQAQ#v=onepage&q=salmo%20trutta%20nocturnal&f=false

(Salmo trutta)

(Letöltés ideje: 2020. június 24.)

<https://books.google.hu/books?id=dEEGtAtR1NcC&pg=PA115&dq=Turdus+merula+at+night&hl=hu&sa=X&ved=0ahUKEwj536SXzYTpAhUBtosKHQ0LD-f8Q6AEIMzAB#v=onepage&q=Turdus%20merula%20at%20night&f=false>

(Turdus merula)

(Letöltés ideje: 2020. június 24.)

<https://brainmanpictures.piwigo.com/picture?/3034>

(Barbatula barbatula)

(Letöltés ideje: 2020. június 24.)

https://c402277.ssl.cf1.rackcdn.com/publications/1187/files/original/LPR2018_Full_Report_Spreads.pdf

<http://chernelmte.extra.hu/cinege12-8.html>

(Erithacus rubecula)

(Letöltés ideje: 2020. június 24.)

http://eta.bibl.u-szeged.hu/2089/7/EFOP343_AP2OKTIG2_jegyzet_L%C5%91rinczi%26Torma_zool%C3%B3gia_jegyzet_20190627_rev.pdf

<https://mormisfly.wordpress.com/2016/06/16/a-nagy-karaszok-idoszaka/>

(Carassius carassius)

(Letöltés ideje: 2020. június 12.)

https://mttmuzeum.blog.hu/2016/03/03/van_uj_a_viz_alatt

(Barbus peloponnesius)

(Letöltés ideje: 2020. június 12.)

https://www.researchgate.net/publication/280876810_Recording_movement_and_activity_pattern_of_a_White-tailed_Sea_Eagle_Haliaeetus_albicilla_by_a_GPS_datalogger

(Haliaeetus albicilla) (Letöltés ideje: 2020. június 14.)

<https://www.pineridgenaturalhealth.com/vostochnaja-sardina-5-bukv.php>

(Sardina pilchardus) (Letöltés ideje: 2020. június 24.)

<https://www.pineridgenaturalhealth.com/gde-zhivet-ryba-treska.php>

(Gadus morhua) (Letöltés ideje: 2020. június 24.)

<https://web.archive.org/web/20170525112844/https://naturalhistory.si.edu/mna/glossary.cfm>

<https://wol.jw.org/hu/wol/d/r17/lp-h/101999686>

(Thunnus thynnus)

(Letöltés ideje: 2020. június 14.)

http://www.eltereader.hu/media/2014/04/Bevezetes_az_allattanba.pdf

<https://www.haldorado.hu/topikok/finomszerelekes-technikak-c4/rakos-bottal-nagyhalakra-c92/ejjeli-pontyok-a1208>

(Cyprinus carpio carpio morpha)

(Letöltés ideje: 2020. június 18.)

<http://www.mme.hu/keteltuek-es-hullok/keresztes-vipera>

(Vipera berus)

(Letöltés ideje: 2020. június 24.)

<http://www.mme.hu/keteltuek-es-hullok/nagy-tavibeka>

(Rana esculenta)

(Letöltés ideje: 2020. június 12.)

https://www.researchgate.net/publication/271176048_A_lapi_poc_Umbra_krameri_elofoordulasa_a_Hansagban_Mudminnow_Umbra_krameri_in_the_Hansag

(Umbra krameri)

(Letöltés ideje: 2020. június 25.)

http://www.seaturtle.org/PDF/Witherington_1997_InBehavioralApproachesto-Conservationi_p303-328.pdf

<https://www.tiszatoelovilaga.hu/zold-levelibeka/>

(Hyla arborea)

(Letöltés ideje: 2020. június 24.)

On-line reference

Szinetár Cs., (2006) *Pókok, Könyvtár Élővilág*. Kossuth Kiadó, Budapest, 112 pp.
<http://apropok.blogspot.com/2010/04/az-ev-europai-pokja-araneus-diadematus.html>

(Letöltés ideje: 2020. június 24.)

North American Bear Center

<https://bear.org/bear-facts/black-bears/basic-bear-facts/>

(Letöltés ideje: 2020. június 12.)

Dr Kiss Á., (2005) *Az Amuri kagyló (Adononta Woodiana Woodiana Lea, 1834) (Mollusca Unionidae) szaporítása, növekedése és biomasszája*

<http://docplayer.hu/10339967-Az-amuri-kagyló-anodonta-woodiana-woodiana-lea-1834-mollusca-unionidae-szaporitasa-novekedese-es-biomasszaja.html>

(Anodonta cygnea)

(Letöltés ideje: 2020. június 16.)

https://en.wikipedia.org/wiki/List_of_nocturnal_animals

(Letöltés ideje: 2020. június 24.)

Potyó I., Weiperth A., Guti G. MTA ÖK Dunakutató Intézet, Göd. *Elektromos halászattal gyűjtött minták napszakos változásai a Duna Budapest feletti szakaszán és egyes mellékvízfolyásaiban*. Pisces Hungarici 7 (2013) 57–6

http://haltanitarsasag.hu/ph7/Potyó_et.al_Pisces.Hungarici_2013.pdf

(Abramis brama, Esox lucius)

(Letöltés ideje: 2020. június 24.)

Wallendums P., Polster G. *Sokszínű rókavadászat*

<http://hazaivadasz.hu/2015/01/12/sokszinu-rokavadaszat/>

(Letöltés ideje: 2020. június 18.)

<https://hu.wikipedia.org/wiki/Skorpi%C3%B3k>

(Scorpiones)

(Letöltés ideje: 2020. június 24.)

Daphnia él. Nagy-Daphnia (lat)

<https://irgp2.ru/hu/dafniya-obitaet-bolshaya-dafniya-lat-daphnia-magna-melkii-vetvistousyi-rachok/>

(Daphnia pulex) (Letöltés ideje: 2020. június 12.)

Amit a rákról tudni kell

<https://myfish.hu/szenvedelyunk-a-hal/ amit-a-rakokrol-tudni-kell>

(Homarus gammarus)

(Letöltés ideje: 2020. június 24.)

Dr. Farkas J., Dr. Német Sz., Dr. Tóth Z. (2013) Tengerbiológiai terepgyakorlatok
https://regi.tankonyvtar.hu/hu/tartalom/tamop412A/2011-0073_tengerbiologiai_terepgyakorlatok/ch05.html
(Letöltés ideje: 2020. június 22.)

<https://www.arcanum.hu/hu/online-kiadvanyok/pannon-pannon-enciklopedia-1/a-magyarsag-kezikonyve-2/noveny-es-allatvilag-1E2/lepkek-37C/a-kaposztalepke-a-bagolylepke-es-a-medvelepke-387/>
(*Pieris brassicae*)
(Letöltés ideje: 2020. június 22.)

Kotlán S.; I. osztály fonálférgék (Nematoda Rud.)
<https://www.arcanum.hu/hu/online-kiadvanyok/Brehm-brehm-allatok-vilaga-8CCA/a-fergek-vermes-allattorzse-8059/harmadik-altorzsz-gyurutlenfergek-amera-814A/i-osztaly-fonalfergek-nematoda-rud-8163/>
(*Trichinella spiralis*)
(Letöltés ideje: 2020. június 24.)

<https://www.edenkert.hu/vilagos-zold/allatok-a-kertben/a-foldigiliszta-biomassza-talaj/2901/>
(*Lumbricus terrestris*)
(Letöltés ideje: 2020. június 12.)

Medvelap.hu 2020.
<http://www.farkasnora.hu/medve/fajtai.html>
(Letöltés ideje: 2020. június 18.)

Meghökkenítő Octopus tények 2019
<https://www.greelane.com/hu/tudom%C3%A1ny-tech-math/%C3%A1llatok-%C3%A9s-term%C3%A9szet/fascinating-octopus-facts-4064726/>
(*Octopus vulgaris*)
(Letöltés ideje: 2020. június 12.)

Magyarország Nagylepkéi
http://www.macrolepidoptera.hu/lepke/lissoria-lathonia_hun
(Letöltés ideje: 2020. június 28.)

<https://www.merriam-webster.com/dictionary/vespertine>
(Letöltés ideje: 2020. június 12.)

Magyar Madártani és Természetvédelmi Egyesület honlapja
<http://www.mme.hu/keteltuek-es-hullok/barna-asobeka>
(*Pelobates fuscus*)
(Letöltés ideje: 2020. június 12.)

Molnár O., 2009 Napnyugta környékén verődnek össze a többmillió halrajok
<https://www.origo.hu/tudomany/20090326-mint-a-heringek-amikor-vonzo-a-tomeg.html>
(*Clupea harengus*)
(Letöltés ideje: 2020. június 2.)

- Pesthy G., 2010. Támad a nagy spanyolcsiga-armada
<https://www.origo.hu/tudomany/20100922-hogyan-vedekezunk-a-kartevo-csupaszcsigak-ellen.html>
(Letöltés ideje: 2020. június 2.)
- Pesthy G. (2010). Ilyen, amikor álmosak a méhek.
<https://www.origo.hu/tudomany/20101214-az-almos-mehek-pontatlanul-tancolnak.html>
(Letöltés ideje: 2020. június 24.)
- Witherington (1997) In Behavioral Approachesto Conservationi p303-328.pdf
http://www.seaturtle.org/PDF/Witherington_1997_InBehavioralApproachestoConservationi_p303-328.pdf
(Letöltés ideje: 2020. június 24.)
- Homonnay Zsolt G., Parányi lebegő állatok a Balatonban A zooplankton.
http://www.titzala.hu/letolt/Homonnay_1.pdf
(Letöltés ideje: 2020. június 15.)
- BSCZO 201 Book.pdf
<http://www.uou.ac.in/sites/default/files/slm/BSCZO-201.pdf>
(Cephalochordata sp)
(Letöltés ideje: 2020. június 18.)
- <https://www.vocabulary.com/dictionary/nocturnal>
(Letöltés ideje: 2020. június 18.)
- <http://www.vpbathory.sulinet.hu/orvosi/cernagiliszta.pdf>
(Enterobius vermicularis)
(Letöltés ideje: 2020. június 18.)
- Dr. Nagy L.; A Magyarországon előforduló féregfertőzések
Részletek: <https://www.webbeteg.hu/cikkek/eloskodok/10163/magyarorszagon-elofordulo-feregfertozesek>
<https://www.webbeteg.hu/cikkek/eloskodok/10163/magyarorszagon-elofordulo-feregfertozesek>
(Ascaris lumbricoides)
(Letöltés ideje: 2020. június 20.)
- <https://www.wikiwand.com/hu/R%C3%A9cef%C3%A9l%C3%A9k>
(Tadorna ferruginea) (Letöltés ideje: 2020. június 18.)