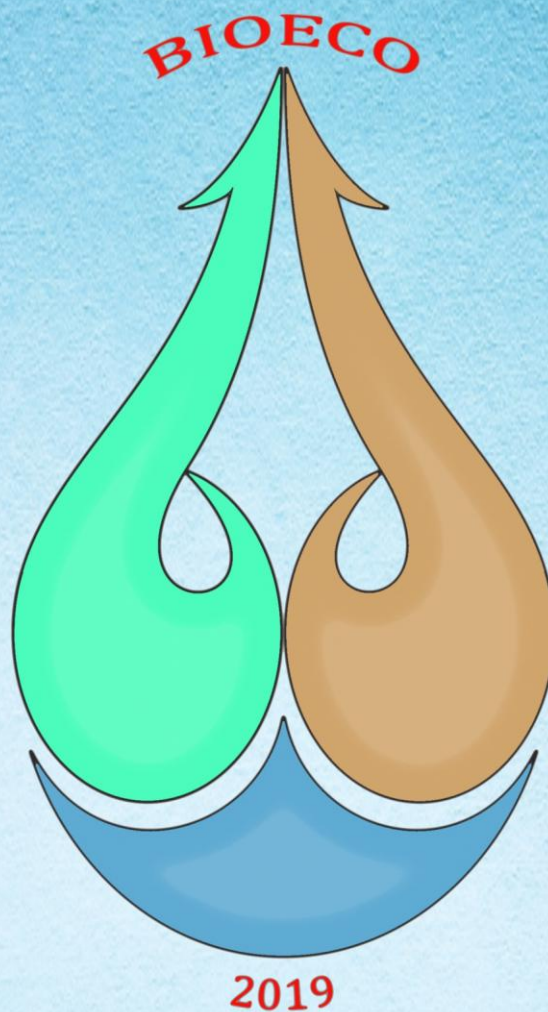


INTERNATIONAL BIODIVERSITY & ECOLOGY SCIENCES SYMPOSIUM PROCEEDINGS (BIOECO2019)

SEPTEMBER 26-28, 2019
İSTANBUL / TURKEY

Edited By
Dr. Tahir ÖZCAN



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Preface

Thousands of species which belongs to plants, animals, aquatic & terrestrial organisms, micro-organisms, invertebrates and their genetic variability launch biodiversity web of the world. Today, biodiversity and ecology sciences are significantly important in order to protect and sustain ecosystem. In the context of BioEco2019, nine subtitles were evaluated under the nine main theme which constitutes the main study areas of biodiversity and ecology sciences. In addition to the recent developments in these areas, how to maintain the ecological status and how to transform this knowledge to the future generations were discussed. The maintenance and management of biodiversity and ecology of the terrestrial & aquatic ecosystems require the close cooperation of scientists, politicians and stakeholders, and must arise from the best available knowledge and experience provided by ecologists. For that reason, this symposium aimed to provide an opportunity to bring experts from different disciplines together in the scientific community and contribute greatly to our knowledge of the theoretical and practical aspects of biodiversity and ecological sciences.



Final Declaration

The First Symposium on Biodiversity and Ecology Sciences (BioEco2019), which took place at the Shareton Hotel, İstanbul, Turkey, 26–28 September 2019, was organised by Palas Academic (Palas Akademik Organizasyon ve Ticaret A.Ş), Iskenderun Technical University, Harran University with the support of Blue and Green Nature and Science Association (Mavi Yeşil Doğa ve Bilim Derneği), Academic Union Association (Akademik Birlik Derneği) and Ecovasion.

Overall, 150 participants from 50 research centers, universities and institutions attended.

Participants from twenty-two different countries (Turkey, Algeria, Austria, Bulgaria, Croatia, Finland, Georgia, Germany, Indonesia, Iran, Italy, Kosova, Libya, Macedonia, Montenegro, Oman, Poland, Romania, Russia, Serbia, Tunisia and Uzbekistan) participate to the symposium. Among all participants, scientists from Algeria (50) were the most numerous.

94 oral and 137 poster presentations were contributed, including both original and review studies. In total, there were three key-note speeches presented; Dr. Nuri Başusta, Dr.Łukasz Kaczmarek and Dr. Manuel Marinelli.

Overall, this first symposium on Biodiversity and Ecology Sciences was an excellent opportunity for all participants to discuss all kinds of biodiversity and ecology with various study subjects and to examine prospective options for collaboration and information exchange. In final closing speech of the symposium, a consensus was reached for the continuous organization of this symposium.



Day 1 - Thursday, 26 September 2019	
Conference Hall- İstanbul Balo Salonu	
8:00-09:30	Registration of Participants
09:30-10:00	Coffee Break
10:00-10:15	Opening Ceremony
10:15-10:45	Memorial Ceremony for Kipiris Kostas
10:45-11:15	Age determination techniques in the marine gastropods
11:15-11:45	Diversity and ecology of tardigrades
11:45-12:15	Climate induced changes in population Dynamics in the Mediterranean Sea
12:15-14:00	Lunch Break

Theme Section A: Conservation of Biodiversity: Biological and Ecological Aspects in Aquatic Ecosystems		Theme Section A: Conservation of Biodiversity: Biological and Ecological Aspects in Aquatic Ecosystems		Theme Section B: Biological and Ecological Aspects in Terrestrial Ecosystems	
Freshwater Ecosystems		Conservation of Biological Diversity		Population Status, Life Histories, Ecology, Assessment, Conservation and Management of Terrestrial Species	
Conference Hall- Ankara		Conference Hall- Bodrum		Conference Hall- Bursa	
Chairman	Dr. Muhammed Yasar DÖRTBUDAK	Chairman	Dr. Yusuf Bozkurt	Chairman	Dr. Emire Elmas
14:00-14:15	Freshwater ichthyodiversity in Iran: Past, present and future trends <u>Hamid Reza Esmaili</u>	14:00-14:15	Cryobanks and their role in conservation of aquatic biodiversity <u>Yusuf Bozkurt</u>	14:00-14:15	How plant strategy types change in coastal wetland from dune to reeds? <u>Emire Elmas, Sevdâ Türkis, Barış Bani</u>
14:15-14:30	Diversity and density of Pleco (<i>Pterygoplycthis sp.</i>) in Ciliwung River, Jakarta Indonesia <u>Dewi Elfidasari, Huruin Fathonah Muthmainah, Fahma Wijayanti</u>	14:15-14:30	Determination of genetic variations of <i>Carasobarbus luteus</i> populations living in Euphrates River based on mitochondrial DNA cyt b sequences <u>Anil Parmaksız</u>	14:15-14:30	Study of soil-vegetation relationships of the forest Ouled Bechih (Souk Ahras) Algéria <u>Ibtissem Sami, Nouha Menadjiia</u>
14:30-14:45	First occurrence of <i>Ligula. sp</i> in endemic cyprinid <i>Ladigesocypris irideus</i> (Ladiges, 1960) From Ula Reservoir (Muğla, Turkey) <u>Sonayveh Doostij, Fevzi Yılmaz</u>	14:30-14:45	Isolation and 16S rRNA sequence analysis of six environmental haloversatile bacteria from Çamaltı Saltern <u>Pınar Çağlayan</u>	14:30-14:45	Analysis of vegetal biodiversity under saline conditions <u>Adda Ababou, Abdelkader Bouthiba</u>
14:45-15:00	Relationship of otolith size to standard length of The Prussian Carp <i>Carassius gibelio</i> (Bloch, 1782) in Tigris River, Şırnak, Turkey <u>Muhammed Yasar DÖRTBUDAK, Günaz ÖZCAN</u>	14:45-15:00	Selective enrichment for clinical strains of <i>Vibrio vulnificus</i> based on virulence correlating gene <u>Sedat Cam, Robin Brinkmeyer</u>	14:45-15:00	Biological strategy for the rehabilitation of saline soils in the perspective of sustainable agricultural development. <u>Moulay Belkhouja, Nadia Souahm</u>
15:00-15:15	Relationship of otolith size to standard length of the <i>Capoeta trutta</i> (Heckel, 1843) in Tigris River, Şırnak, Turkey <u>Muhammed Yasar DÖRTBUDAK, Günaz ÖZCAN</u>	15:00-15:15	Effect of environmental factors on biofilm formation by clinical and environmental <i>Vibrio vulnificus</i> strains <u>Sedat Cam, Robin Brinkmeyer</u>	15:00-15:15	The economic value analysis approach to conservation and sustainable use of Biological Diversity: <i>Fritillaria sp.</i> as a case study <u>Aynur Demir</u>
15:15-15:30	The ancient Lake's Ohrid and Prespa ecological status- a comparative study <u>Sasho Trajanovski, Biljana B. Gjoreska, Sonja Trajanovska, Konstantin Zdravski</u>	15:15-15:30		15:15-15:30	Securing the production of durum wheat (<i>Triticum durum</i> desf.) by supplementary irrigation in the semi-arid zone (south of setif province, <i>Asteroides of the homocladus variety</i>) <u>Chentti Khalissa, Guessoum Salma, Djouada Lyamine, Belhaouchet Zine Abidine, Mansour Lynda-Maya</u>
15:30-16:00	Coffee Break	15:30-16:00	Coffee Break	15:30-16:00	Coffee Break
Theme Section D: Bioindicators and Biomonitoring		Theme Section E: Biological Diversity: its past and prospects		Theme Section H: Environmental Management: Renewable Sources, Recycling and Environmental Management	
Conference Hall- Ankara		Conference Hall- Bodrum		Conference Hall- Bursa	
Chairmen	Dr. Levent Bat	Chairmen	Dr. Nuri Bayusta	Chairmen	Dr. Nurçin Kili
16:00-16:15	Concentrations of toxic elements in mussel <i>Mytilus galloprovincialis</i> as bio-indicator of coastal pollution <u>Levent Bat</u>	16:00-16:15	Predicting the impact of climate change on yield and water requirement of rainfed crops in setif region (Algeria) <u>Tarek Bourgeaa</u>	16:00-16:15	Stakeholder Analysis of The Artificial Reefs in Edremit Bay (Northern Aegean), Turkey: Contributions to management <u>Sezgin Tunca, Vahdet Ünal, José Luis Sánchez Lizaso</u>
16:15-16:30	The Contents of Heavy Metals in Plecostomus (Loricariidae) from the Ciliwung River Jakarta, Indonesia <u>Laksmi Nurul Ismi, Dewi Elfidasari, Riris L. Puspitasari, Irawan Sugoro, Afina P. Sabira</u>	16:15-16:30	A Dileptid Ciliate Isolated From Tekirdağ Soils, <i>Rutirkoplites armatus</i> (Foissner & Schade 2000) Ciliophora: Litostomatea, Rhynchostomata): Infecilitaria and Morphometric Characterization <u>Hilal Ural, İsmail Yıldız, Naciye Gülkız Şenler</u>	16:15-16:30	Analysis of Biodiversity and Ecological Data by R Software Packages <u>Yusuf Kurt</u>
16:30-16:45	Variable glochidium prevalence on gills suggests different resistance potential in fish: a preliminary evidence in the fish community of a temperate small stream (Tersakan, Muğla) <u>Ertan Ercan, Neslihan Agraçlı, Ali Serhan Tarkan</u>	16:30-16:45	Diversity and distribution pattern of waterbirds in wetlands of Algerian steppe region <u>Ettayeb Bensaci, Asma Zoubri, Yassine Noujdjem, Fateh Mmeche, Bilal Gasmi and Menouar Saheb</u>	16:30-16:45	Impact of production systems on salt lakes: Case of the complex Chott Merouane and Melghir (Algeria) <u>Fatma Demnati, Farid Allache, Mounira Zouatine, Naima Mebrek</u>
16:45-17:00	Determination of some species of invertebrate on mussel culture units in Balıkköy, İzmir Bay <u>Sepil SERDAR, Ali ULAS, Şükri YILDIRIM</u>	16:45-17:00	Distribution of the Genus <i>Garra</i> Hamilton, 1822 in Anatolia <u>Cüneyt Kaya, Esra Baycelebi</u>	16:45-17:00	Study approach of a strategy with sustainable development of a Ramsar site: Case Lake Réghaia, Algeria <u>Mounira Zouatine, Fatma Demnati, Farid Allache</u>
17:00-17:15	Fishing Competitions in Turkey and Focus on Alaçatı Big Fish Tournament <u>Ali Ulus, Zeynep Güleşci</u>	17:00-17:15	Review of the genus <i>Gobio</i> Cuvier, 1816 in Turkey <u>Esra Baycelebi, Cüneyt Kaya</u>	17:00-17:15	The Rising Phenomenon in Turkish Marine Protected Areas: Charter Fishing <u>Sezgin Tunca, Vahdet Ünal</u>
17:15-17:30		17:15-17:30	Biodiversity and Varietal Improvement of Drum Wheat (<i>Triticum durum</i> Desf.) <u>Yanina Bonatrous</u>	17:15-17:30	First Record of the Starfish <i>Asterina phylactica</i> (Echinodermata: Asteroidea) from the Eastern Mediterranean <u>Aysenur UYSAL, Ertan DAĞLI, Alper DOĞAN</u>
Dinner		Dinner		Dinner	



Age determination techniques in the marine gastropods

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Abstract

Among the marine gastropods, some whelk species, such as *Buccinum undatum*, *Neptunea antiqua*, *Busycotypus canaliculatus*, have of commercial importance. Age determination as well as stock assessment of populations of gastropods are important issues in fisheries research. Generally, management of whelk populations is difficult due to lacks of their life history. Up to date, opercular rings, shell marks, stable oxygen isotopes, statistical methods and measurements of statoliths in many gastropod species have been used to determine their ages. But, one of the most realistic methods is age reading from the statolith. In this review, age determination techniques in gastropods were compiled.

Keywords: Gastropods, age determination, opercula rings, statoliths, shell marks

Introduction

Age determination and also stock assessment of gastropods are important issues for the fisheries research. In marine gastropods, some whelks such as *Buccinum undatum*, *Neptunea antiqua*, *Busycotypus canaliculatus*, are important species commercially. A large proportion of these gastropod landings are exported to the Eastern Asia (Grana-Raffucci et al., 1997; Saglam, et al., 2015; Fisher, 2015; Hollyman et al. 2018). In 2017, the Turkish landings of *Rapana venosa* by Turkish dredge fishery totalled 2,049 tonnes with a value at sale of \$ 12.5 million (EBSEA, 2018). In 2015, *B. undatum* landings caught by the UK vessels totalled 20,900 tonnes with a value at first sale of £ 18.7 million (MMO, 2016). There are some methods that are commonly used to calculate age in gastropods. These are opercula rings (Bökenhans, 2016), shell marks (Bökenhans, 2016; Fisher, 2015; Hollyman et al. 2018), statoliths, oxygen stable isotopes analysis (Kos'yan and Antipushkina, 2011) and length-frequency distribution (Şahin et al., 2005), among them the first three methods are more widely used. The oxygen stable isotopes analysis is expensive method and length-frequency distribution method is dependent on sample size (Schultz et al. 2016). In this review applicable age determination methods in gastropods are discussed.

Methods

Three most commonly used age determination methods in gastropods were explained here;

- 1- Operculum ageing
- 2- Shell marks (spawning marks) ageing
- 3- Statolith ageing

Operculum ageing

The operculum is an organic structure and takes place on the whelk foot which is used to protect the shell aperture when the whelk foot withdraws into its shell. This method is used and validated by many fisheries scientists (Santarelli and Gros,1985). The opercular rings of many gastropod species have been



used to determine their ages, however proper validation of their seasonality is usually absent. Generally, this method has had a low success rate because of poor visibility of the rings, a problem reported by Kideys (1996) and Lawler (2013). The exclusion of large ratios of samples due to poor visibility of the rings is likely to have biased data; the fitted population growth curves were highly variable, probably due to the uncertainty of the operculum readings (Hollyman et al. 2018).

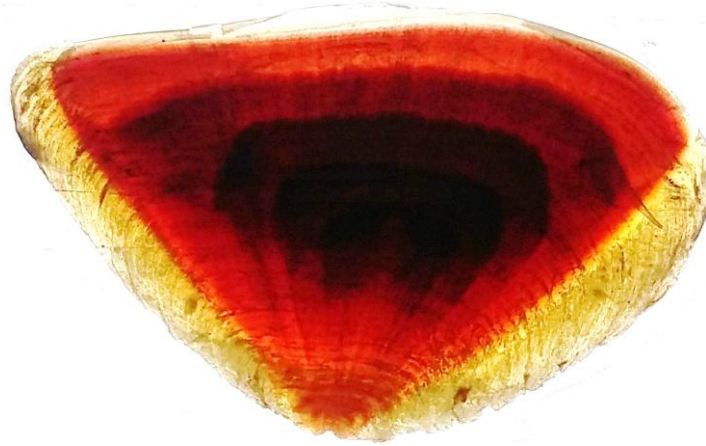


Figure 1. Operculum rings

Shell marks (spawning marks) ageing

Other age reading method in gastropods can also be done on the spawning marks, counting on the shell surface. The annual spawning marks are formed during the seasonal cessation of growth of the shell and thickening of its edges. The first spawning mark is formed at 2+ age. The full age of the individuals is determined according to Chuhchin (1961) formula: $(n + 2) +$

n – is the number of spawning marks.



Figure 2. Shell marks (Spawning marks) Statolith ageing

Spherical granules called statoliths are calcareous structures and integral to the cerebral ganglion of some animal groups including the Polychaeta (Beesley et al., 2000), Holothuroidea (Ehlers, 1997), Crustacea (Espeel, 1985), Gastropoda (Barroso ve ark., 2005; Chatzinikolou ve Richardson, 2007; Galante-Oliveira ve ark., 2013; Hollyman et al. 2018). Statoliths are used in gravity perception and a contained within a statocyst (Chase, 2002). The statoliths of gastropods are often singular and can contain rings that are



deposited annually as in *Nassarius reticulatus*, *Neptunea antique*, *Buccinum undatum*, *Busycotypus canaliculatus* (Barroso et al. 2005; Richardson et al. 2005a; Richardson et al. 2005b; Fisher, 2015; Hollyman et al. 2018).

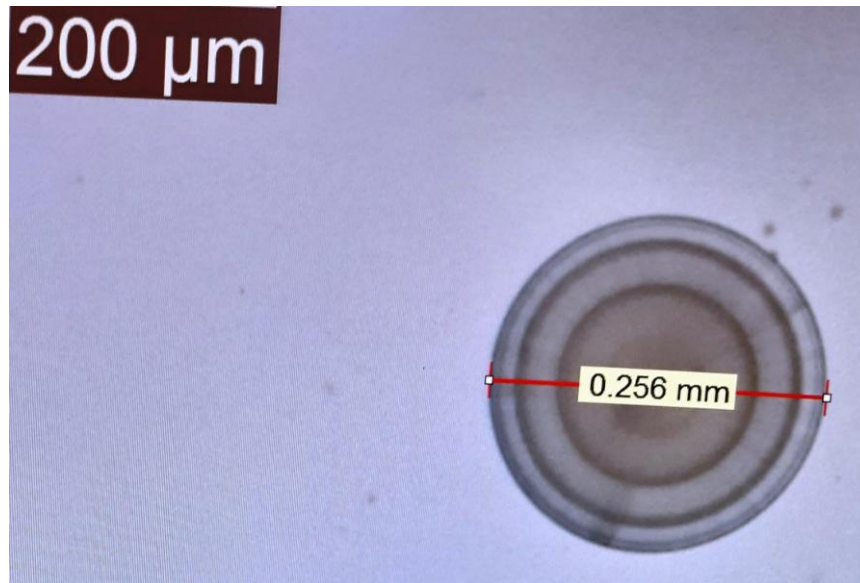


Figure 3. Statolith rings

Results and Discussion

Opercula ageing is rather an unreliable method in whelks. The shell cutting technique is relatively a new method and should be further developed and compared with statolith ageing method. Statolith rings reading method provides more reliable results, but it has also some difficulties, for instance; statoliths are quite fragile and can easily be broken during the recovery. These are the most important hard structures that can be used for the age determination of the whelks and this knowledge can be used to assess whelk stocks, having commercial importance (i.e. *B. undatum*, *N. antiqua*, *B. canaliculatus*).

References

- Barroso, C.M., Nunes, M., Richardson, C.A., Moreira, M.H., 2005. The gastropod statolith: a tool for determining the age of *Nassarius reticulatus*. *Marine Biology*, 146: 1139-1144.
- Beesley, P.L., Ross, G.J.B., Glasby, C.J, (eds) Polychaetes & Allies: The Southern Synthesis. Fauna of Australia. Vol. 4A Polychaeta, Myzostomida, Pogonophora, Echiura, Sipuncula. CSIRO publishing, Melbourne.
- Bökenhans, V., Bigatti, G., Averbuj, A., 2016. Age estimation methods in the marine gastropod *Buccinanops globulosus* comparing shell marks and opercula growth rings.
- Chase, R., 2002. Behaviour and its neural control in gastropod molluscs. Oxford University Press, New York, NY
- Chukhchin, V. D., 1961. Reproduction of *Rapana* (*Rapana bezoar* L.) in the Black Sea." *Tr. Sevastop. Biol. Stations* 163-168. [Чухчин, В. Д. "Размножение рапаны (*Rapana bezoar* L.) в Чёрном море." *Тр. Севастоп. Биол. Станции* (1961): 163-168.]
- Chatzinikolaou, E. & C. A. Richardson. 2007. Evaluating the growth and age of the netted whelk *Nassarius reticulatus* (Gastropoda: Nassariidae) from statolith growth rings. *Mar. Ecol. Prog. Ser.* 342:163–176.
- EBSEA (Eastern Black Sea Exporters Association), 2018. Black Sea rapa whelk fisheries statistics 2018. Office for Statistics, Trabzon, Turkey.



- Ehlers, U., 1997. Ultrastructure of the statocysts in the Apodous Sea Cucumber *Leptosynapta inhaerens* (Holothuroidea, Echinodermata). Acta Zool – Stockholm 78 (1): 61-68.
- Espeel, M., 1985. Fine structure of the statocyst sensilla of the mysid shrimp *Neomysis integer* (Leach, 1814) (Crustacea, Mysidacea). J. Morphol. 186: 149-165.
- Fisher, R.A., 2018. Age, growth, size at sexual maturity and reproductive biology of channeled whelk, *Busycotypus canaliculatus*, in the U.S. Mid-Atlantic. VIMS Marine Resource Report No. 2015-15-15 VSG-15-09.
- Galante-Oliveira, S., Marçal, R., Ribas, F., Machado, J., Barroso, C., 2013. Studies on the morphology and growth of statoliths in caenogastropoda. Journal of Molluscan Studies, 79: 340-345.
- Grana-Raffucci, F.A., Appeldoorn, R.S., 1997. Age determination of larval strombid gastropods by means of growth increment counts in statoliths. Fish Bull (Wash DC) 95: 857-862.
- Hollyman, P.R., Leng, M.J., Chenery, S.R.N., Laptikhovsky, V.V., Richardson, C.A., 2018. Statoliths of the whelk *Buccinum undatum*: a novel age determination tool. Marine Ecology Progress Series. 598. 261-272. <https://doi.org/10.3354/meps12119>
- Kideys A.E., 1996. Determination of age and growth of *Buccinum undatum* L. (Gastropoda) off Douglas, Isle of Man. Helgol Meeresunters 50: 353-368
- Kos'yan A. R., Antipushkina, Zh. A., 2011. Determination of *Rapana venosa* individuals' ages based on $\delta^{18}O$ dynamics of the shell carbonates. Oceanology 51 (6): 1082-1089.
- Lawler, A., 2013. Determination of the size of maturity of the whelk *Buccinum undatum* in English waters - DEFRA Project MF0231. <http://randd.defra.gov.uk/Default.aspx?Module=More&Location=None&ProjectID=17916>
- MMO (Marine Management Organisation), 2016. UK sea fisheries statistics 2015. Office for National Statistics, London
- Richardson, C.A., Saurel, C., Barroso, C.M., Thain, J., 2005a. Evaluation of the age of the red whelk *Neptunea antiqua* using statoliths, opercula and element ratios in the shell. J Exp Mar Biol Ecol 325: 55-64.
- Richardson CA, Kingsley-Smith PR, Seed R, Chatzinikolaou E (2005b) Age and growth of the naticid gastropod *Polinices pulchellus* (Gastropoda: Naticidae) based on length frequency analysis and statolith growth rings. Mar Biol 148: 319-326.
- Saglam H, Kutlu S, Dağtekin M, Başçınar S, Şahin A, Selen H, Düzgüneş E., 2015. Population biology of *Rapana venosa* (Valenciennes, 1846) (Gastropoda: Neogastropoda) in the south-eastern Black Sea of Turkey. Cah. Biol. Mar. 56: 363-368.
- Santarelli L, Gros P (1985) Age and growth of the whelk *Buccinum undatum* L. (Gastropoda: Prosobranchia) using stable isotopes of the shell and operculum striae. Oceanol Acta 8: 221-229
- Schultz, D. L., Mayfield, M.P., Whitlock, S.L. (2016) Sample sizes needed to describe length-frequency of small-bodied fishes: An example using larval pacific lamprey. Journal of Fish and Wildlife Management, (2): 315-322.
- Şahin C, Düzgüneş E, Engin S, Mutlu C, Hacımurtazaoğlu N., 2005. Analysis of Age and Growth Parameters of Rapa Welk (*Rapana thomasi*), Türk Sucul Yaşam Dergisi; 4: 34-38.



Diversity and ecology of tardigrades

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Abstract

In my presentation, I will introduce you Tardigrada, called also water bears. It will be a short summary on this group of tiny invertebrates inhabiting all known ecosystems from ocean depths to highest mountain ranges. Up to now, it is still very poorly known group of animals and every year many new species are describe throughout the world. I will not only discuss their taxonomy and diversity, but also try to present you what we know about their ecology and zoogeography. Moreover, I will also present amazing physiological adaptations of tardigrades thanks to which they are able to inhabit extreme habitats and survive a many years without water or freeze in ice. I will also present a general information about tardigrades as model organisms in different types of research starting from physiology and ending with astrobiology. I will also all problems connected with their taxonomy and correct identification of species.

Keywords: physiology, Tardigrada, taxonomy, water bears



Climate induced changes in population Dynamics in the Mediterranean Sea

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Abstract

The current study was conducted via personal observations as well as interviews with fishermen and local dive centers from the Aegean part of Turkey through the South coast of Crete and following the western shore of the Adriatic sea to Lignano over the course of 20 months. As an immediate result some major shifts in local fauna and flora have been witnessed over the last 5-7- years throughout the observation areas. Those include vanishing of *Posidonia oceanica* meadows in Croatian waters, decimated populations of Echinoderms in Greek waters and a big increase in the populations of invasive species such as *Pterois miles* in the southern waters of the Mediterranean.

Keywords: Climate change, Invasive Species, Mediterranean Sea, *Posidonia oceanica*, *Pterois miles*, Echinoderms



ORAL PRESENTATIONS

BIOECO



An investigation on the gravid females and embriyos of *Gymnura altavela* from Yumurtalik Bight, Iskenderun Bay (Turkey)

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Abstract

In this study, gravid females of *Gymnura altavela* were examined from Yumurtalik Bight (Iskenderun Bay, North-eastern Mediterranean). Firstly, on 25 August 2011, a gravid female of *G. altavela* has been captured as accidentally at depth of 30 m by longline in Yumurtalik Bight and then on 11 November 2011, another pregnant female was caught as accidentally in the same area. Three embryos (2 males and 1 female) have been observed in left and right uterus of spiny butterfly ray. The presence of pregnant females in Yumurtalik Bight suggests that may be using this region as a mating, parturition and nursery area.

Keywords: Spiny butterfly ray, *Gymnura altavela*, Yumurtalik Bight, gestation period, pregnant female

Introduction

Spiny butterfly ray, *Gymnura altavela* (Linnaeus, 1758) inhabits sandy or muddy substrate to depths of 100 m. These large rays are ovoviviparous and females give birth to 4-7 young of 40 cm disc width (DW) after a gestation period of 6 months (Golani et al., 2006). Size at birth ranged between 281 and 367 mm DW by Alkusaairy et al (2014). Spiny butterfly ray is assessed as Critically Endangered (CR) species in the Mediterranean Sea by IUCN (2011). Up to date, the reproductive biology of *G. altavela* were studied from the Syrian coast by Alkusaairy et al. (2014). Recently, Yeldan (2018) given some population parameters and stock assessment of *G. altavela* in the Levant Basin coast (Northeastern Mediterranean) and finally Taylan et al. (2019) observed the embryos of spiny butterfly ray from Gulf of Izmir, Aegean Sea. But, there is no information on the pregnant female and embryos of this species in the Northeastern Mediterranean. So, this paper declares the existence of pregnant female of *G. altavela* caught from the Yumurtalik Bight, Iskenderun Bay, North-eastern Mediterranean.

Material and Methods

Pregnant individuals of *Gymnura altavela* were captured accidentally by on 25 August 2011, a gravid female of *G. altavela* has been captured as accidentally at depth of 30 m by longline in Yumurtalik Bight (Fig. 1) and then on 11 November 2011, another pregnant female was caught as accidentally in the same area (Fig. 2).

The spiny butterfly ray samples were transferred to the laboratory at Faculty of Fisheries, Fırat University where they were identified, sexed and photographed. Total lengths and disc widths were determined to the nearest 1 mm and the weight of each specimen was weighted with a digital scale nearest to the 0.01 g. The specimens were preserved at the Museum of Fisheries Faculty, Fırat University (FFM-FISH/2011-03 and FFM-FISH/2011-04).



Figure 1. Map of the study area, sampling stations in Yumuralik Bight, Iskenderun Bay, North-eastern Mediterranean.



Figure 2. Pregnant *G. altavela* from Yumuralik Bight, Iskenderun Bay, North-eastern Mediterranean.

Results and Discussion

Information are very scarce on the biology of *G. altavela* species in Turkish marine waters. Furthermore, the spiny butterfly ray is in the list of critically endangered species and its fishing was banned throughout the Turkish marine waters by Turkish government in 2018.

Disc width and weight of first pregnant female of *G. altavela* were 102.3 cm and 7630 g, respectively and it had only one embryo in left uterus (Figure 2-3). Disc width and weight of second pregnant female were 110.5 cm and 10100 g and it had two embryos in left uterus and one embryo in right uterus of pregnant *G. altavela* have been observed, in contrast to that one male and two female embryos have been observed in a study, carried out in Izmir Bay by Taylan et al. (2019).

Total lengths, disc lengths, disc widths and weights of male embryos were 15.8 -17.2cm, 11.1-11.4 cm, 18.1-19.3cm and 62.21- 68.86 g, respectively. Total length, disc length, disc width and weight of female embryo respectively were 18.2 cm, 12.2 cm, 20.4 cm and 92.53g (Figure 4). The absorption of the embryo's yolk sacs had not yet occurred (Figures 3 and 5). The disc width and weight of the female embryo was bigger than those male embryos, whereas Taylan et al. (2019) noted that, in the Aegean Sea, the male embryo was larger than the females.

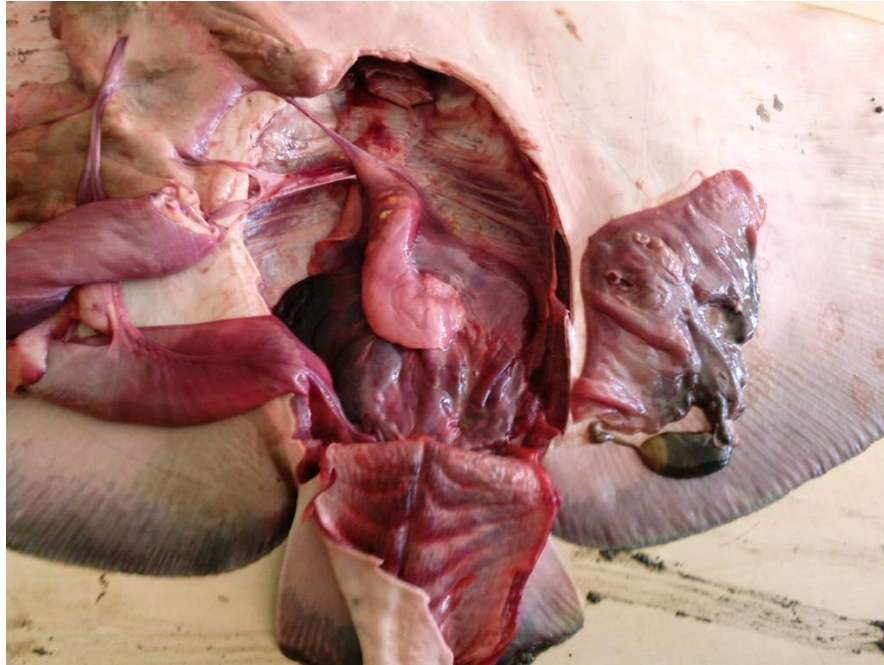


Figure 3. Embryo of first pregnant *G. altavela* from Yumuralık Bight, Iskenderun Bay, North-eastern Mediterranean.



Figure 4. Embryos of second pregnant *Gymnura altavela* from Yumuralık Bight, Iskenderun Bay, North-eastern Mediterranean.



Figure 5. Ventral surface of embryos of *Gymnura altavela* from Yumuralık Bight, Iskenderun Bay, North-eastern Mediterranean.

Castro (1993) reported that the decision respecting the use of an area as a nursery by a given species was made considering the presence of new born, juveniles and gravid females. Moreover, Heupel et al. (2007) noticed that a region requires three criteria to be identified as a nursery area: (1) species are more commonly come across in the area than other region; (2) species have a tendency to stay or come back for extended periods; and (3) the region or habitat is continuously used through the years. The presence of pregnant females in different times in Yumurtalik Bight suggests that may be using this region as a mating, parturition and nursery area.

References

- Abdul Malak, D., Livingstone, S.R., Pollard, D., Polidoro, B.A., Cuttelod, A., Bariche, M., Bilecenoglu, M., Carpenter, K.E., Collette, B.B., Francour, P., Goren, M., Kara, M.H., Massutí, E., Papaconstantinou, C., Tunesi, L. (2011). Overview of the conservation status of the marine fishes of the Mediterranean Sea. Gland, Switzerland and Malaga, Spain: IUCN. vii + 61pp.
- Alkusaury H., Ali M., Saad A., Reynaud C., Capapé C. 2014. Maturity, reproductive cycle, and fecundity of spiny butterfly ray, *Gymnura altavela* (Elasmobranchii: Rajiformes: Gymnuridae), from the coast of Syria (eastern Mediterranean). Acta Ichthyol. Piscat. 44 (3): 229–240.
- Castro J. I. 1993. The shark nursery of Bulls Bay, South Carolina, with a review of the shark nurseries of the the southeastern coast of the United States. Environmental Biology of Fishes, 38: 37-48.
- Golani, D., Ozturk, B., Başusta, N. (2006). Fishes of the eastern Mediterranean. Turkish Marine Research Foundation, Istanbul, Turkey. Pub. Number: 24, pp. 259.
- Heupel M. R., Carlson K. J. & Simpfendorfer C. A. 2007. Shark nursery areas: concepts, definition, characterization and assumptions. Marine Ecology Progress Series, 337: 287–297.
- Taylan, B., Bayhan, B., Saglam, C., Kara, A. (2019). First observation of the embryos of spiny butterfly ray, *Gymnura altavela* (Linnaeus, 1758) (Chondrichthyes: Gymnuridae) from Eastern Mediterranean, a species critically endangered. Fresenius Environmental Bulletin, 28 :3147-3152 .
- Yeldan, H. (2018). Estimating some population parameters and stock assesment of spiny butterfly ray, *Gymnura altavela* (Linnaeus, 1758) the Levant Basin Coast (Northeastern Mediterranean). Indian Journal of Animal Research, 52 (12): 1790-1796. DOI: 10.18805/ijar.B-917



Cryobanks and their Role in Conservation of Aquatic Biodiversity

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Abstract

Aquatic biodiversity comprise different life and ecosystems in freshwater, brackish water and marine environment. On the other hand, aquatic biodiversity which carrying vital value for the future is decreasing day by day because of various reasons such as loss and fragmentation of the habitat, overusing of resources, climatic changings, pollution of invasive exotic species, diseases and poaching. In addition, releasing of fries which produced via genetic manipulations, into natural water bodies also contribute deterioration of native species in the wild. From this point of view, there is necessity applying of appropriate conservation strategies and actions to protect aquatic genetic resources.

This situation has led to an increased interest for the creation of cryobanks regarding conservation of aquatic genetic resources in frozen state. It is assumed that cryoconservation can be a safe method to preserve genetic material with the help of reproductive biotechnologies which using sperm, oocytes, embryos, primordial germ cells or somatic cells. In addition, cryobanks may also play an important role in genetic selection programs in the field of aquaculture. On the other hand, cryopreservation protocols need to be carefully designed for each species and each type of cells should provide optimal survival.

Keywords: cryobank, genetic resources, biodiversity, biotechnology



What steps should be taken to ensure the protection of sandbar shark, *Carcharhinus plumbeus*, in Turkey?

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Abstract

Turkey is in an advantageous position in terms of the protection studies about the sandbar shark, *Carcharhinus plumbeus* and has the essential legal ground for the species' protection. But still it's need to create a correct strategy about protection. There is a crisis about scientific data about sandbar shark. It's important to understand the biological characteristics of the species in our seas as soon as possible with appropriate scientific methods, without damaging the species, and take into account these data in the effective protection. We should create an inventory data for sandbar shark. A sustainable course of action should be planned with the contribution of the government, educational institutions, local peoples, NGOs and local administrations. Modern techniques should be carry out in collaboration with scientists and local peoples. It should stop trying to impose a mentality based on forbidden, and tell about methods that understand the story and culture of the local and contribute to their economy. It should be remembered an inefficient conservation effort is condemned to regress.

Keywords: Shark conservation, Boncuk Cove, Public awareness, Eco-tourism models

Introduction

The sandbar shark, *Carcharhinus plumbeus* (Nardo 1827), is a widely distributed in temperate, tropical and subtropical regions of the Pacific, Indian, and Atlantic Oceans, as well as the Mediterranean Sea (Compagno, 1984). Boncuk Cove in the Gökova Specially Environmental Protection Area (SEPA, established by the Decree of Cabinet of Ministers number 88/13019 on 12.06.1988) is a critical habitat for sandbar shark, since the cove has been used as a nursery area by this species (Clo & Sabata, 2004; Öztürk, 2006).

Turkey is in an advantageous position in terms of the protection studies about the sandbar shark because of Boncuk Cove. Additionally, Turkey with a 67 chondrichthyan species (Bilecenoğlu et al., 2014) is one of important places in the Mediterranean Sea (73 chondrichthyans; IUCN, 2016) in terms of understanding of cartilaginous fishes and contribution to protect them.

The aim of the study is to find out an answer what steps should be taken to ensure that the protection of *Carcharhinus plumbeus* comes to where it deserves in Turkey?

Material and Methods

Whole information compiled in this study was collected from official newspapers, national and international legislations and scientific literatures.

Results

Species Conservation

Turkey has the necessary national legal groundwork for the protection of sandbar shark as well as critical habitat of the species, with a holistic approach. The sandbar shark is listed in Annex 3 of the Barcelona Convention (Turkish Republic Official Gazette date and number: 12/06/1981 and 17368) and



its protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean (Turkish Republic Official Gazette date and number: 22/08/2002 and 24854)]. Based on Barcelona Convention, Turkey has the essential national legal ground for the species' protection since 2006 (Anonymous, 2006a, b) and still protected by national notifications (Anonymous, 2016a, b).

Habitat Protection

Boncuk Cove is located on the southern coast of Gökova SEPA, just next to Sedir Island. In the northern part of the cove, a Shark Protection Area (SPA) bounded by 5 buoys was established in 2006 (EPASA, 2006), and then whole cove was declared as a No Fishing Zone (NFZ) in 2010 (EPASA, 2010).

Scientific Efforts

In fact, throughout the Mediterranean, Turkish scientists' works are known. Our "regional conservation efforts" have a particular and certain place. In addition to the general work (for example distribution, nursery area records & biology), Turkey appeared to be the only country in the Mediterranean capable of conservation and monitoring efforts (Table 1).

Table 1. Efforts regarding Sandbar Shark in the Mediterranean Sea (Effort Types= A: Occurrence studies; B: Nursery area records; C: Biological contribution; D: Conservation efforts; E: Monitoring efforts).

Countries	A	B	C	D	E
Spain	1				
Italy		2, 3, 4			
Slovenia	5, 6				
Croatia		7			
Greece	8				
Turkey	9, 10	11	12	13, 14, 15	16, 17, 18, 19, 20, 21, 22, 23, 24
Syria	25				
Israel	26, 27, 28				
Libya	29, 30, 31, 32				
Tunisia		33	34, 35		
Algeria	36		37, 38		

1: Morey et al. (2008); 2: Constantini et al. (2000); 3: Constantini & Affronte (2003); 4: Consoli et al. (2004); 5: Lipej et al. (2000); 6: Lipej et al. (2008); 7: Dragicevic et al. (2010); 8: Damalas & Megalofonou (2012); 9: Başusta & Erdem (2000); 10: Kabasakal (2002); 11: Clo & Sabata (2004); 12: Filiz (2016); 13: Öztürk (2006); 14: Payaşlıoğlu & Varol (2006); 15: Ergün (2008); 16: Bilecenoglu (2008); 17: EPASA (2009); 18: Akça (2010); 19: Filiz (2012); 20: Filiz (2013); 21: Filiz (2019); 22: Filiz & Gülşahin (2014); 23: Filiz & Gülşahin (2015); 24: Filiz et al. (2014); 25: Saad et al. (2006); 26: Golani (2006); 27: Barash et al. (2018a); 28: Barash et al. (2018b); 29: Rafrafi-Nouira et al. (2015); 30: Tobuni et al. (2016); 31: Capape et al. (2018); 32: Soufi-Kechaou et al. (2018); 33: Bradai et al. (2005); 34: Capape (1984); 35: Saidi et al. (2007); 36: Hemida et al. (2002); 37: Saidi et al. (2005); 38: Saidi et al. (2006).

Public awareness

Until 2019, a single training project (Barlas et al., 2010) was carried out in order to set up a public awareness in local for the introduction and protection of the species.

Discussion

What steps should be taken to ensure that the protection of *Carcharhinus plumbeus* comes to where it deserves?

In Turkey, "species protection" action always came up with the adjective "forbidden". We should stop trying to impose a mentality based on forbidden, and tell about methods that understand the story and culture of the local and contribute to their economy. For example, as we almost all know well there are touristic shark diving in the Red Sea and they do this without damaging the ecosystem and/or species. People go there just to experience it. Implementation of such an "eco-tourism" models will not only contribute economically to the local people, but will also elucidate the need of "what to protect for what purpose". In addition, financial resources will be provided for protection from income obtained via eco-tourism models.



In species conservation studies in countries such as Italy, Spain and Greece, we see that modern techniques have been carried out in collaboration with scientists and local peoples (for example Citizen Science applications). Indeed, local peoples have power. Here, the importance of education, and also public awareness, emerges again. In the Turkish education system, “science” is very weak due to insufficient staff and financial difficulties. The academicians who have undergone an international formation on species conservation among the Turkish academy staff is very limited in number. This issue needs to be considered as a state policy. A sustainable course of action should be planned with the contribution of the government, educational institutions, local people, NGOs and local administrations.

Scientific ethics, good data and qualified output are first and foremost ones. Therefore, it is essential to value and invest in the local communities, good fishing practices and healthy ecosystems. Governmental policies are being added to these, as well as our personal life habits.

The biodiversity and conservation concepts should not be given only in faculties limited in number. Education on biodiversity and conservation should be in the curriculum of primary, secondary and high schools.

Instead of imitating other works, the increase in number of those who develop their own genuine and qualified works is important. We think that the biggest obstacle in development is prejudice. It is necessary to get rid of prejudices, to approach science with open ideas, to wonder and to investigate. We need to write our own story with our own conservation practices and techniques, but not forgetting the available ones.

It should be remembered again that an inefficient conservation effort is condemned to regress.

References

- Akça, N. (2010). Underwater observations on the bioecology of *Carcharhinus plumbeus* (Nardo, 1827) inhabiting Boncuk Bay (Gökova Gulf) [Boncuk Koyu'ndaki (Gökova Körfezi) *Carcharhinus plumbeus* (Nardo, 1827) Biyoekolojisi Üzerine Sualtı Gözlemleri]. Adnan Menderes University: Thesis for Higher Education.
- Anonymous (2006a). Circular 37/1. Republic of Turkey Ministry of Agriculture and Rural Affairs, Regulating Commercial Fishing in Marine and Inland Waters in 2006-2008 Period, Number: 26269, Published in the Official Gazette date: 24.08.2006, Ankara (in Turkish).
- Anonymous (2006b). Circular 37/2. Republic of Turkey Ministry of Agriculture and Rural Affairs, Regulating Amateur (Sportive) Fishing in Marine and Inland Waters in 2006-2008 Period, Number: 26269, Published in the Official Gazette date: 24.08.2006, Ankara (in Turkish).
- Anonymous (2016a). Notification 4/1. Republic of Turkey Ministry of Agriculture and Rural Affairs, Notification 4/1 Regulating Commercial Fishing. Published in the Official Gazette date: 13.08.2016-29800, Notification Number: 2016-35, Ankara.
- Anonymous (2016b). Notification 4/2. Republic of Turkey Ministry of Agriculture and Rural Affairs, Notification 4/2 Regulating Amateur (Sportive) Fishing. Published in the Official Gazette date: 13.08.2016-29800, Notification Number: 2012-36, Ankara.
- Barash, A., Pickholtz, R., Pickholtz, E., Blaustein, L. & Rilov, G. (2018a). Seasonal aggregations of sharks near coastal power plants in Israel: an emerging phenomenon. *Marine Ecology Progress Series*, 590, 145–154.
- Barash, A., Pickholtz, R., Nativ, R., Malamud, S., Scheinin, A. & Tchernov, D. (2018b). Seasonal arrival and feeding of injured coastal sharks at fish farms in the eastern Mediterranean. *Journal of the Black Sea / Mediterranean Environment*, 24(1), 86-90.
- Barlas, M., Kaska, Y., Yılmaz, F., & Başkale, E. (2010). *Training for the Protection of Sandbar Sharks (Carcharhinus plumbeus) in Gökova Special Environmental Protection Area-2010* [Gökova Özel Çevre Koruma Bölgesindeki Kum Köpekbalıklarının (*Carcharhinus plumbeus*) Korunmasına Yönelik Eğitim Çalışması-2010]. Sonuç Raporu. Ankara, 56 sayfa. [in Turkish].
- Başusta, N., & Erdem, Ü. (2000): İskenderun Körfezi Balıkları Üzerine Bir Araştırma. *Tr. J. Zool.*, 24 (supp.), 1-19.
- Bilecenoğlu, M. (2008). Project of Conservation and Monitoring of Sandbar Shark (*Carcharhinus plumbeus*) in Boncuk Bay in Gökova Special Environmental Protection Area. Ministry of Environment and Urban Planning. https://webdosya.csb.gov.tr/db/destek/editordosya/boncuk_ingilizce.pdf.



- Bilecenoğlu, M., Kaya, M., Cihangir, B. & Çiçek, E. (2014). An updated checklist of the marine fishes of Turkey. *Turk. J. Zool.*, 38(6), 901-929.
- Bradai, M.N., Saidi, B., Bouain, A., Guelorget, O. & Capape, C. (2005). The gulf of Gabès (central Mediterranean): Nursery area for the sandbar shark, *Carcharhinus plumbeus* (Nardo, 1827) (Chondrichthyes: Carcharhinidae). *Annales, Series Historia Naturalis*, 15, 187-194.
- Capape, C. (1984). Nouvelles données sur la morphologie et la biologie de la reproduction de *Carcharhinus plumbeus* (Nardo, 1827) (Pisces, Carcharhinidae) des côtes tunisiennes. *Investigación Pesquera*, 48, 115-137.
- Capape, C., Rafrafi-Nouira, S., Ounifi-Ben Amor, K. & Ben Amor, M.M. (2018). Additional Records of Sandbar Shark, *Carcharhinus plumbeus* (Chondrichthyes: Carcharhinidae) from the Northern Tunisian Coast (Central Mediterranean Sea). *Annales Ser. Hist. nat.*, 28(2), 99-104.
- Compagno, L.J.V. (1984). FAO species catalogue. Vol. 4. Sharks of the world. An annotated and illustrated catalogue of shark species known to date. Part 2 - Carcharhiniformes. *FAO Fish. Synop.*, 125(4/2), 251-655.
- Consoli, P., Romeo, T., Florio, G., Perdichizzi, F., Greco, S., Vacchi, M. & Rinelli, P. (2004). First record of *Carcharhinus plumbeus* (Pisces: Carcharhinidae) from the southern Tyrrhenian Sea. *J. Mar. Biol. Ass. U.K.*, 84, 1085-1086.
- Costantini, M., & Affronte, M. (2003). Neonatal and juvenile sandbar sharks in the northern Adriatic Sea. *Journal of Fish Biology*, 62, 740-743. doi:10.1046/j.1095-8649.2003.00045.x
- Constantini, M., Bernardini, M., Cordone, P., Giuliani, P.G. & Orel, G. (2000). Observation on fishery feeding habits and reproductive biology of *Mustelus mustelus* (Chondrichthyes, Triskidae) in Northern Adriatic Sea. *Biol. Mar. Medit.*, 7(1), 427-432.
- Clo, S., & de Sabata, E. (2004). In the sharks' cradle. 8th European Elasmobranch Association Conference, Book of Abstracts, London, p: 45.
- Damalas, D., & Megalofonou, P. (2012). Occurrences of large sharks in the open waters of the southeastern Mediterranean Sea. *Journal of Natural History*, 46(43-44), 2701-2723.
- Dragicevic, B., Dulcic, J., & Lipej, L. (2010). On the record of the sandbar shark *Carcharhinus plumbeus* Nardo, 1827 (Carcharhiniformes: Carcharhinidae) in the middle Adriatic Sea. *Acta Adriatica*, 51(2), 227-232.
- EPASA (2006). *Determination of biodiversity of marine and coastal area of Gökova Special Environment Protection Area* [Gökova Özel Çevre Koruma Bölgesi'nin Kıyı ve Deniz Alanlarının Biyolojik Çeşitliliğinin Tespiti]. Project Report, Environmental Protection Agency for Special Areas, Ministry of Environment and Forestry, Ankara, 504 pp. [in Turkish].
- EPASA (2009). *Project of Conservation and Monitoring of Sandbar Shark (Carcharhinus plumbeus) in Gökova Special Environmental Protection Area* [Gökova Özel Çevre Koruma Bölgesi Kum Köpekbalığı (Carcharhinus plumbeus) Türünün Korunması ve İzlenmesi Projesi]. Project Report, Environmental Protection Agency for Special Areas, Ministry of Environment and Forestry, Ankara, 32 pp. [in Turkish].
- EPASA (2010). *Project of Monitoring of Fisheries in Five Special Environmental Protection Area and Ayvalık Islands and Natural Park and No Fisheries Zones in Gökova SEPA* [Beş Özel Çevre Koruma Bölgesi ve Ayvalık Adaları Tabiat Parkı'nda Deniz ve Kıyı Koruma Alanları Balıkçılığın Mevcut Durumu ve Gökova ÖÇKB'de Belirlenen Balıkçılığa Kısıtlı Alanların İzlenmesi Projesi]. Project Report, Environmental Protection Agency for Special Areas, Ministry of Environment and Forestry, Ankara, 190 pp. [in Turkish].
- Ergün, G. (2008): Gökova özel çevre koruma bölgesi Boncuk Koyu kum köpekbalığı (*Carcharhinus plumbeus*) koruma sahası oluşturulması ve gözlem sisteminin kurulması projesi. *Türkiye'nin Kıyı ve Deniz Alanları VII. Ulusal Kongresi Bildiriler Kitabı*, 1, 225- 231.
- Filiz, H. (2012). Monitoring of Sandbar Shark (*Carcharhinus plumbeus*) in Boncuk Bay in Gökova Specially Environmental Protected Area (Report of 12 May – 28 September). National System of Marine Protected Areas. http://dcm.dka.gov.tr/App_Upload/G%C3%B6kova%20%C3%96%C3%87K%20B%C3%B6lgesi%20Kum%20K%C3%B6pekbal%C4%B1%C4%9F%C4%B1%202012%20Raporu.pdf [in Turkish].
- Filiz, H. (2013). Boncuk Koyu Kumsal Köpekbalığı (*Carcharhinus plumbeus*)'nı Anlamak". Su ve Biyolojik Çeşitlilik Sempozyumu Bildiri Özetleri, sf. 50.



- Filiz, H. (2016). Notes on the Stomach Contents of Juvenile Sandbar Sharks from the south Aegean Sea, Turkey. 2nd International Congress on Applied Ichthyology & Aquatic Environment (Hydromedir2016), Book of Abstracts, pp. 270-273, Messolonghi - Greece / 10-12 November, 2016.
- Filiz, H. (2019). Year-Round Aggregation of Sandbar Shark, *Carcharhinus plumbeus* (Nardo, 1827), in Boncuk Cove in the southern Aegean Sea, Turkey (Carcharhiniformes: Carcharhinidae). *Zoology in the Middle East*, 65(1), 35-39, DOI: 10.1080/09397140.2018.1540148.
- Filiz, H., Gülşahin, A. (2014). One Year Monitoring of Sandbar Shark from a Special Environmental Protection Area in Turkey. In: 8th International Symposium on Underwater Archaeology (ISUR 8), Book of Abstracts, p. 13, Procida - Italy / 26-29 March, 2014.
- Filiz H, & Gülşahin, A. (2015). First 12 months of sandbar shark monitoring in Turkey. [https://oceanos-dspace.hcmr.gr/bitstream/handle/123456789/1135/PanhellSympOcean_Fish11\(113-116\)2015..pdf?sequence=1](https://oceanos-dspace.hcmr.gr/bitstream/handle/123456789/1135/PanhellSympOcean_Fish11(113-116)2015..pdf?sequence=1).
- Filiz, H., Gülşahin, A., Cerim, H., & Sevingel, N. (2014). Kum Köpekbalığı (*Carcharhinus plumbeus* Nardo, 1827) Peşinde. Bilimsel Araştırma Projeleri Koordinasyon Birimi Sonuç (Kesin) Raporu, Proje no: BAP 13/07, Muğla, 49 sayfa.
- Hemida, F., Seridji, R., Labidi, N., Bensaci, J. & Capape, C. (2002). Records of *Carcharhinus* spp. (Chondrichthyes: Carcharhinidae) from off the Algerian coast (southern Mediterranean). *Acta Adriatica*, 43(2), 83-92.
- Golani, D. (2006). Cartilaginous fishes of the Mediterranean coast of Israel. In: The Proceedings of the International Workshop on Mediterranean Cartilaginous Fishes with Emphasis on Southern and Eastern Mediterranean (Basusta N., Keskin Ç., Serena F. & B. Séret, eds), pp. 95-100. Istanbul: Turkish Marine Research Foundation.
- IUCN (2016). *The Conservation Status of Sharks, Rays and Chimaeras in the Mediterranean*. IUCN Centre for Mediterranean Cooperation, Malaga, Spain.
- Kabasakal, H. (2002). Elasmobranch species of the seas of Turkey. *Annales, Ser. Hist. Nat.*, 12, 15-22.
- Lipej, L., Makovec, T., Soldo, A. & Ziza, V. (2000). Records of the sandbar shark *Carcharhinus plumbeus*, (Nardo, 1827) in the Gulf of Trieste (Northern Adriatic). (*Annals for Istran and Mediterranean Studies*), *Series historie naturalis*, 10, 199– 206.
- Lipej, L., Mavric, B., Dobrajc, Z., & Capape, C. (2008). On the occurrence of the sandbar shark, *Carcharhinus plumbeus* (Chondrichthyes: Carcharhinidae) off the Slovenian coast (northern Adriatic). *Acta Adriatica*, 49, 137-145.
- Morey, G., Soldo, A., Riera, F., & Serena, F. (2008). Records of *Carcharhinus limbatus* and *C. plumbeus* (Chondrichthyes: Carcharhinidae) from off the Balearic Islands (NW Mediterranean). *Cybium*, 32(3), 195-200.
- Öztürk, B. (2006). Save the sandbar sharks of Boncuk Bay, Turkey. Proceedings of the International Workshop on Mediterranean Cartilaginous Fish with Emphasis on Southern and Eastern Mediterranean. *Turkish Marine Research Foundation*, 23, 42-47.
- Payışlıoğlu, M., & Varol, E. (2006). Boncuk Koyu Kum Köpekbalığı Koruma Sahası Oluşturulması ve Gözlem Sisteminin Kurulması Projesi 1.Faz (1 Temmuz 2006 - 1 Ağustos 2006) Sonuç Raporu, 21 sayfa.
- Rafrafi-Nouira, S., El Kamel-Moutalibi, O., Rey-naud, C., Boumaiza, M. & Capape, C. (2015). Additional and unusual captures of elasmobranch species from the northern coast of Tunisia (central Mediterranean). *J Ichthyol.*, 55(6), 337-345.
- Saad, A., Ali, M. & Seret, B. (2006). Shark exploitation and conservation in Syria. Proceedings of the International Workshop on Mediterranean Cartilaginous Fish with Emphasis on Southern and Eastern Mediterranean. *Turkish Marine Research Foundation*, 23, 202-208.
- Saidi, B., Bradai, M.N., Bouain, A., Guelorget, O. & Capape, C. (2005). The reproductive biology of the sandbar shark, *Carcharhinus plumbeus* (Chondrichthyes: Carcharhinidae), from the Gulf of Gabès (southern Tunisia, central Mediterranean). *Acta Adriatica*, 46(1), 47-62.
- Saidi, B., Bradai, M.N., Marouani, S., Guelorget, O., & Capape, C. (2006). Atypical characteristics of an albino embryo of *Carcharhinus plumbeus* (Chondrichthyes: Carcharhinidae) from the Gulf of Gabès (southern Tunisia, central Mediterranean). *Acta Adriatica*, 47(2), 167-174.



- Saidi, B., Bradai, M.N., Bouain, A. & Capape, C. (2007). Feeding habits of the sandbar shark *Carcharhinus plumbeus* (Chondrichthyes: Carcharhinidae) from the Gulf of Gabès, Tunisia. *Cah. Biol. Mar.*, 48, 139-144.
- Soufi-Kechaou, E., Ounifi Ben Amor, K., Ben Souissi J., Ben Amor, M.M. & Capape, C. (2018). The capture of a large predatory shark, *Carcharhinus plumbeus* (Chondrichthyes: Carcharhinidae), off the Tunisian coast (Central Mediterranean). *Ann., ser. Hist. Nat.*, 28(1), 23-287.
- Tobuni, I.M., Benabdallah, B-A.R., Serena, F., & Shakman, E. (2016). First documented presence of *Galeocerdo cuvier* (Péron & Lesueur, 1822) (ELASMOBRANCHII, CARCHARHINIDAE) in the Mediterranean basin (Libyan waters). *Marine Biodiversity Records*, 9,94 DOI 10.1186/s41200-016-0089-3.

BIOECO2019



Concentrations of toxic elements in mussels *Mytilus galloprovincialis* as bio-indicator of coastal pollution

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Abstract

The amounts of Pb, Cd and Hg in the edible tissues of *Mytilus galloprovincialis* Lamarck, 1819 (Mediterranean mussel) collected from Sinop shores of the Black Sea during summer months of the years 2016, 2017 and 2018 have been determined by Inductively Coupled Plasma – Mass Spectrometer (ICP/MS). The concentrations of toxic heavy metals in *M. galloprovincialis*, decreased in the following order: Pb> Hg> Cd. Concentrations of Pb, Hg and Cd in mussels ranged from 0.15 to 0.23, 0.007 to 0.10 and 0.05 to 0.08 with averages of 0.19, 0.087 and 0.067 mg/kg wet wt., respectively. In the present study, the concentrations of Pb, Hg and Cd in mussels studied were considerably lower than the maximum levels set by the European Commission and Turkish Food Codex reports and, therefore, the edible tissues of the mussels analysed were safe for human consumption in this region. The data presented in this study have also shown that *M. galloprovincialis* to be used as bio-indicator organisms which are species used by environmental researchers to monitor the health of a coastal ecosystem.

Keywords: Toxic metals, accumulation, *Mytilus galloprovincialis*, estimated daily intake, Black Sea

Introduction

The Black Sea is the main sources of seafood for Turkey (Bat et al., 2013; Sahin et al., 2016; Bat et al., 2018a). Contamination of seafood by toxic heavy metals represents a serious threat to people health and a major economic concern. In order to protect the health of seafood consumers, monitoring studies need to be done continuously (Bat and Arıcı, 2018). It is therefore of value to monitor the amounts of toxic contaminants in the coastal area, where most fishery activities are carried out.

Trace contaminants such as mercury (Hg), cadmium (Cd) and lead (Pb) are natural elements ubiquitously found in the marine coasts. On the other hand, anthropogenic activities, such as mining, industry, fisheries, agriculture and touristic, may be considerable rising their amounts in the ecosystem of the marine environment (Bat et al., 2018b). Therefore, the main aim of the present study is to assess toxic heavy metals in mussels from Sinop coasts of the Black Sea with respect to national and international regulations (EU Commission Regulation, 2001 and 2006; Official Gazette of Republic of Turkey, 2002 and 2009).

Although the population of Sinop center is approximately 64500 people, during the summer months 400000 people visit for touristic purposes. Therefore, mussel consumption increases in these months. For this purpose, mussels were captured in the summer months of 2016, 2017 and 2018.

Material and Methods

The mussels employed were the common species in Sinop coasts of the Black Sea (Fig. 1), *Mytilus galloprovincialis*, collected from the rock habitats by a diver. After sampling, the mussels were placed in aquaria with sea water taken from the same place for 24 hours to defecate (Bat et al., 1999, 2012, 2018c, 2018d). The tissues of specimens were put in nylon bags in a deep freeze at -21°C till their metal analysis.

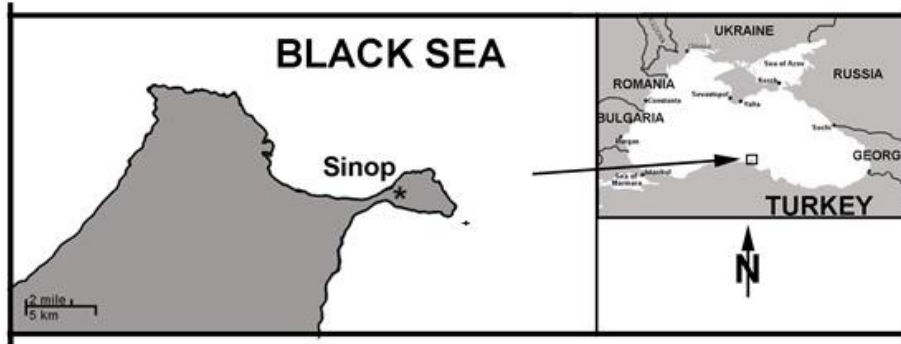


Figure 1. Map of the study area, with location of sampling station.

The size of mussels was between 75 and 85 mm. The tissues of each sample were removed from the shell. The edible tissues were digested with HNO_3 using a microwave digestion system and the residues were diluted with deionized water and were analysed by the Inductively Coupled Plasma – Mass Spectrometer (ICP/MS).

The accuracy of the analytical method in this study was appraised using the Standard Reference Material (SRM) 2976 from National Institute of Standards and Technology. Results of the determinations were in well agreement between the certified and the analytical values, together with the Relative Standard Deviation (RSD) percentage which always below the 10%.

The sensitivity of the method was determined according to the detection limits established for ICP/MS, which were $< 0.001 \mu\text{g l}^{-1}$ for Pb and Cd, and $< 0.01 \mu\text{g l}^{-1}$ for Hg.

Estimated daily intake (EDI) of heavy metals in mussels

The EDI depends on both the metal levels and amount of consumption of mussels. The EDI of toxic metals was estimated using the equation below:

$$\text{EDI} = C_{\text{metal}} \times W_{\text{mussel}} / \text{Bw}$$

Where: C_{metal} is the metal levels in mussels; W_{mussel} represents the daily mean consumption of mussels; Bw is the body weight of an adult (70 kg). The estimated weekly intakes (EWI) were calculated from EDI.

Statistical analyses

The results of this study are means \pm SD of three measurements. Differences between seasons were tested by one-way ANOVA. The p values of < 0.05 were considered significant.

Results

The average amounts of Hg, Cd and Pb of 20 mussels collected in July and August of each year are shown in Figure 2. The concentrations of toxic heavy metals in *M. galloprovincialis*, decreased in the following order: Pb > Hg > Cd. Concentrations of Pb, Hg and Cd in mussels ranged from 0.15 to 0.23, 0.007 to 0.10 and 0.05 to 0.08 with averages of 0.19, 0.087 and 0.067 mg/kg wet wt., respectively.

The concentrations of the metals in all years were below the acceptable limits (EU Commission Regulation, 2001, 2006; Official Gazette of Republic of Turkey, 2002, 2009). However, Pb values in mussels were high in 2018 and followed by 2016 and 2017. The Provisional Tolerable Weekly Intake (PTWI) quantity is assess of metal levels that may be taken by human during lifespan perceptible risk (EFSA, 2010, 2012a, 2012b, 2012c). PTWI is recommended by the Joint Food and Agricultural Organization (FAO) for the United Nations / World Health Organization (WHO) Expert Committee on Food Additives (JECFA). The average daily mussels' consumption in Turkey is 1 g per person (FAO, 2010). In case of the Black Sea coastal cities of Turkey, this quantity is high. Thus, maximal values of Estimated Weekly Intakes (EWI) and Estimated Daily Intakes (EDI) for a 70 kg adult person on basis of the present study outcomes are used and given in Table 1. The Joint FAO/WHO (2010 and 2011) has set a limit for Pb, Hg and Cd intake based on bodyweight. For an average adult (70 kg body weight), the provisional tolerable daily intake for these toxic metals were also shown in Table 1.

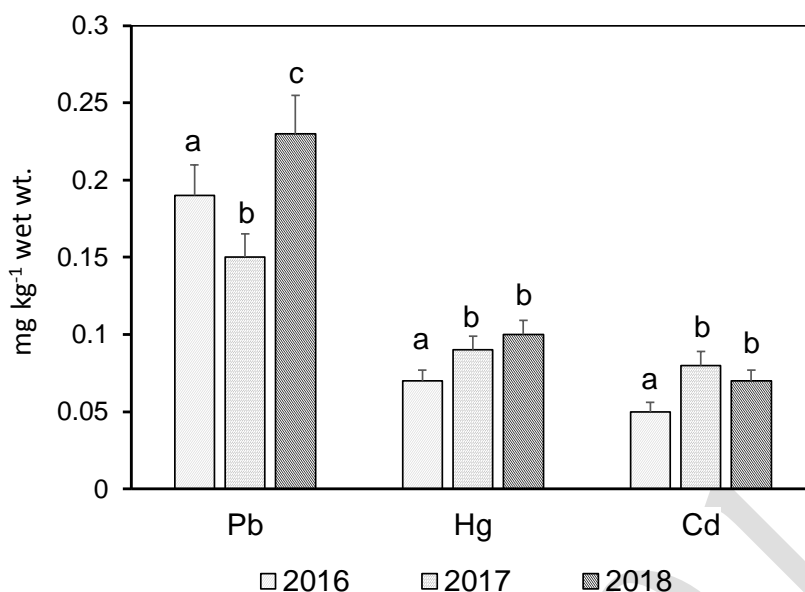


Figure 2. Mean (\pm SE) toxic metal levels in mussels among the years. The different letters beside the vertical bars indicate that the values are significantly different ($p < 0.05$).

Table 1. Estimated Daily Intakes (EDI) and Estimated Weekly Intakes (EWI) and of heavy metals in mussels from Sinop shores of the Black Sea.

Metals	PTWI ^a	PTWI ^b	PTDI ^c	EDI ^e	EWI ^d
Pb	0.025	1.75	0.25	0.00023	0.00161
Cd	0.007	0.49	0.07	0.000008	0.000056
Hg	0.004	0.28	0.04	0.00010	0.0007

^aPTWI (Provisional Tolerable Weekly Intake) in mg/week/kg body wt.

^bPTWI for 70 kg adult person (mg/week/70 kg body wt.)

^cPTDI (Permissible Tolerable Daily Intake) (mg/day/70 kg body wt.)

^dEWI (Estimated Weekly Intake) (mg/week/ kg body wt.)

^eEDI (Estimated Daily Intake) (mg/day/ kg body wt.)

Discussion

The sessile organisms like mussels cannot avoid contamination problems by escaping from the ecosystem and may concentrate important contaminants such toxic heavy metals. As a result, they in a way reflect the contamination status that the coastal ecosystem faces. In many studies, there have been cases where *M. galloprovincialis* in the Black Sea have been proposed as bio-indicators (Bat et al., 2018c), where they have been regarded as a suitable bio-indicator of coastal health in marine ecosystems in regard to its ability of heavy metal bioaccumulation. In this study, other references are given to support this issues (Bat et al., 1999, 2012, 2018c, d; Bat and Öztekin, 2016).

In the present study, the amounts of Hg and Cd detected in mussels was low in 2016 but increased in the following years 2017 and 2018. The tolerable Pb, Cd and Hg values in mussels were 1.5, 1.0 and 0.5 mg/kg wet wt., respectively (Commission Regulation EU, 2001, 2006; Official Gazette of Republic of Turkey, 2002, 2009). In the present study, the concentrations of Pb, Hg and Cd in *M. galloprovincialis* from Sinop shores of the Black Sea during summer months of the years 2016, 2017 and 2018 were below the maximum levels set by the European Commission and Turkish Food Codex reports. It may be concluded the edible tissues of the mussels analysed were suitable for human consumption in this region.

The calculated EDI and EWI values also support this. The estimated EDIs of these toxic metals via consumption of mussels by Turkish people in Sinop shores of the Black Sea were well below the permissible tolerable daily intake for 70 kg person set by FAO/WHO (2010, 2011). Thus, it can be



suggested that no problems on human health would be emerged at present from the consumption of the edible tissues of mussels from fish market or restaurant of Sinop Province.

However, it should be borne in mind that Pb, Hg and Cd have been proved to be toxic to both people and marine biota. Because of their toxicity and their possible bioaccumulation, these elements should be subject to mandatory monitoring studies. Although amounts of these toxic heavy metals are low in the present study, a likely danger may emerge in the future depending on the touristic and domestic activities in this region. It is therefore advisable not to eat mussels frequently.

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References

- Bat, L., Gündoğdu, A., Öztürk, M., & Öztürk, M. (1999). Copper, zinc, lead and cadmium concentrations in the Mediterranean mussel *Mytilus galloprovincialis* Lamarck 1819 from Sinop coast of the Black Sea. *Turkish Journal of Zoology*, 23, 321-326.
- Bat, L., Üstün, F., & Gökkurt-Baki, O. (2012). Trace element concentrations in the Mediterranean mussel *Mytilus galloprovincialis* Lamarck, 1819 caught from Sinop coast of the Black Sea, Turkey. *The Open Marine Biology Journal*, 6, 1-5.
- Bat, L., Sezgin, M., Şahin, F., Birinci Özdemir, Z., & Ürkmez, D. (2013). Sinop city fishery of the Black Sea. *Marine Science*, 3(3), 55-64.
- Bat, L., & Öztekin, H.C. (2016). Heavy metals in *Mytilus galloprovincialis*, *Rapana venosa* and *Eriphia verrucosa* from the Black Sea coasts of Turkey as bioindicators of pollution. *Walailak Journal of Science and Technology*, 13 (9), 715-728.
- Bat, L., & Arıcı, E. (2018). Heavy metal levels in fish, molluscs, and crustacea from Turkish seas and potential risk of human health. In: A.M. Holban & A.M. Grumezescu (Eds.) *Handbook of Food Bioengineering, Volume 13, Food Quality: Balancing Health and Disease* (pp. 159-196). Elsevier, Academic Press.
- Bat, L., Sahin, F., Sezgin, M., Gonener, S., Erdem, E., & Ozsandıkcı, U. (2018a). Fishery of Sinop coasts in the Black Sea surveys. *European Journal of Biology*, 77(1), 18-25.
- Bat, L., Öztekin, A., Şahin, F., Arıcı, E., & Özsandıkcı, U. (2018b). An overview of the Black Sea pollution in Turkey. *Mediterranean Fisheries and Aquaculture Research*, 1(2), 67-86.
- Bat, L., Arıcı, E., & Öztekin, A. (2018c). Human health risk assessment of heavy metals in the Black Sea: Evaluating Mussels. *Current World Environment*, 13 (1), 15-31.
- Bat, L., Arıcı, E., Öztekin, A., Yardım, O., & Üstün, F. (2018d). Use of the Mediterranean mussel *Mytilus galloprovincialis* Lamarck, 1819 from Sinop coasts of the Black Sea as bio-monitor. *International Journal of Marine Science*, 8(5): 44-47.
- EFSA (European Food Safety Authority). (2010). Panel on contaminants in the food chain (CONTAM). Scientific Opinion on Lead in Food. *EFSA Journal*, 8(4), 1570. 151 pp.
- EFSA (European Food Safety Authority). (2012a). Cadmium dietary exposure in the European population. *EFSA Journal*, 10 (1), 2551, 37 pp.
- EFSA (European Food Safety Authority). (2012b). Panel on contaminants in the food chain (CONTAM). Scientific Opinion on the Risk for Public Health Related to the Presence of Mercury and Methylmercury in Food. *EFSA Journal*, 10 (12), 2985, 241 pp.
- EFSA (European Food Safety Authority). (2012c). Lead dietary exposure in the European population. *EFSA Journal*, 10 (7), 2831, 59 pp.
- EU Commission Regulation (2001). *Setting maximum levels for certain contaminants in foodstuffs*. No 466/2001 of 8 March 2001.
- EU Commission Regulation (2006). *Setting maximum levels for certain contaminants in foodstuffs*. No 1881/2006 of 19 December 2006.
- FAO (Food and Agriculture Organization of the United Nations). (2010). *The food consumption refers to the amount of food available for human consumption as estimated by the FAO*. Food Balance Sheets.
- FAO/WHO. (2010). *Summary Report of the Seventy-third Meeting of JECFA*. Joint FAO/WHO Expert Committee on Food Additives Geneva.



- FAO/WHO. (2011). *Food Standards Programme Codex Committee on Contaminants in Foods*. Fifth Session Codex Alimentarius Commission. The Hague, The Netherlands.
- Official Gazette of Republic of Turkey (2002). *Notifications about determination of the maximum levels for certain contaminants in foodstuffs of Turkish Food Codex* (in Turkish). Notification No: 2002/63, 24885.
- Official Gazette of Republic of Turkey. (2009). *Notifications changes to the maximum levels for certain contaminants in foodstuffs* (in Turkish). Notification No: 2009/22, 27143.
- Sahin, F., Sezgin, M., & Bat, L. (2016). *Igneada fishery of the Black Sea, Turkey: A review*. *Pakistan Journal of Marine Sciences*, 25 (1&2), 41-58.

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Levels of some trace elements (cadmium, lead, mercury and chromium) in water and planktonic organisms in Abant Lake (Bolu, Turkey)

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Abstract

Abant Lake (30 km south-west of Bolu province) which was formed due to the blockage of the valley with the debris, is one of the economically and ecologically important water potential of Turkey, situated in the Western Black Sea Region. The measures to be taken which depend on the changes in macro and micro element levels and which will be determined as a result of conducting water quality researches and revealing the accumulation of those elements in plankton, which constitutes the first link of the food chain, are of great importance for the health of the ecosystems in the region as in all over the world. In this research, Cadmium (Cd), Lead (Pb), Mercury (Hg) and Chromium (Cr) levels in water and planktonic organisms were investigated in seasonal samplings from two stations between April 2008 and December 2009 in Abant Lake. Besides, species diversity was identified by determining the seasonal variation and abundance of phytoplankton and zooplankton populations in the investigation area, and some important environmental variables (temperature, pH, dissolved oxygen and light transmittance) were measured. Among the trace elements investigated in water and planktonic organisms, lead was found at the highest level (autumn season) whereas mercury concentration was found to be very low.

Keywords: Trace element, Phytoplankton, Zooplankton, Lake Abant, Accumulation

Introduction

Lakes and their catchments accommodate various biotic and abiotic elements and they are influenced by a series of ecological factors. In the absence of anthropogenic pressure, all the ecosystems function smoothly and ecological balances are properly maintained. Overpopulation, migration, rapid increase of the industry, improper urbanization, irrational use of natural resources as well as the conventional agricultural practices give rise to the loss of natural characteristics of lakes and rivers and also to pollution. It is known that the substances which are toxic and do not get degraded for a long time in the nature are significant pollutants. It is acknowledged that vital activities of all living organisms are adversely affected when the trace elements (metals) in those substances are mixed with aquatic ecosystems. Mixing of trace elements that originate from natural or anthropogenic activities with surface waters leads to the accumulation in aquatic organisms through the food chain in time (Turan et al., 2006; Lloyd, 1992; Alinnor & Obji, 2010). Phytoplanktonic organisms form the first link of the food chain in aquatic ecosystems and the elements start accumulating in these organisms. They accumulate in the tissues of various living creatures up to fish in the food chain, adversely affect the development of aquatic organisms, and can reach such levels that threaten the human health by consuming fish which is an important source of protein. Studies on trace element accumulation are generally done in fish tissues in Turkey. However, the number of researches on the accumulation in water, sediment and planktonic



organism in lentic and lotic systems has increased in recent years (for instance Atıcı et al., 2008, Atıcı et al., 2010).

In Abant Lake, the accumulation of trace elements in water, sediment, macrophytes and some aquatic organisms were investigated (such as Duman et al., 2007; Doğan & Kızılkaya, 2010) while there are hardly any studies on the accumulation of trace elements in water and planktonic organisms. The aim of this study is to determine the planktonic organisms of Abant Lake, their seasonal distribution and species diversity, and to investigate the accumulation levels of some trace elements (cadmium, lead, mercury and chromium) in water and planktonic organisms between April 2008 and December 2009.

Material and Methods

Study area

Located 30 km south-west of Bolu, it was formed by the blockage of the valley, in which Lake is located, by debris. Its elevation from the sea level is 920 m and surface area is 4 km² and its deepest place is 32 m. It discharges its excess water into Dirgene Creek through its outlet called Büyüksu, and it is surrounded by reeds (Figure 1). Abant Lake is of great importance for tourism (Atıcı et al., 2005).



Figure 1. Geographical location of Abant Lake and sampling stations.

Sampling and Analysis

Water samples and plankton samples were taken from the two stations in Lake Abant (Figure 1) every two months between April 2008-December 2009 for trace element analysis and they were brought to the laboratory. Phytoplankton, constituting the plankton, was sampled with Nansen bottles, and zooplankton was sampled with Hydro Kiel plankton grab having 55 μ aperture. Algae and zooplankton samples were collected from stations where samples were taken for trace elements analysis, and species of planktonic organisms along with their distribution over the seasons were examined. Phytoplankton were



counted with microscope and zooplankton samples were counted with the Sedgy Rafter Chamber counting glass.

Water samples were filtered with ashless filter paper and filter paper on which the plankton was collected was kept in the laboratory for a while, the water of the filter paper was slightly evaporated, and wet weights were determined (Toker, 1988). Dry weights were determined after the filter paper was dried in drying-oven at 90°C in 24 hours. Then it was placed in crucible and burned at 550°C for 4 hours. 20 ml was treated with 1.5 N HCl at 80°C, then filtered into 100 ml flasks. They were filled with distilled water to 100 ml and all samples were analysed with a Hitachi Z 8200 polarized Zeeman AAS (Atomic Absorption Spectrophotometer) (Kelly & Whitten, 1989). In the species identification of plankton; Pestalozzi (1982), Gerrath & Danny (1979), Parra & Gonzales (1973), Çelekli et al. (2007), Van Den Hook et al. (1995), Obalı et al. (2002), Ruttner-Kolisko (1974), Scourfield & Harding (1966), Altındağ (1999), Margaritora & Cottarelli (1970) and, Altındağ & Yiğit (2000) were used.

Results

Some environmental parameters determined in the Lake Abant are summarized in Table 1. The temperature varied between 5.1-25°C; the pH between 8.0-8.6; the dissolved oxygen (DO) between 8.5-9.3 mg/l; the electrical conductivity (EC) 2.0-2.8 µS/cm and the secchi depth between 30-43 cm.

Waters of Abant Lake are in the I. quality class in terms of general conditions (temperature, pH) and oxygenation parameters. Among them, dissolved oxygen (DO) is especially needed for the proliferation of organisms living in aerobic conditions and in energy-producing metabolic activities. Therefore, DO levels indicate the auto-depuration capacity (Karpuzcu, 2007). In addition, it is one of the important parameters which supports the aquatic flora and fauna and which is used for monitoring water quality changes, ensuring ecological balance, calculating the assimilation capacities of the receiving environment, estimating the aging periods of lakes and seas, maintaining ecological life in natural environments. It is also used for waste water treatment and drinking water purification processes as well as controlling water pollution and waste processes. It is promising to have high DO levels in lake waters.

A total of 96 phytoplankton species were identified from Lake Abant (Table 2). Among zooplankton fauna, a total of 34 species (Table 3) (21 Rotifera, 11 Cladocera and 2 Copepoda) were identified in Abant Lake.

In Abant Lake, in spring *Asterionella*, *Chroococcus*, *Ceratium* and *Dinobryon*; in summer *Asterionella*, *Ceratium*, *Dinobryon*, *Chlamydomonas*, *Staurastrum* and *Cymbella*; in autumn *Asterionella*, *Cosmarium*, *Ceratium* and *Gomphonema*; and in winter *Asterionella*, *Microcystis*, *Cyclotella* and *Dinobryon* genera occurred abundantly. *Asterionella* species were dominant and continuous organisms which occurred with the highest numbers making up 35-38% of total organisms in all seasons.

In total 34 species, consisting of 21 Rotifera, 11 Cladocera and 2 Copepoda were identified from zooplankton samples collected during the study period. It was found that 26.35% of the zooplankton fauna of Lake Abant consists of Cladocera, 32.55% of it is made up of Copepoda and 41.10% of it made up of Rotifer species. As a result of the study, dominant species of Abant Lake are as follows: *Keratella longispina* from Rotifera with 9.85%, *Diaphanosoma brachyurum* from Cladocera with 8.92% and *Acanthodiatomus denticornis* from Copepoda with 12.64%. In the study, maximum number of Cladocera species were recorded in Autumn (September) and minimum numbers were found in Autumn (November); the maximum number of Rotifer species were recorded at the beginning of autumn and minimum numbers were found at the end of autumn (November); maximum number of Copepoda species were recorded in autumn and minimum number was found winter (January).

6 Rotifer species (*Asplanchna brightwelli*, *Conochilus unicornis*, *Filinia terminalis*, *Kellicottia longispina*, *Keratella cochlearis* and *Keratella quadrata*) were found in a former study conducted in Abant Lake by Margaritora and Cotarelli (1970). Among these species *Conochilus unicornis* and *Filinia terminalis* were not observed in this study.



Table 1. Some physical and chemical parameters of Abant Lake.

PARAMETERS	Spring	Summer	Autumn	Winter
Temperature (°C)	14.0	25.0	12.8	5.1
pH	8.0	8.3	8.6	8.2
Dissolved oxygen (mg/L)	8.5	8.8	9.0	9.3
EC ₂₅ ^o (µs/cm)	2.2	2.8	2.2	2.0
Secchi depth (cm)	32.0	36.0	30.0	43.0

Table 2. Distribution of phytoplankton species found in Abant Lake over the seasons.

Taxa	Sampling Season			
	Spring	Summer	Autumn	Winter
CYANOPHYTA, CYANOPHYCEAE, CHOROOCOCCALES				
<i>Choroococcus disperus</i>	+	+	+	+
<i>Choroococcus limeticus</i>	+	+	+	-
<i>Gloeotheca rupestris</i>	-	-	-	+
<i>Merismopedia tenuissima</i>	+	+	-	-
<i>Microcystis aeruginosa</i>	+	+	+	+
<i>Synechococcus aeruginosa</i>	+	+	+	-
OSCILLATORIALES				
<i>Oscillatoria formosa</i>	+	+	+	+
<i>Oscillatoria geminata</i>	-	+	+	-
<i>Oscillatoria princeps</i>	+	-	+	-
<i>Spirulina nordstedtii</i>	+	+	+	+
NOSTOCALES				
<i>Anabaena affinis</i>	+	+	+	+
<i>Anabaena minutissima</i>	-	-	-	+
<i>Aphanizomenon flos – aque</i>	+	+	+	-
<i>Plectonema notatum</i>	+	+	+	+
PERIDINIALES				
<i>Peridinium sp.</i>	+	+	+	-
<i>Peridinium cinctum</i>	-	-	-	+
<i>Ceratium hirundinella</i>	+	+	+	-
EUGLENOPHYTA, EUGLENOPHYCEAE, EUGLENALES				
<i>Euglena polymorpha</i>	+	+	+	+
<i>Trachelomonas pulchella</i>	+	+	-	+
<i>Trachelomonas volvocina</i>	+	+	+	+
CHRYSOPHYTA, CHRYSOPHYCEAE, CHRYSOMONADALES				
<i>Dinobryon divergens</i>	+	+	+	+
<i>Dinobryon sertularia</i>	+	-	+	+
CHLOROPHYTA, CHOLOROPHYCEAE, VOLVOCALES				
<i>Chlamydomonas sp.</i>	+	+	+	-
TETRASPORALES				
<i>Palmella sp.</i>	-	+	+	-
CHLOROCOCCALES				
<i>Botryococcus braunii</i>	+	+	+	+
<i>Chlorella vulgaris</i>	+	+	+	+
<i>Coelastrum microporum</i>	+	+	+	+
<i>Crucigenia quadrata</i>	+	+	+	-
<i>Nephrocytium agardhianum</i>	+	+	+	-
<i>Oocystis borgei</i>	+	+	+	+
<i>Oocystis parva</i>	+	+	+	+



<i>Oocystis pusilla</i>	-	-	-	+
<i>Scenedesmus bijuga</i>	+	-	+	-
<i>Scenedesmus ovelterinus</i>	+	+	+	+
<i>Scenedesmus quadricauda</i>	+	+	+	+
<i>Sphaerocystis polycocca</i>	+	+	+	-
CHAELOPHORALES				
<i>Stigeoclonium nanum</i>	+	+	+	+
ULOTHRICALES				
<i>Ulothrix subtilissima</i>	+	+	+	-
<i>Ulothrix tenerrima</i>	-	-	-	+
ZYGNEMAPYCEAE, DESMIDIALES				
<i>Closterium kuetzingii</i>	+	+	+	-
<i>Cosmarium botrytis</i>	+	+	+	+
<i>Cosmarium granatum</i>	+	+	+	+
<i>Staurastrum brachiatum</i>	+	+	-	+
<i>Staurastrum furcatum</i>	+	-	-	+
<i>Staurastrum polymorphum</i>	+	+	+	-
ZYGNEMALES				
<i>Spirogyra gratiana</i>	+	+	+	+
<i>Spirogyra mirabilis</i>	+	+	+	+
<i>Zygnema chelybeospermum</i>	+	-	+	-
<i>Zygnema pectinatum</i>	+	+	+	+
BRYOPSISIDOPYCEAE, CLADOPHORALES				
<i>Cladophora fracta</i>	-	+	+	+
<i>Cladophora glomerata</i>	-	+	-	+
OEDOGONIOPHYCEAE, OEDOGONIALES				
<i>Oedogonium upsalines</i>	+	+	+	+
BACILLARIOPHYTA, CENTROBACILLARIOPHYCEAE, CENTRALES				
<i>Cyclotella meneghiniana</i>	+	+	+	+
<i>Cyclotella ocellata</i>	+	+	+	+
<i>Melosira granatum</i>	-	-	+	+
<i>Melosira varians</i>	+	+	+	+
<i>Stephanodiscus astrea</i>	+	-	-	+
PENNATIBACILLARIOPHYTA, PENNALES				
<i>Achnanthes lapponica</i>		+	+	+
<i>Achnanthes minutissima</i>	+	-	-	-
<i>Amphora aqualis</i>	-	-	+	+
<i>Amphora pediculus</i>	+	+	+	+
<i>Asterionella formosa</i>	+	+	+	+
<i>Campylodiscus spiralis</i>		+	+	+
<i>Cocconeis placentula</i>	+	+	+	+
<i>Cymatopleura elliptica</i>	+	+	+	-
<i>Cymbella amphicephala</i>	+	+	+	+
<i>Cymbella cistula</i>	+	+	+	+
<i>Cymbella cymbiformis</i>	+	+	+	+
<i>Cymbella gracilis</i>	+	+	-	-
<i>Cymbella helvetica</i>	+	+	-	-
<i>Cymbella lanceolata</i>	+	+	+	-
<i>Diatoma elongatum</i>	+	+	+	+
<i>Diatoma vulgare</i>	+	+	+	+
<i>Diploneis ovalis</i>	+	+	+	+
<i>Epithemia sorex</i>	-	-	-	+
<i>Epithemia turgida</i>	+	-	-	-
<i>Fragilaria intermedia</i>	+	+	+	+
<i>Fragilaria pinnata</i>	+	+	+	+



<i>Fragilaria vaucheriae</i>	+		+	+
<i>Gomphonema constrictum</i>	+	+	+	+
<i>Gomphonema olivaceum</i>	+	+	+	+
<i>Gyrosigma acuminatum</i>	+	+	+	+
<i>Navicula cuspidata</i>	+	+	+	+
<i>Navicula lanceolata</i>	+	+	+	+
<i>Navicula minute</i>	-	-	+	-
<i>Navicula menismus</i>	+	+	+	+
<i>Navicula radiosa</i>	-	+	+	-
<i>Nephrocytium agardianum</i>	+	+	+	-
<i>Nitzschia amphibia</i>	+	+	+	+
<i>Nitzschia linearis</i>	+	+	+	+
<i>Nitzschia lorenziana var. subtilis</i>	-	+	-	+
<i>Pinnularia biceps</i>	+	+	+	+
<i>Stautoneis smithii</i>	+	+	+	+
<i>Surirella angustata</i>	+	+	-	+
<i>Synedra capitata</i>	+	+	+	+
<i>Synedra ulna</i>	-	+	+	+

Table 3. Seasonal distribution of zooplankton fauna of Abant Lake.

Taxa	Sampling Season			
	Spring	Summer	Autumn	Winter
ROTIFERA				
<i>Ascomorpha ecuadis</i>	-	-	+	-
<i>Asplachna girardi</i>	+	+	+	-
<i>Colletheca ornata</i>	-	-	+	-
<i>Colletheca pelagica</i>	-	+	-	+
<i>Colurella adratica</i>	+	-	-	+
<i>Corachilus hippocrepis</i>	+	-	-	+
<i>Euchlanis dilatata</i>	-	-	+	-
<i>Filinia longiseta</i>	+	+	+	+
<i>Gastropus stylifer</i>	-	+	-	-
<i>Keratella quadrata</i>	+	-	+	+
<i>Keratella cochlearis</i>	+	+	-	+
<i>Keratella longispina</i>	+	+	-	+
<i>Lecane lunaris</i>	+	+	-	-
<i>Lecane hamata</i>	-	+	-	-
<i>Lepadella patella</i>	-	+	-	-
<i>Lophpcharis salpina</i>	-	+	-	-
<i>Notholca squamula</i>	+	-	-	+
<i>Polyarthra dolichoptera</i>	-	+	-	+
<i>Synchaeta pectinata</i>	+	+	+	+
<i>Synchaeta littoralis</i>	+	+	+	+
<i>Trichocerca pocillum</i>	-	-	-	+
CLADOCERA				
<i>Alona nana</i>	+	-	+	-
<i>Alona excisa</i>	-	+	+	-
<i>Alana rectangula</i>	-	-	+	-
<i>Bosmina longirostris</i>	+	+	-	-
<i>Ceriodaphnia quadrangula</i>	-	-	+	+
<i>Chydorus sphaericus</i>	+	-	-	-
<i>Daphnia longispina</i>	+	+	+	+
<i>Diaphanosoma brachyurum</i>	+	+	+	+



<i>Pleuroxus truncatus</i>	-	-	+	-
<i>Polyhemus pediculus</i>	+	-	+	-
<i>Scabholoberis mucronata</i>	-	-	+	-
COPEPODA				
<i>Acanthodiaptomus denticornis</i>	+	+	+	+
<i>Cyclops</i> sp.	+	+	+	-

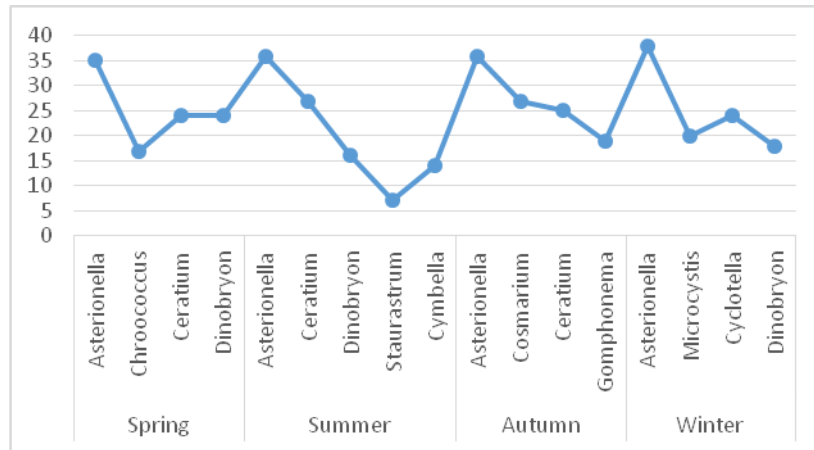


Figure 2. Seasonal distribution of % values of some genera belonging to phytoplankton of Abant Lake.

Cadmium, lead, mercury and chromium levels detected in water and planktonic organisms of Abant Lake are given in Table 4. The accumulation order of heavy metals in water samples was found as Cd > Pb > Cr > Hg in spring; Pb > Cr > Cd > Hg in summer; Pb > Cd > Cr > Hg in autumn and Pb > Cr > Cd > Hg in winter. The highest rate was recorded for Pb (267 µg/l) and the lowest for Hg (0.52 µg/l). The heavy metals accumulations in plankton samples were as Pb > Cr > Cd > Hg in spring; Pb > Cr > Cd > Hg in summer; Pb > Cr > Cd > Hg in autumn and Cd > Pb > Cr > Hg in winter (Table 4).

Table 4. The amount of trace elements in water (µg/l) and 1 gr plankton of Abant Lake.

Metals/Samples	Spring	Summer	Autumn	Winter	
Cd	Water	108.50	35.50	32.50	21.00
	Plankton	81.25	79.41	45.16	100.81
Pb	Water	93.50	267.00	152.50	119.50
	Plankton	110.42	413.80	589.82	88.48
Hg	Water	0.68	0.52	1.28	1.04
	Plankton	1.07	1.01	0.93	1.63
Cr	Water	58.00	45.00	23.50	47.00
	Plankton	90.63	144.64	57.80	67.39

Cd was at the highest level with 108.5 µg/l in water in spring period, and with 100.81 µg/gr in plankton during winter in Abant Lake. **Pb** was at the highest level with 267.0 µg/l in water in summer period, and with 589.82 µg/gr in plankton in autumn. **Hg** was at the highest level with 1.28 µg/l in water in winter period, and with 1.63 µg/gr in plankton in spring. **Cr** was at the highest level with 58.00 µg/l in water in spring period, and with 144.64 µg/gr in plankton in summer.

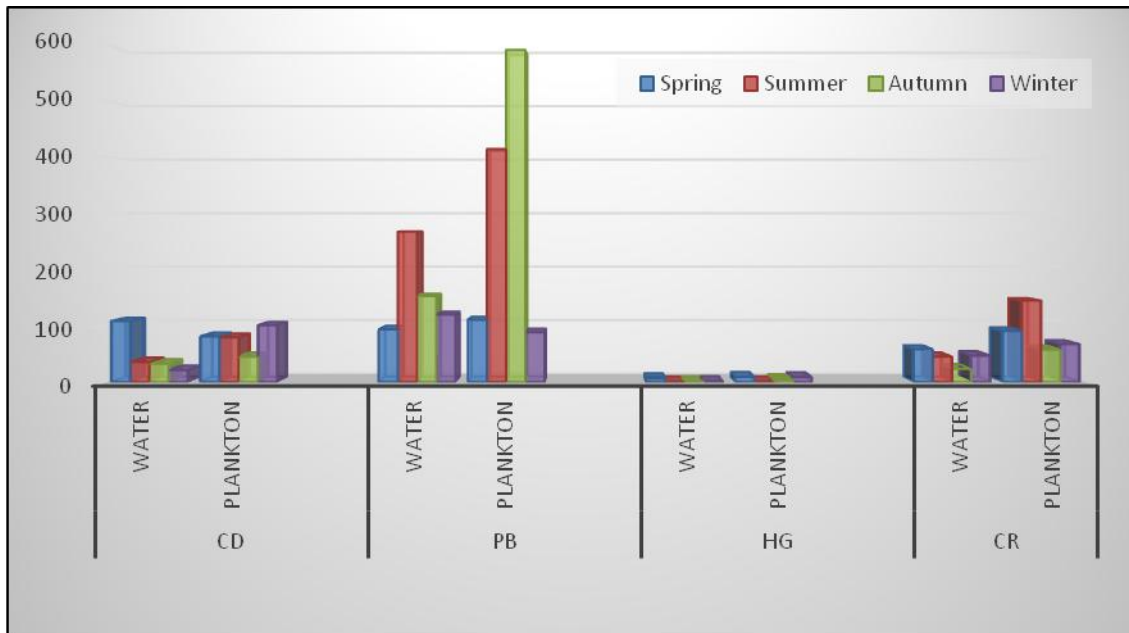


Figure 3. The amount of trace elements in water and plankton of Abant Lake.

Discussion

Cr was recorded in the range of 23.5-58.0 $\mu\text{g/L}$ in Abant Lake water. These values are well below the ones in Surface Water Quality By-law used in Turkey (20-200 $\mu\text{g/L}$) and the amount in planktonic organisms can be regarded as high. One of the main problems with chromium pollution in aquatic ecosystems is that it can remain in the water for years before it starts accumulating in the sediment (Elder, 1988). It is reported that high Cr levels detected in the various tissues of different fish species prevent the reproduction of fish (Pickering, 1980; Maples & Lisa, 2003), cause genotoxic effects in *Astacus* species (De la Sienna et al., 2003) whereas in other invertebrates (such as *Daphnia magna* and *Chironomus tentans*) they threaten the survival of those organisms and Cr is transferred to the higher level in the food chain (Eisler, 1986).

It was shown in experimental studies that *Chlamydomonas* species take Cr into their bodies by means of biosorption (Arıca et al., 2001). Moreover, it was also observed that in case *Chlamydomonas acidophila* species are stimulated with metals (cadmium, zinc and copper), quite sensitive changes took place in its structure (Nishikawa et al., 2003). In Abant Lake *Chlamydomonas* species were identified on the genus level and increased in number especially in the summer period. It can be stated that *Chlamydomonas* species absorbed Cr in Abant Lake and therefore the amount of Cr increased in planktonic organisms (144.64 mg/g) and decreased in water in summer period.

Lead is the first trace element which brings the biggest damage to the aquatic ecosystems through the human activities. In the 1920s, lead compounds (tetra-ethyl lead) were introduced into the gasoline and this area of use played an essential role in the spread of lead into ecological systems. As known, lead is used as an additive in motor vehicle fuels. As a result of the combustion of leaded fuels, the lead is primarily transferred to the atmosphere and then to the closest aquatic system through rains (Denny et al., 1987). Lead is used in accumulators, petroleum & dyeing industry, batteries, power cables, in colouring of ceramics, as stabilizers in plastics, in alloys, in the glass and insecticide industry, in polishing of pipes and containers as well as in printing. Ecologically, lead tends to precipitate in solid form and does not form compounds except for special cases. Lead diffusion in the food chain usually takes place through the organisms containing calcium in their shells depending on their calcium. It has been reported that unicellular organisms and fish can tolerate waters containing 0.04-0.198 ml/L inorganic lead, however they experience acute poisoning in case of an intake of lower amounts of lead through the food (Kahvecioglu et al., 2003).

Lead values determined in Abant Lake water are in the range of 93.5-267.0 $\mu\text{g/L}$. However, the range given in the Surface Water Quality By-law is 10-50 $\mu\text{g/L}$. In this case, it can be stated that lake waters are highly contaminated in terms of lead.



Hg accumulates in algae and other aquatic plants at all levels in the primary food chain and therefore occurs in low concentrations in waters. It was indicated in their study that Hg accumulation is fast in plankton but the elimination rate is slow. Although the Hg levels detected in this study are not very high, the presence of toxic mercury element in water is an undesirable contamination. Mercury can be transferred to the receiving environment as a result of burning of fossil fuels, breaking of rocks containing mercury in mining sector, leaking from landfills during mercury production, random disposal of waste batteries, amalgam fillings used in dentistry, breaking of mercury containing instruments used at home, and spreading of that mercury to the environment. Mercury, which is mixed with water, is converted into methyl mercury under the effect of bacteria and organisms and it is highly toxic to human health. The level of mercury in waters is 0.1 µg/L and it can vary from 0.1 to 2 µg/L in surface waters (Surface Water Quality By-law, 2018). Organic mercury or mercury compounds can accumulate in fish living at the bottom of aquatic systems contaminated with mercury. Humans who consume mercury-containing fish are at risk through the food chain (Soleimani et al., 2011). Mercury concentration should not exceed 0.004 mg/L in marine waters, bathing waters and waters intended for recreational purposes in order to prevent the mercury accumulation in receiving environments. The limit value of mercury concentration in natural mineral spring waters is 1 µg/L according to European Union and World Health Organization. In this case, it seems that mercury levels which were detected in Abant Lake Waters are in the range of 0.52-1.28 µg/L and limit values are exceeded especially in autumn and winter periods. Based on the increase in mercury concentrations in the water, an increase was also noted in planktonic organisms in the next sampling period. It means that the amount gets intensified at every step of the food chain.

Various researchers argued the use of algae as biomonitors of trace element contamination in aquatic environments. The term "biomonitor" which was put forward by Ward (1987) means organisms used for the identification of the geographic distribution of trace element causing pollution, or the level of pollution in the region. This is done by analysing the content of trace elements of organisms.

It can be asserted that trace elements accumulate at high levels in planktonic organisms that constitute the first ring of the food chain. Given that trace element and other pollutants accumulate increasingly at each step of the food chain, they are quite likely to become a threat to human health. Species in the upper tiers of the food pyramid, especially the humans at the top level, accumulate many pollutants especially toxic elements much more when they are fed on species at lower tiers that have accumulated pollutants in their tissues. Therefore, the amount of trace elements which have toxic effect in aquatic ecosystems should be monitored constantly.

References

- Alinnor, J.I., & Obiji, A.I. (2010). Assesment of trace Metal Composition in Fish Samples from Nworie River. *Pakistan Journal of Nutrition*, 9(1), 81-85.
- Altındağ, A. (1999). A taxonomical study on the Rotifera Fauna of Abant Lake (Bolu). *Turkish Journal of Jeology*, 23, 211-214.
- Altındağ, A., & Yiğit, S. (2000). Abant (Bolu) Gölü zooplankton faunasının mevsimsel değişimi. *E.Ü. Su Ürünleri Dergisi*, 17, (1-2), 9-18.
- Arıca, M.Y., Tüzün, İ., Yalçın, E., İnce, Ö., & Bayramoğlu, G. (2001). Utilisation of native, heat and acid-treated microalgae *Chlamydomonas reinhardtii* for biosorption of Cr(VI) ions. *Elsevier, Process Biochemistry*, 40, 2351-2358.
- Atıcı, T., Ahıska, S., Altındağ, A., & Aydın, D. (2008). Ecological effects of some heavy metals (Cd, Pb, Hg, Cr) pollution of phytoplanktonic algae and zooplanktonic organisms in Sariyar Dam Reservoir in Turkey. *African Journal Of Biotechnology*, 7(12), 1972-1977.
- Atıcı, T., Obalı, O., & Elmacı, A. (2005). Abant Gölü (Bolu) Bentik Algleri. *Ekoloji-Çevre Dergisi*, 14(56), 9-15.
- Atıcı, T., Obalı, O., Altındağ, A., Ahıska, S., & Aydın D. (2010). The accumulation of heavy metals (Cd, Pb, Hg, Cr) and their state in phytoplanktonic algae and zooplanktonic organisms in Beysehir Lake and Mogan Lake, Turkey. *African Journal Of Biotechnology*, 9(4), 475-487.
- Çelekli, A., Obalı, O., & Kulköylüoğlu, O. (2007). The phytoplankton community (except Bacillariophyceae) of Lake Abant (Bolu). *Turk J Bot*, 31, 109-124.
- De la Sienra, E., Armienta, M.A. and Gonsebatt, M.E., 2003. Potassium dichromate increases the micronucleus frequency in the crayfish *Procambarus clarkia*. *Environmental Pollution* 126,3: 367-370.



- Denny, P., Hart, B.T., Lasheen, M.R., Subramanian, V., & Wong, M.H. (1987). Group Report: Lead, Lead, Mercury, Cadmium and Arsenic In The Environment. In: S.C.O.P.E. of the I.C.S.U. (Hutchinson, T, C., Meema, K, M., -eds.). Canada.
- Doğan, M., & Kızılkaya, B. (2010). Some air and water pollution indicators in and around the Lake Abant, Turkey. *J. Black Sea/Mediterranean Environment*, 16(1), 53-74.
- Duman, F., Obalı, O., Aksoy, A., & Sezen, G. (2007). A comparative analysis of seasonal changing of some heavy metal concentrations in Abant Lake water. *Anadolu University Journal Of Science and Technology*, 8(1), 131-138.
- Eisler, R. (1986). Chromium Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review. Biological Report No. 85(1.6), Contaminant Hazard Reviews Report No. 6. US Fish and Wildlife Service, US Department of the Interior, *Patuxent Wildlife Research Center*, Laurel, MD. January 1986.
- Elder, J.F. (1988). Metal biogeochemistry in surface-water systems a review of principles and concepts. Washington, DC .
- Gerrath, F.J, & Danny, P. (1979). Freshwater Algae of Sierra Leona I. Euglenophyta, Nova Hedwigia, Band XXXI, 1+2, Braunschweig.
- Kahvecioğlu, Ö., Kartal, G., Güven, A., & Timur, S. (2003). Metallerin çevresel etkileri-I. *Metalurji Dergisi*, 136, 47-53.
- Karpuzcu, M. (2007). Çevre Kirlenmesi ve Kontrolü, İstanbul.
- Kelly, M.G, & Whitten B.A. (1989). Interspecific Differences in Zn, Cd, and Pb Accumulation By Freshwater Algae and Bryophytes. *Hydrobiologia*, 175(1), 1–11.
- Lloyd, R. (1992). Pollution and freshwater fish, *Marston Book Services Ltd*, 176 s.
- Maples, N.L., & Lisa, J.B. (2003). Trivalent Chromium Alters Gene Expression in the Mummichog (*Fundulus heteroclitus*). *Environmental Toxicology and Chemistry*, 23(3), 626-631.
- Mergaritora, F.G, & Cottarelli V. (1970). Le Biocenosi Planctoniche Estive Del Lago Abant (Turchia Asiatic, Regione Del Mal Mero). *Rendic Accad Lambardo Sci. Lett. Cl. Sci. B.*, 104, 170–190.
- Nishikawa, K., Yamakoshi, Y., Uemura, I., & Tominaga, N. (2003). Ultrastructural changes in *Chlamydomonas acidophila* (Chlorophyta) induced by heavy metals and polyphosphate metabolism. *FEMS Microbiology Ecology*, 44, 253-259.
- Obalı, O., Atıcı, T., & Elmacı, A. (2002). Abant Gölü (Bolu) Fitoplanktonu Üzerine Taksonomik Bir Çalışma. *Ot Sistematik botanik dergisi*, 9, 143-151.
- Parra O. O., & Gonzales M. (1973). Freshwater Algae of Chiloe Island, Chile., Nova Hedwigia, Band XXX. Braunschweig, 1978. Prescott, G:W. *Algae of the Western Great Lake Area.*, M.C. Brown Comp., Dubuque., Iowa, 997 p.
- Pestalozzi, H.G. (1982). Das Phytoplankton Des Süßwassers, Systematik und Biologie, Teil, 1. Conjugatophyceae, Zygnematales and Desmidiiales, E. Schweizerbart'sche Verlagsbuchhandlung, (Naegle u Obermiller), Stuttgart.
- Pickering, Q.H. (1980). Chronic Toxicity of Hexavalent Chromium to the Fathead Minnow (*Pimephales promelas*). *Archives of Environmental Contamination and Toxicology*, 9, 405-413.
- Ruttner-Kolisko, A. (1974). Plankton Rotifers Biology and Taxonomy Biological Station. *Lunz of the Academy of Science*, Stuttgart, 146 p.
- Scourfield, D.J, & Harding, J.P. (1966). A key to the British freshwater Cladocera. *Freshwater Biol., Ass.Sci. Publ.*, No. 5.
- Soleimani, M., Mahmodi, M.S., Morsali, A., Khani, A., & Afshar, M.G. (2011). Using a new ligand for solid phase extraction of mercury. *Journal of Hazardous Material*, 189, 371-376.
- Surface Water Quality By-Law (2018). Yerüstü Su Kalitesi Yönetmeliği. Resmî Gazete Sayı : 29797, 10 Ağustos 2016 <http://www.resmigazete.gov.tr/eskiler/2016/08/20160810-9.htm>
- Toker, C. (1988). Uptake of Lead by Barley (*Hordeum distichon* L.) Roots and its Relation to Potassium Doğa, *T. J. Biology.*, 12(2), 128–133.
- Turan, H., Kaya, Y., & Sönmez, G. (2006). Balık Etinin Besin Değeri ve İnsan Sağlığındaki Yeri. *E.Ü. Su Ürünleri Dergisi*, 23(1/3), 505-508.
- Van Den Hook, C., Mann, D.G, & Jahns, H.M. (1995). Algae, An Introduction to Phycology. *Cambridge Üniv.*, 627p.
- Ward, T.J. (1987). Temporal variation of metals in the seagrass *Posidonia australis* and its potential as a sentinel accumulator near a lead smelter. *Mar. Biol.*, 95, 315 – 321.



Preliminary Researches on Tardigrada Fauna of Meşelik Campus (Eskişehir, Turkey)

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Abstract

In order to carry out preliminary studies on Tardigrada fauna of Eskişehir Osmangazi University Campus, mosses on trees and rocks were collected and examined in April-May 2019. As a result of the study, 66 individuals belonging to 2 genera were identified. The photographs of identified individuals were taken and taxonomic characteristics used for the identification were noted. Tardigrada species identified within the scope of this study are new records for Eskişehir region where no research has been done about Tardigrada fauna.

Keywords: Tardigrada, Turkey, Eskişehir, Meşelik Campus

Introduction

Tardigrada phylum is composed of micro-metazoa that are capable of living in extreme and challenging conditions and changing their shells. More than 1200 species have been identified as a result of the studies carried out until now and there are fossil records from ancient times (Maas & Waloszek, 2001; Degma et al., 2017). The Tardigrada phylum, which can survive in extreme conditions by means of cryptobiosis along with passive distribution and parthenogenetic reproduction in harsh environmental conditions, has a wide distribution (Nelson, 2002; Bertolani et al., 2004). Tardigrates are found in marine areas and in various habitats including river mouths, freshwater and terrestrial areas (McFatter et al., 2007).

Tardigrada, which is a taxonomic group with hardly any researches, were studied by Maucci (1973, 1975, 1978, 1979, 1980, 1981, 1985), Morgan (1977), Maucci & Ramazzotti (1981), Binda (1988) and Kaczmarek et al. (2012). In these studies, conducted in very limited area and various habitats, a total of 50 species belonging to 17 tardigrade genera have been identified to date (Figure 1). Most of the species identified are cosmopolitan species and 10 species originate from Turkey, and 6 of them are endemic to Turkey.

As known, Turkey has a very different habitat structure due to its geographical location, historical development, diversity both in terrestrial and aquatic environments and accommodates many living creatures. Due to these characteristics, the species diversity is quite high. It is evident that Tardigrada fauna of Turkey consists of more than 50 species which were identified in a limited number of studies carried out until now. The number of scientists working on this group is quite low. From this point of view, it was aimed to carry out a preliminary study to determine the Tardigrada fauna of Meşelik Campus of Eskişehir Osmangazi University.

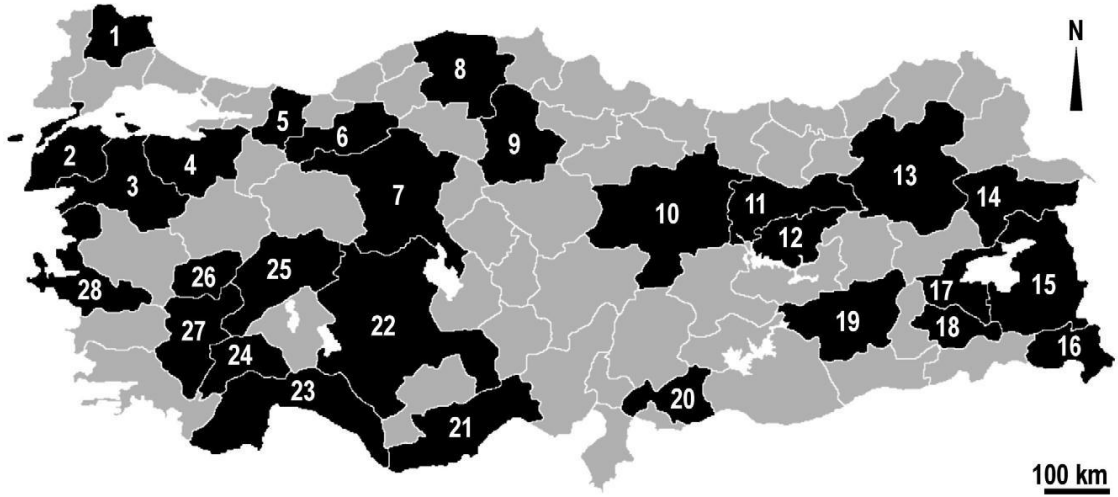


Figure 1. Provincial demonstration of tardigrades in Turkey (Kaczmarek et al., 2012).

1-Kırklareli, 2-Çanakkale, 3-Balıkesir, 4-Bursa, 5-Sakarya, 6-Bolu, 7-Ankara, 8-Kastamonu, 9-Çorum, 10-Sivas, 11-Erzincan, 12-Tunceli, 13-Erzurum, 14-Ağrı, 15-Van, 16-Hakkari, 17-Bitlis, 18-Siirt, 19- Diyarbakır, 20-Gaziantep, 21-Mersin, 22-Konya, 23-Antalya, 24-Burdur, 25-Afyonkarahisar, 26-Uşak, 27-Denizli, 28-İzmir.

Material and Methods

Eskişehir Osmangazi University (Meşelik Campus) is situated in Odunpazarı District of Eskişehir Province and on Eskişehir-Afyonkarahisar highway (Figure 2).



Figure 2. Satellite image of Osmangazi University and sampling stations (Google Earth-18/05/2019).

Mosses were collected (Figure 3) from trees and rocks from 3 sampling stations shown in Figure 2 from Meşelik Campus of Eskişehir Osmangazi University in April-May 2019. They were put in a dry envelop and brought to the laboratory. Wet samples were dried in the laboratory. The samples to be examined later were stored at -20 °C.



Figure 3. Moss sampling in Eskişehir Osmangazi University, Eskişehir, Turkey.

Some of the moss samples, which were taken from the field and dried, were put into a large bowl and tap water was added to half of the bowl. The samples were kept in water for one day and filtered using nested sieves of 300 μm and 500 μm . The deposits collected in the lower sieve (300 μm) were taken in a petri dish and examined with ZEISS SteREO Discovery V12 microscope. Identified Tardigrada samples were placed on the slide with a pasteur pipette and permanent slides were prepared with Hoyer's Medium solution, and they were made ready for the identification to the lowest taxonomic level (order-genus-species). Tardigrada samples were examined with Nikon Eclipse E80i phase contrast microscope for identification. In the morphological identification of individuals belonging to Tardigrada phylum, Ramazzotti & Maucci (1983), Dastych (1988) and Bertolani and Rebecchi (1993) identification keys were used. In addition, the photographs of morphological characteristics, which are the criteria for the identification, were taken and recorded.

Results

As a result of the examination of samples collected from Meşelik Campus of Eskişehir Osmangazi University, *Macrobiotus* sp. (Figure 4) and *Paramacrobiotus* sp. (Figure 5) taxa belonging to Macrobiotidae family were identified. Due to the lack of visualization of eggs and buccal-pharyngeal apparatus, which are one of the taxonomic characteristics of some individuals, identification could not be done at the species level but at the family level. Distribution and number of species by stations are given in Table 1.

Table 1. Distribution of species obtained from moss samples collected from trees and rocks over the stations.

Taxa	Meşelik Campus of Eskişehir Osmangazi University		
	Stations		
Family/Species	1	2	3
Macrobiotidae			
<i>Macrobiotus</i> sp.	4	2	-
<i>Paramacrobiotus</i> sp.	18	6	12
Tardigrada spp.	6	7	11
Total	28	15	23



Figure 4. Light microscope images of *Paramacrobiotus* sp.

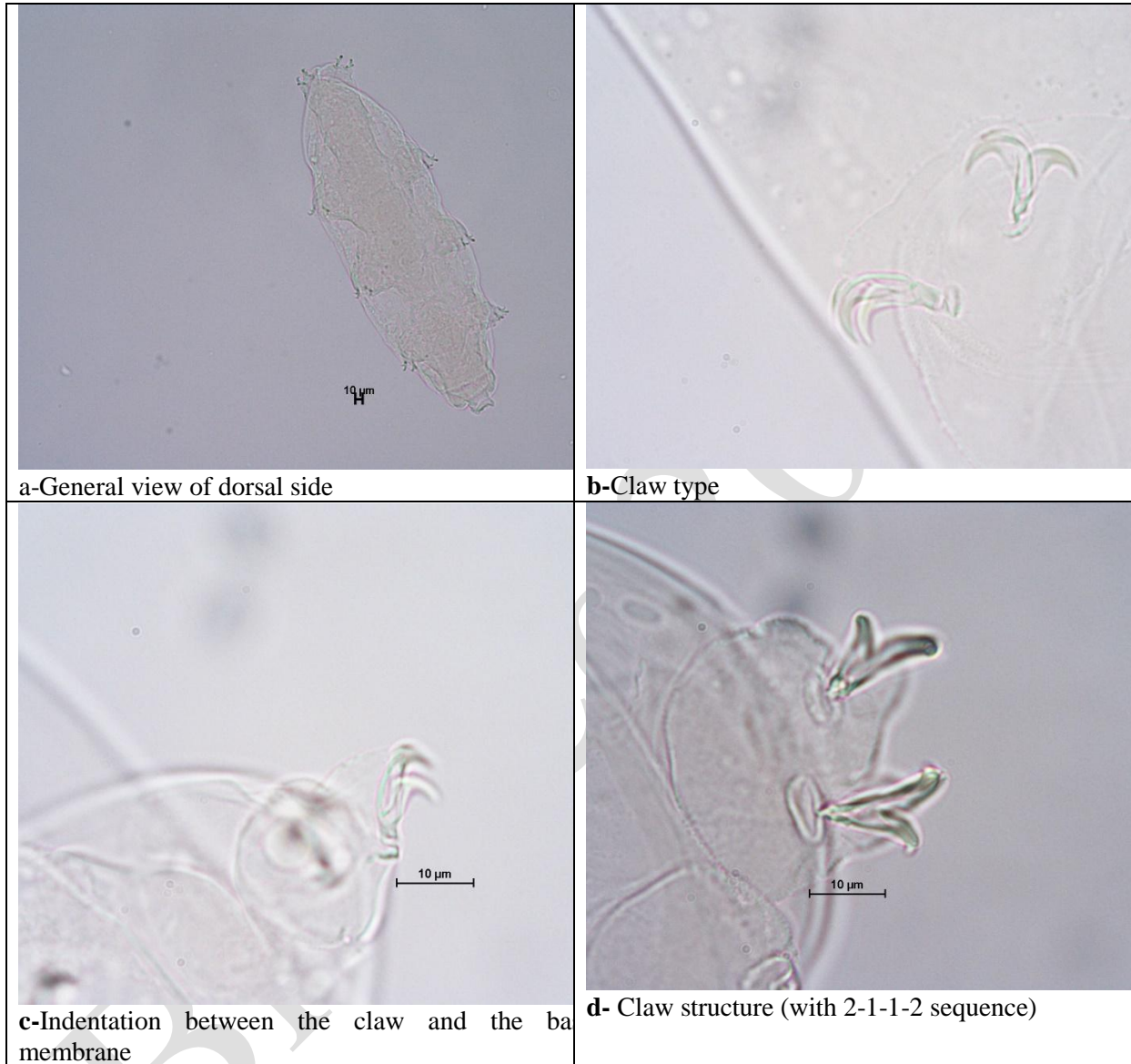


Figure 5. Light microscope images of *Macrobiotus* genus.

Discussion and Conclusion

Based on the information regarding buccal–pharyngeal apparatus, claw structure, mouthparts and morphology of the organism, a total of 66 individuals belonging to Macrobiotidae family were identified including 36 individuals from *Paramacrobiotus* genus, 6 individuals from *Macrobiotus* as well as 24 individuals identified at the family level.

Individuals belonging to *Paramacrobiotus* genus, whose geographical distribution is not yet fully known although they are cosmopolitan species, were recorded with (one species; *Paramacrobiotus richtersi* (Murray, 1911) from Ankara, Antalya, Burdur, Çanakkale, Izmir and Van provinces (Maucci, 1973; 1975; 1978), and again with one species from *Macrobiotus* genus, *Macrobiotus reinhardti* Michalczyk & Kaczmarek, 2003 in Konya (Kaczmarek et al., 2012).



In general, both genera are cosmopolitan species and their exact geographical distribution is not known. According to the data obtained at the genus level as a result of the study, *Macrobiotus* sp. and *Paramacrobiotus* sp. species are the first records in Eskişehir Province. Individuals from these two genera were recorded previously in Ankara, Afyonkarahisar and Bolu provinces which have land borders with Eskişehir. These two genera, whose distribution is not clearly known, are new records for Eskişehir province. As a result of field studies carried out in the Meselik Campus of Eskişehir Osmangazi University during the spring period, identification of species and the collection of taxonomic characters such as eggs could not be performed due to lack of adequate equipment (phase contrast microscope, electron microscope), and the identifications were done at the genus level. Undoubtedly, the determination at the genus level is not a sufficient taxonomic level to reveal the fauna structure of a region. However, there are scarcely any studies regarding Tardigrada and people working in this field in our country. Moreover, no research has been done on the Meşelik Campus before. Therefore, any kind of data obtained is valuable and can give an idea for the studies that are planned to be carried out in the future.

References

- Morgan, C.I. (1977). An Annotated Catalogue of Tardigrada in the Collections of the Royal Scottish Museum, Edinburgh. *Natural History*, 5, 1-29.
- Maucci, W., & Ramazzotti, G. (1981). Adorybiotus gen. nov.: nuova posizione sistematica per *Macrobiotus granulatus* Richters, 1903 e per *Macrobiotus coronifer* Richters, 1903 (Tardigrada, Macrobiotidae). *Memorie dell' Instituto Italiano di Idrobiologia, Pallanza*, 39, 153-159.
- Binda, M.G. (1988). Redescrizione di *Macrobiotus echinogenitus* Richters, 1904 e sul valore di buona specie di *Macrobiotus crenulatus* Richters, 1904 (Eutardigrada). *Animalia*, 15, 201-210.
- Bertolani, R., Guidetti, R., Jönsson, K.I., Altiero, T., Boschini, D., & Rebecchi, L. (2004). Experiences with dormancy in tardigrades. *J Limnol*, 63(1), 16-25.
- Bertolani, R., & Rebecchi, L. (1993). A revision of the *Macrobiotus hufelandi* group (Tardigrada, Macrobiotidae), with some observations on the taxonomic characters of eutardigrades. *Zoologica Scripta*, 22, 127-152.
- Dastych, H. (1988). Tardigrada of Poland. *Monografie Fauny Polski*, 16, 1-255.
- Degma, P., Bertolani, R., & Guidetti, R. (2017). Actual checklist of Tardigrada species (2009-2017, 32th Edition: 01-06-2017). <http://www.tardigrada.modena.unimo.it/miscellanea/Actual%20checklist%20of%20Tardigrada.pdf>. p. 36.
- Kaczmarek, Ł., Jakubowska N., & Michalczyk, Ł. (2012). Current knowledge on Turkish tardigrades with a description of *Milnesium beasleyi* sp. nov. (Eutardigrada: Apochela: Milnesiidae, the granulatum group). *Zootaxa*, 3589, 49-64.
- Maucci, W. (1973). Tardigradi muscicoli della Turchia. *Memorie del Museo Civico di Storia Naturale di Verona*, 20, 169-221.
- Maucci, W. (1975). Tardigradi muscicoli della Turchia (secondo contributo). *Bollettino Museo civico Storia naturale, Verona*, 1, 255-275.
- Maucci, W. (1978). Tardigradi muscicoli della Turchia (terzo contributo). *Bollettino Museo civico Storia naturale, Verona*, 5, 111-140.
- Maucci, W. (1979). I *Pseudechiniscus* del gruppo *cornutus*, con descrizione di una nuova specie (Tardigrada, Echiniscidae). *Zeszyt Naukowe Uniwersytetu Jagiellońskiego, Prace Zoologiczne Krakow*, 25, 107-124.
- Maucci, W. (1980). Analisi preliminare di alcuni dati statistici sulla ecologia dei tardigradi muscicoli. *Bollettino del Museo Civico di Storia Naturale, Verona*, 7, 1-47.
- Maucci, W. (1981). Analisi di alcune biocenosi relative a Tardigradi muscicoli. *Bollettino del Museo Civico di Storia Naturale, Verona*, 8, 67-83.
- Maucci, W. (1985). Materiali per una revisione del genere *Echiniscus* Schultze, 1840. I. Il complesso blumi (Heterotardigrada, Echiniscidae). *Bollettino del Museo Civico di Storia Naturale, Verona*, 12, 109-139.
- McFatter, M.M., Meyer, H.A., & Hinton, J.G. (2007). Nearctic freshwater tardigrades: a review. *J Limnol*. 66, 84-9.



- Maas, A., & Waloszek, D. (2001). Cambrian Derivatives of the Early Arthropod Stem Lineage, Pentastomids, Tardigrades and Lobopodians- An 'Orsten' Perspective. *Zool. Anz.*, 240, 451-459.
- Nelson, D.R. (2002). Current status of the Tardigrada: Evolution and Ecology. *Integr Comp Biol.*, 42, 652-9.
- Ramazzotti, G., & Maucci, W. (1983). Il Phylum Tardigrada. *Memorie dell'Istituto Italiano di Idrobiologia, Pallanza*, 41, 1-1012.

BIOECO2019



How plant strategy types change in coastal wetland from dune to reeds?

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Abstract

Coastal wetlands have a fluctuating structure, so they are dynamic environments. Plant individuals adjust themselves phenologically, physiologically or morphologically to environment. In the present study, we aimed to determine distribution of CSR (competitive, stress-tolerant, ruderal) strategy types in coastal wetland from dune to reeds areas. This area contains dune, *Juncus* ssp. reed, *Thypha angustifolia* reed and transition area between dune and reeds. Field study was carried out between 2015-2017 years. Specific leaf area (SLA), canopy height, dry matter content, leaf dry weight, lateral spread, flowering initiation and flowering period were used to determine CSR strategy types. Bray-Curtis similarity matrix and SIMPER analysis were used to determine the similarity/dissimilarity in study area. Correspondence Analysis (CCA) was used to analyse distribution of CSR strategy types. It was determined that the distribution of CSR types changed between different areas. Competitive (C) strategy type was dominant in *T. angustifolia* reed, while C/SC, CR and C/CSR in *Juncus* ssp. reed, S/SR, R and R/CR in transition area and C/CR, R and R/CR in dune area. The similarity percentage was 88.71% for *T. angustifolia* reed, 86.38% for *Juncus* ssp. reeds, 75.65% for transition area and 65.20% for dune area. These results show that there are disturbance situations in dune and transition areas. On the other hand, the reed areas have suitable conditions for plant survival, so competitive species become dominant in these areas.

Keywords: CSR strategy types, Reeds, Dune, Coastal wetland



Biodiversity and honey bee diseases in Algeria

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Abstract

The honey bee, *Apis mellifera*, is the most economically valuable pollinator of agricultural crops worldwide. Total honey bee populations have decreased in the last years around the world including in Algeria. Multiple factors including habits and nutrition, bee management practices, pesticides, pests and diseases play a role in causing this decline. The present study was conducted in different regions of Algeria and the honey bee genetic diversity was first investigated using mitochondrial DNA and microsatellite loci and their health status was also investigated. The screening was concerned microsporidia, protozoa, mites, bacterial pathogens and viruses. The analyses provide genetic evidence of the African origin of Algerian honey bee populations and showed that they are characterized by a higher level of genetic variation. Concerning honey bee health, the studies revealed the presence of the mites *Varroa destructor* and *Acarapis woodi*; the microsporidia *Nosema ceranae*; the bacteria *Paenibacillus larvae*; the protozoa *Apicystis bombi* and *Crithidia mellificae* and eight viruses were detected. In addition, a parasitism of a phorid flies species: *Megaselia scalaris* (Diptera: Phoridae) and *Senotainia tricuspis* (Diptera: Sarcophagidae) was reported in honey bees. Despite the presence of multiple virus infections and pathogens in the colonies screened, these colonies showed no obvious clinical signs of diseases. These data will contribute to the growing knowledge concerning bee pathogens and conservation measures will be needed to prevent the loss of these native honey bees and to preserve their biodiversity.

Keywords: *Apis mellifera*, Biodiversity, Health, Pests, Diseases, Algeria



Stakeholder Analysis of the Artificial Reefs in Edremit Bay (Northern Aegean), Turkey: Contributions to management

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Abstract

Artificial reefs (ARs) have been used in fisheries enhancement and management during recent decades. Besides, ARs generate welfare increasing services for their users and non-users. This study was conducted to represent a stakeholder analysis of users and non-users of the ARs in Edremit Bay (Northern Aegean Sea), Turkey. We contacted commercial fishermen, recreational fishermen, heads of fishery cooperatives, owners of fishing equipment shops and owners of SCUBA diving centers by using specifically designed separate semi structured questionnaire forms. The study was conducted in the northern coastal towns of Edremit Bay called Altınoluk, Güre and Küçükkuyu. We described characteristics, interactions, problems and conflicts of users and non-users of the ARs. Our analysis revealed some problems emerged by the absence of a management plan of the ARs. However; these problems are very likely to be eradicated by a well-designed local and national management scheme. In addition, commercial and recreational fishermen are ready to contribute to the AR management as their livelihoods are mostly dependent on the ARs. Furthermore, the small scale commercial and recreational fisheries sectors have a future potential for greater socioeconomic activity as well as lobbying and engagement. Our analysis would be useful for managers to deeply understand each AR stakeholder through the establishment of a consistent AR management plan.

Keywords: Artificial Reefs, Management, Stakeholder Analysis, Edremit Bay, Turkey

Introduction

During the last few decades, artificial reefs (ARs) have been used for the purpose of habitat conservation, stock enhancement, prevention from illegal fishing, coastal zone management where intensive anthropogenic activities exist (Seaman and Sprague, 1991; Bortone et al., 2011). ARs deployed on the seabed to conserve sensitive marine habitats or to augment and contribute to the productivity of resources, have positive effects on commercial and recreational fishing (Seaman and Sprague, 1991). In addition to habitat and fisheries enhancement, ARs create services for recreational activists on-site such as SCUBA divers, making AR very important both economically and socially (Roberts et al., 1985; Milon, 1988a; 1988b; 1988a; 1989b; Ditton and Baker, 1999; Ditton et al., 2001; Morgana et al., 2009; Oh et al., 2008; Pendleton, 2004).

AR practices in Turkey have increased in recent years during which considerable attention has been paid to the limited biological and technical research (Lök, 1997; Düzbastılar, 2003; Ulaş, 2007; Lök and Gül, 2005, Tiryakioğlu, 2008). In the Mediterranean countries, the lack of socioeconomic studies on ARs results in uncertainty about the effects of AR deployments on user and non-user groups. Therefore, socioeconomic studies of AR areas should be conducted to provide baseline information for interested parties particularly decision makers. Understanding the perception and attitudes of user and non-users towards the ARs would also be key for the success of the deployment (Ramos et al., 2011; 2019;



Kirkbride-Smith et al., 2013; Tunca et al., 2016;). Also, socio-economic and environmental targets have to be considered carefully and related data should be collected (Milon et al., 2000; Ramos et al., 2007).

In this study, we conducted a stakeholder analysis to illustrate main characteristics, interactions, problems and conflicts of users and non-users of the ARs in Edremit Bay (Northern Aegean), Turkey. This illustration would be useful for managers to better-understand each AR related group in establishing proper AR management plan.

Materials and Methods

Study Site

This study was conducted for the first AR project in Edremit Bay that supported under the Turkish National Artificial Reef Program that has been prepared by The Ministry of Food, Agriculture and Livestock (Ministry of Agriculture and Forestry since 2008. The main objectives of this AR deployment were not significantly different from the previous ARs deployed in other coastal areas of Turkey. The main objectives were: (1) to support small-scale and traditional fisheries, (2) to create new sites for recreational fishing and diving, (3) to protect biodiversity, especially in the littoral zone, (4) to protect fish-spawning and nursery areas (e.g., *Posidonia* meadows) from illegal trawling. The deployment started in 2011 and finished in 2012. The deployment budget was approximately US \$2 million and about 7,000 concrete units with an approximate total volume of 25,000 m³. The AR units were placed in a 0.5 km 'strip' along 15 km of coastline covering a total area of 7.5 km².

Data Collection and Analysis

30 commercial fishermen (CF) and 50 recreational fishermen (RF) in each town, with total numbers of 90 CF and 150 RF, were queried via face-to-face interviews. Additionally, 2 diving centers, 9 fishing equipment shops and 3 heads of fishery cooperatives were surveyed. The sampling was carried out from October to December, 2014 in Altınoluk, Güre and Küçükkuşu. The data was collected from CF and RF (shore-based and boat-based) before, after and during the commercial fishing and recreational fishing activity via on site face-to-face interviews using questionnaire forms on fishing sites or on access points. A fixed number of 30 CF and 50 RF were randomly interviewed at each town in order to get a representative sample of fishing and socioeconomic indicators by site and commercial and recreational fishing modalities. Also, the heads of fishery cooperatives, the owners of diving centers and fishing equipment shops were queried via specifically designed questionnaire forms in each town.

Stakeholder Analysis

In our stakeholder analysis, we defined basic characteristics, interactions, problems and conflicts of stakeholders in the study site. Such information was assumed to be useful for managers to understand each group in especially constructing necessary management rules as well as through the all phases of the AR project.

Results

Overview

The AR deployment in Edremit Bay is likely to generate great interest among multiple stakeholder groups with diverse and conflicting values and opinions surrounding usage of the AR site. To deal effectively with these groups and to foster a participative approach to decision-making, managers need to identify and understand stakeholder groups and their values. Below, the major stakeholders and their interest in the Edremit ARs were identified (Table 1; Table 2; Table 3).

ARs have been deployed by the Ministry of Food, Agriculture and Livestock with a direct attempt by the head of Altınoluk Fishery Cooperative and the researchers from Ege University, Faculty of Fisheries. Behind, there are two fishing towns under exposure of the deployment area, one is Küçükkuşu of which the head of the cooperative was not willing to accept the deployment, and he did not agree any



deployment in their fishing zone, and the other is Güre which had not a fishery cooperative during the planning of ARs. In 2013, they also established a fishery cooperative and the head did not agree with the deployment of ARs close to their fishing areas. However, Güre fishermen were willing to have ARs in or close to their fishing sites according to the personal communications during the on-site surveys.

There were also diverse range of groups and organizations including: shore-based and boat-based RF, and SCUBA diving groups, government management agencies (including fisheries, coast guards and environmental protection agencies), researchers (universities and institutes), community groups, and private businesses (e.g. dive operators; fish equipment shops).

In this project, ARs were proposed and promoted primarily by small scale fishermen under directions of the authorities of the ministry, fishing and diving interests and, secondly, for protection from trawlers. However, exclusion of well-established commercial dive-tour operators and considerable number of recreational fishers from such an AR project, it was unlikely that these groups may promote AR development and did not have the chance to participate in this AR program. More likely, local fishermen especially the ones in Altınoluk Fishery Cooperative would go on lobbying in government meetings to take the lead on AR projects.

Commercial fishermen

Commercial fisheries in three fishing towns (Altınoluk, Küçükkuyu and Güre) have great social and economic values comprise over 150 professional fishers. Therefore, increase in the recreational take of shared fish stocks in the ARs resulted in conflicts between CF and RF. Moreover, inexistence of an agreement on the commercial and recreational user rights of the AR zone resulted in conflicts among commercial and recreational fishermen. The uncertainty about the use rights of ARs is also an issue of concern among the CF in the region.

Recreational Fishermen and SCUBA Divers

RF and SCUBA divers are usually the primary direct users of ARs, and would also be the primary users of ARs that were deployed in Edremit Bay. Fishers and divers using ARs in Edremit Bay would likely be a mix of local residents and non-local tourists accessing the ARs on either private or commercial vessels. RF and divers in three towns had very positive attitudes towards ARs; however, in Altınoluk, the attitudes, preferences, and opinions of RF and recreational divers regarding ARs in Edremit Bay were previously assessed by Tunca et al. (2016).

Further, in three towns, there are approximately 500 shore-based and boat-based RF (~10% boat based; ~50 vessels only exist in Altınoluk), excluding high seasons, who are active both in summer and winter seasons. RF were complaining about the high port prices that were taken by fishery cooperatives (fishery cooperatives in three regions have rights to operate ports). Especially, boat-based RF sometimes had conflicts with CF because of overlapping times of site use.

There was one diving association which was established in 2009, and it was only active for its members in summer periods. The diving association organizes diving by the Altınoluk Diving Center. Up to now, more than 300 dives were realized by this club within the AR site. The club was conducting diving activities by five divers in each group. The price of one dive was 8,5 €.

The club had ultimately 25 members, and it has a diving instructor who has 15 years of diving experience and who is also the founder of the club. Most of the members have diving license of CMAS (World Confederation of Underwater Activities). Apart from SCUBA diving activities organized by the members, the club organizes introducing dives for native and foreign tourists. According to the personal communication with the head of the club, the SCUBA divers were ignored during the AR project planning phase, and this situation resulted in loss of great direct and indirect economic gains by SCUBA diving activities. Furthermore, there is tendency to organize diving tours to the AR site. Today, the diving club operates as a commercial diving center. There is also one another diving club queried during the survey.

Tourism and related businesses

Domestic tourism is one of the largest commercial activities in Edremit Bay, generating great income to local people. Interests such as local and fishing charters dives as well as fishing equipment stores, and other indirect businesses such as hotels and restaurants could potentially benefit from the AR



development in the region. There are currently few RF Charter operators in Edremit Bay with a considerable number of non-licensed tour organizers who are mostly artisanal fishermen and more than 5 fishing equipment shops, numerous restaurants and cafes which are affected by RF and divers especially coming far away. These stakeholders could also potentially encounter negative consequences if AR deployment results in changes of use patterns in Edremit Bay, particularly if changes result in movement of tourism dollars within the region rather than attracting additional tourism to the area.

Management authorities

Responsible authorities for managing AR site and the activities which occur in the area are also major stakeholders in decisions concerning ARs. The management responsibility of ARs in Edremit Bay is under the control of General Directorate of Fisheries and Aquaculture. The directorate is responsible for policy setting and decision making regarding the management of ARs. They are also responsible for seeking compatibility of deployment, management of ARs with the existing national and international legal instruments.

Environmental organizations

The ARs may attract a great deal of attention from environmental organizations as in other cases worldwide. Environmentalists may place high value for the ARs in Edremit Bay and they are concerned primarily with resource preservation and protection. In our case, there wasn't any participation from an environmental organization neither in the planning nor in the management process of ARs in Edremit Bay.

Scientific community

ARs provide a unique opportunity to study ecological and socioeconomic processes, and are being used for research purposes by researchers from universities and institutes. It is likely that marine scientists and economists would value the opportunity to investigate ecological and socioeconomic process associated with ARs, and would likely be called upon to evaluate the ecological and socioeconomic consequences of AR deployment in Edremit Bay. But, to achieve that sufficient time period is needed. Up to now, almost two years which is a short time period, has passed after the AR deployment. Conversely, the scientific community has not yet reached consensus on the ecological benefits of ARs. However, many studies for socioeconomic impact assessment have demonstrated their great direct and indirect economic benefits, especially, in the US. In the planning phase of current AR project, there was lack of participation to the AR project planning meetings by researchers studying different fields such as economics and management. Some members of the scientific community could potentially oppose the use of ARs to enhance fishing and/or diving opportunities and they may conclude that ARs are not an ecologically sound option for Edremit Bay.

Wider community

Many people in the wider community locally, nationally, and internationally hold diverse values regarding the ARs in Edremit Bay. Although understanding the diversity of values held by the wider community regarding the ARs is difficult, it is known that the general public holds strong values related to the protection of the unique environment of Edremit Bay. Edremit Bay, especially the coastline including Altınoluk, Güre and Küçükkuyu, is a highly visited area by mainly domestic but also foreign tourists enjoyed for its aesthetic features. The AR deployment may be perceived as diminishing or raising the aesthetic values of the area.

Discussion

ARs in Edremit Bay have been characterized by an open-access or non-property management under which the advantages of utilization are accessible to anybody beside few zone closures. In spite of the fact that the open access management is no more as broadly implemented, the presumption of open access still wins on a broad range (Cocklin et al., 1998). The AR deployment in Edremit Bay possibly change the management and property and asset utilization rights, which could be gainful to a few clients



and hindering to others. As the project's principal objective is to support small scale fisheries, the priority should be given to commercial fishermen; however, the high numbers of RF around the ARs can pass beyond the importance of commercial fishermen because of principally high participation supported by high catch satisfaction, economic impact and value. Having said that, deploying the ARs on a seabed where commercial fishermen operate may naturally reduce the total benefits of the ARs in the region due to open access and privileged utilization of the sites.

In Europe, ARs are regularly used to avoid trawling from sensitive habitats (Guillen et al 1994; Baine and Side, 2003); in our case, AR cubic structures have also been circled by specifically designed trawl preventing ARs. This is thought to naturally limit the access of trawlers into the ARs but does not keep them far away from the ARs. During the survey, it was determined a number of trawlers have been fishing so close to ARs as well as attracting fishes. Therefore, this type of ARs should be supported by better surveillance and inspections. Another issue is purse seiners that are allowed to fish in Edremit Bay. Purse seiners, as in the case of the trawlers, have also been fishing around the ARs by using light to attract fish. Changes to property and asset utilization rights can be realized through management of ARs. Commercial fishermen are frequently excluded from utilizing ARs (Branden et al., 1994), and numerous ARs deployed and managed for diving exclude both commercial and recreational fishing, as in the case of the HMAS Swan (Dowling and Nichol, 2001) and the HMAS Brisbane (QEPA, 2005). Therefore, in the future, the same situation may possibly occur for our case because there is high possibility for future conflicts among small scale, recreational and large-scale fishers. Furthermore, restrictions on utilization of ARs in the Edremit Bay (the assignment of the part of the ARs as a protected zone) may attract the institutional and human use in the region (Cocklin et al., 1998). Considerable amount of stakeholder allegations was observed during the on-site surveys when resource-use rights are changed. Especially, existing restrictions prepare grounds for conflicts because of mainly lack of participation of principal user stakeholders in the region, commercial fishermen and RF, into the management decisions. Specifically, exclusion of CF and RF from ARs can possibly be understood by few fishers as further disintegration of fishing rights in the fishing zone. Similar to other aquatic environments, ARs may require some degree of management either to assure that they provide the desired outcomes for both biological resources and the users. Additionally, effective management can help reduce potential risks such as damage to fishing gears, injuries to recreational divers, decomposed materials or movement of the AR units off-site. Therefore, an adequate management plan should be developed before the deployment of an AR and should be implemented during the whole AR project.

This plan should include simple actions, such as indication of the ARs' location on nautical maps to avoid damages to fishing gears and providing diver safety guidelines to prevent injuries to people diving at the AR, as well as establishment of technical measures aimed to regulate access and exploitation at the AR site. Physical, biological and socio-economic monitoring are key elements of the management plan as it allows to assess the structural performance of the ARs on time, to analyze whether the ARs provide expected benefits from the ecological and economic point of view and to evaluate the efficiency of the applied control measures. The involvement of stakeholders in the AR management plan is crucial. CF, RF and divers can support AR monitoring and evaluation. Applied research is another key element in AR management programs to providing assistance in monitoring activities on the AR site by evaluating the efficiency of the adopted management measures and, where necessary, by identifying actions to be undertaken as alternative management options. ARs for recreational use are normally introduced to meet a demand which originates from the absence of such opportunities in a specific area. ARs in Edremit Bay turn into the main point of conflict in and across the stakeholder groups (Samples, 1989). Conflict is characterized as an objective interference credited to another's behavior (Jacob and Schreyer, 1980), and has been reported on various AR sites around the world (Samples, 1989; Murray and Betz, 1994). Conflict around the ARs in Edremit Bay, as nearly similar with the cases around the world, can emerge from various issues including: (1) Crowding and congestion; (2) stock impacts; and (3) type of utilization.

Conclusion

To summarize, two years after the \$2 Million valued AR Deployment, our analysis revealed that many problems exist in relation with ARs and local fishery besides their many benefits. However; these problems are very likely to be eradicated by a good, local management scheme. Further, two related stakeholders, fishery cooperatives and diving charter organizations in each town were determined to have high socioeconomic impact and willingness to contribute in the future management of ARs even if they



also agreed on lack of AR management up to now. These problems are more difficult to overcome if management scales are large or a management plan does not exist. In addition, many fishermen and other interested users are ready to contribute to this AR management process because they are aware of its proven biological and economic contribution in the area and most of them are dependent on this local marine ecosystem as a source of livelihood. By taking this and other actions, the reconciliation of small scale commercial and recreational fisheries and AR deployment concerns is possible, because the small scale commercial and recreational fisheries sector represents a powerful source of socioeconomic action, lobbying and engagement. Furthermore, AR fishery in Edremit Bay is a new type of fishery affecting primarily small-scale CF and RF. Proposals are needed to maintain and enhance the fishing capacity of AR fishery while considering the important functions of the AR for conservation of aquatic biodiversity. These include, but are not restricted to: (1) maintaining AR fishery and ecosystem in the face of other aquatic resource developments; (2) investing in small scale and recreational fishery sectors to promote AR fishery and conservation interests by using an integrated approach; (3) identifying a mechanism for AR management by which the fishing operations do not conflict among themselves and with environmental issues; (4) taking into consideration the use of some management tools such as 'zoning' for different types of fishing techniques and other recreational fishing uses (e.g. private boat-based fishers, recreational charters), besides closing areas in the ARs to promote conservation objectives.

Finally, an AR management plan should be formulated with the active participation of all users and interested parties. Within, there is a need for renewed AR guidelines that are easily understandable by stakeholders and fisheries managers. In particular, these guidelines should be compatible with those produced by organizations such as the General Fisheries Commission for the Mediterranean, to facilitate appropriate management of AR fishery. Then, it is recommended that those updated guidelines for AR deployment should be incorporated into national and local level policy.

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Reference

- Baine, M. and Side J., 2003. Habitat modification and manipulation as a management tool. *Reviews in Fish Biology and Fisheries*, 13:187–99.
- Branden, K.L., Pollard, D.A. and Reimers HA., 1994. A review of recent artificial reef developments in Australia. *Bulletin of Marine Science*, 55 (2–3): 982–94.
- Cocklin C, Craw M and McAuley I., 1998. Marine reserves in New Zealand: use rights, public attitudes, and social impacts. *Coastal Management*, 26:213–31.
- Ditton, R.B. and Baker, T.L., 1999. Demographics, Attitudes, Management Preferences, and Economic Impacts of Sport Divers using Artificial Reefs in Offshore Texas Waters. Report prepared for the Texas Parks and Wildlife Department through a research contract with Texas A&M University, 44 p.
- Ditton, R. B., Thaling, C.E. Riechers, R. and H. Osburn, 2001. The Economic impacts of sport divers using Artificial Reefs in Texas Offshore Waters. *Proceedings of the Annual Gulf and Caribbean Fisheries Institute*, 54: 349-360.
- Düzbastılar, F.O., Tokaç, A., 2003. Determination of effects of artificial reef size on local scouring phenomena resulting from wave action *Ege Journal of Fisheries and Aquatic Science*, 20 (3-4): 373 – 381.
- Guillén, J. E.; Ramos, A. A.; Martínez, L.; Lizaso, J. L. S. 1994 Antitrawling reefs and the protection of *Posidonia oceanica* (L) Delile meadows in the western Mediterranean Sea - demand and aims. *Bull. Mar. Sci.* 55, 645 – 650
- Jacob, G. and Schreyer R., 1980. Conflict in outdoor recreation: a theoretical perspective. *Journal of Leisure Research*. 12:368–80.



- Kirkbride-Smith AE, Wheeler PM, Johnson ML, 2013. The Relationship between Diver Experience Levels and Perceptions of Attractiveness of Artificial Reefs - Examination of a Potential Management Tool. *PLoS ONE* 8 (7): e68899. Doi:10.1371/journal.pone.0068899.
- Lök, A., 1997, Yapay resiflerdeki cezbetmeye karşın üretim hipotezindeki son gelişmeler, *Ege Journal of Fisheries and Aquatic Science*, 14, 1-2: 239-242.
- Lök, A., Gül, B., 2005. İzmir Körfezi Hekim Adası'ndaki deneysel amaçlı yapay resiflerde balık faunasının değerlendirilmesi. *Ege Journal of Fishery and Aquatic Sciences*, 22 (1-2): 109-114.
- Milon, J.W., 1988a. The Economic Benefits of Artificial Reefs: An Analysis of the Dade County, Florida Reef System. Sea Grant Extension Program, University of Florida. SGR-90, Florida Sea Grant College Program, University of Florida, Gainesville, FL. 89 p.
- Milon, J.W., 1988b. A Nested Demand Shares Model of Artificial Marine Habitat Choice by Sport Anglers. *Marine Resource Economics*, 5: 191-213.
- Milon, J.W., 1989a. Artificial Marine Habitat Characteristics and Participation Behavior by Sport Anglers and Divers. *Bulletin of Marine Science*, 44: 853-862.
- Milon, J.W., 1989b. Contingent Valuation Experiments for Strategic Behavior. *Journal of Environmental Economics and Management*, 17: 293-308.
- Milon J.W., Holland, S.M., Whitmarsh, D.J., 2000. Artificial Reef Evaluation with Application to Natural Marine Habitats, Chapter 6: Social and Economic Evaluation Methods, 165-194.
- Morgana, O.A., Massey, D.M., Huth, W.L., Hall, R., 2009. Demand for Diving on Large Ship Artificial Reefs. *Marine Resource Economics*, 24: 43-59.
- Murray, J.D. and Betz, C.J., 1994. User views of artificial reef management in the southeastern US. *Bulletin of Marine Science*; 55 (2-3): 970-81.
- Oh, C, Ditton, R.B., Stoll, J.R., 2008. The Economic Value of Scuba-Diving Use of Natural and Artificial Reef Habitats. *Society & Natural Resources*, 21: 455-468.
- Pendleton, L.H., 2004. Creating Underwater Value: The Economic Value of Artificial Reefs for Recreational Diving, California Artificial Reef Enhancement Program. Prepared for: The San Diego Oceans Foundation. 11 p.
- Queensland Environment Protection Agency (QEPA), 2005. Sink the Brisbane. Environmental Protection Agency/ Queensland Parks and Wildlife Service 2005. Web reference: [/http://www.epa.qld.gov.au/about_the_epa/coming_events/sink_the_brisbaneS](http://www.epa.qld.gov.au/about_the_epa/coming_events/sink_the_brisbaneS). Accessed 22 July 2005.
- Roberts, J.K., Thompson, M.E., and Pawlyk, P.W., 1985. Contingent Valuation of Recreational Diving at Petroleum Rigs, Gulf of Mexico. *Transactions of the American Fisheries Society*, 114: 214-219.
- Ramos, J., Santos, M.N., Whitmarsh, D., Monteiro, C.C., 2007. Stakeholder perceptions regarding the environmental and socio-economic impacts of the Algarve artificial reefs. *Hydrobiologia*, 580: 181-191.
- Ramos, J., Santos, M.N., Whitmarsh, D. and Monteiro, C.C., 2011. Stakeholder analysis in the Portuguese Artificial Reef Context: Winners and Losers. *Brazilian Journal of Oceanography*, 59 (special issue CARAH): 133-143.
- Ramos J, Lino PG, Himes-Cornell A, Santos MN. 2019. Local fishermen's perceptions of the usefulness of artificial reef ecosystem services in Portugal. DOI: 10.7717/peerj.6206
- Samples, K.C., 1989. Assessing recreational and commercial conflicts over artificial fishery habitat use: theory and practice. *Bulletin of Marine Science* 1989;44(2):844-52.
- Tiryakioğlu, F.Ö., 2008. Socio-Economic Evaluation of Artificial Reefs in Aegean Sea, Turkey. University of Portsmouth Business School, Master of Science Dissertation, Portsmouth, UK, 41 pp.
- Tunca, S., Miran, B. and Ünal, V., 2016. Non-Market Economic Value of Artificial Reefs in Edremit Bay (Eastern Mediterranean, Turkey). *Ege Journal of Fisheries and Aquatic Sciences*, 33(2): 97-107. Doi: 10.12714/egejfas.2016.33.2.02
- Ulaş, A., 2007. A pre-study for determining of efficiency of fish sampling methods on artificial reefs. *Ege Journal of Fisheries and Aquatic Sciences* 24(3-4): 287-293.



The Rising Phenomenon in Turkish Marine Protected Areas: Charter Fishing

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Abstract

RF charters in Turkish Marine Protected Areas (MPAs) are becoming popular income generating activity for local people. This study mainly analysed social and economic characteristic of the Recreational Fishing (RF) charters in two MPAs of Turkey. The sampling was carried out from December 2012 to March 2013. 22 RF charter owners in Foça MPA (88% of the total charters, n≈25, in Foça MPA) and 15 RF charter owners in Gökova MPA (15% of total charters, n≈100, in Gökova MPA) were interviewed by a questionnaire form to have social and economic implications of RF charter tours. The results showed there are 16 main species caught during the RF charter tours in both MPAs. Surprisingly mean catch amounts per vessel per tour did not show considerable difference between two MPAs. Annual fuel, repair-maintenance and other expenses of RF tour boats in Foça were found to be higher than the ones in Gökova MPAs. Furthermore, daily RF charter tour fee was found to be difference between two MPAs with a distinct difference by doubling the fee as maximum amount paid for a daily tour in Gökova MPA. European Sea Bass (*Dicentrarchus labrax*), Gilthead Seabream (*Sparus aurata*) and Red Porgy (*Pagrus pagrus*) were three of the species that had lower share in catch amount but, they had the highest shares in total catch value in both MPAs. RF charters tours had substantial biological and socioeconomic impact within the Turkish marine socio-ecological system. Especially, socioeconomic role of RF charters started to expand not only in Turkish MPAs but also along all Turkish coasts but, there are gaps in knowledge and management regarding the issue. Therefore, both fisheries and MPAs management authorities should pay more attention on RF charter activities and their socioeconomic impact.

Keywords: Recreational Charter Fishing, Socioeconomics, Marine Protected Areas, Turkey

Introduction

Recreational fishing (RF) in Turkish Marine Protected Areas (MPAs) are generating new income sources for local people like RF charters. The charter fishing was defined as “RF practiced from a rented boat, with a captain or fishing guide on board, for leisure or sport purposes” (GFCM, 2010). During the last decades, there is a considerable increase in the number of RF charters, especially along the Aegean coasts of Turkey. Both Foça and Gökova MPAs originally have status of special environmental protection area (SEPA), we use MPA term for the marine part of these SEPAs. Particularly, Turkish MPAs including Foça and Gökova have an intense RF use because of their high biodiversity, touristic pressure and geographical locations (Tunca et al., 2016). In many developing countries around the world, there is a tendency from small-scale commercial fisheries towards RF (Ditton, 2008; Ellender et al., 2010), and as a developing country, Turkey is encountering the same scenario with the increasing number of RF charters. However, there is lack of information about the socioeconomic impact of RF charters in the scientific literature. There are also management gaps in monitoring, control and surveillance of RF charters in Turkey. Anyhow, this scene in Turkey can be considered as an indicator for a positively growing economy that increase wellness of nationals with leisure time and touristic trade (FAO, 2009).

RF charters in the United States had positive direct and indirect market returns to the nation with increased income, employment and services (Steinback, 1999). Although economic impacts of charter fishing to coastal communities has not been studied in elsewhere in Turkey, there is some evident that charter fishing is becoming an important contributor to the local economies of coastal rural especially



where MPAs exist. The number of charter fishing boats reached approximately 100 in Gökova MPA and 25 in Foça MPA. The annual number of charter tours and anglers attending these tours have been increasing year by year.

In this study, we investigated first time socioeconomic and fisheries indicators of RF charter boats with their owners in two important Turkish MPAs. The main goal of this work was to attract the attention of decision makers on this relatively new commercial activity, which recently has been rising along the Turkish coasts especially in MPAs.

Material and Method

Study Site

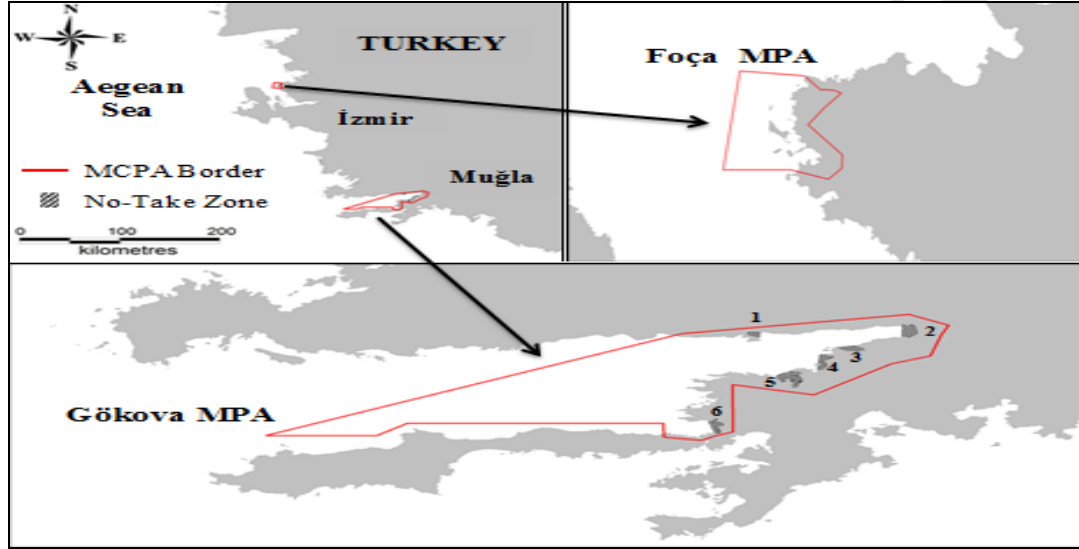


Figure 1. Study Sites and No-Take Zones: 1: Akbük 2: Akyaka, 3: Çamlı, 4: Boncuk, 5:İngiliz Limanı, 6: Bördübet (Tunca et al., 2016)

Both of the study sites, Foça and Gökova MPAs (Figure 1), have a Special Environmental Protection Area (SEPA) status; however, in this paper, we utilized Marine Protected Area (MPA) term as it was commonly named in the literature (McPhee et al., 2008). The primary study site, Foça MPA, essentially because of the presence of endangered monk seal (*Monachus monachus*) population, was allowed SEPA status in 1990. Foça MPA is Turkey's smallest MPA (Kıraç and Güçlüsoy, 2008); it has an aggregate region of 71.44 km² and is situated in Izmir Province, 70 km from the provincial capital. The second study site, Gökova MPA, was announced a SEPA in 1988. It is situated in Muğla Province and is 27.7 km from the center of this province. Gökova MPA covers a zone of 576.9 km², making it the biggest MPA in Turkey. In Gökova MPA, there are 6 NTZs, where no marine activities are allowed, with two exemptions that permit shore-based recreational fishers in Akyaka and Boncuk.

Data collection and analysis

Preliminary approach estimates showed that there are 22 owners in Foça MPA and 15 owners in Gökova MPA were queried from December 2012 to March 2013. The data was collected from RF charter vessel owners before, after and/or during the RF charter activity via on-site face-to-face interviews at fishing sites or at access points. The information was gathered from RF charter owners or owners after and/or during the RF charter tours at access site points mainly in the harbours. Additional information on the number of RF licenses in two MPAs were gathered from RF charter organization by face-to-face interviews.

The survey questionnaires gathered information on RF owners' descriptors (gender, age, marital status, education, occupation, monthly income, means of transport, personal assessment of fishing site, RF experience, ownership of RF tourism license, dimensions of RF charter activity and operational revenues



and costs (fuel, repair, maintenance, food others). Mainly, descriptive statistics of the socioeconomic and fishing related dimensions were demonstrated as figures and tables in the results section below.

Results

Descriptive statistics regarding the socio-demographic characteristics of RF charter owners were presented in this section (Table 1). The vessel owners were mostly middle-aged, not showing relevant difference between Foça and Gökova MPAs. Furthermore, most of the fishers in both MPAs had the high school education or above. Considering the fishing and maritime experience of the owners, they all had almost over two decades' period of time in both MPAs. However, RF tour organization activity determined to be less than a decade history for the owners in both MPAs and have not showed great difference between both MPAs. Regarding the marital status of the owners, the majority of the owners were married in both MPAs; However; there were considerable number of single or widowed owners especially in Gökova MPA. RF charter owners' income only from RF charter tours were calculated for two MPAs. In Foça MPA, slightly more than half of the owners stated they have an income around the minimum wage whereas, one third of the owners had wage slightly over the minimum wage. In Gökova MPA, similarly with Foça MPA, the majority of the respondents had wage around the minimum wage. The majority of the owners had commercial fishing as a primary occupation being around one third of the respondents in both MPAs. Moreover, commercial fishing was followed by captain and national/international companies in both MPAs. The majority of the owners was found to have a cooperative membership in both MPAs. Similarly, almost all queried owners had a social security in both MPAs.

Table 1. Socio-demographic Characteristics of RF tour owners in Foça and Gökova MPAs
Mean±StDev, (Min-Max)

	Foça MPA	Gökova MPA
Age (years)	44±12.3 (27-69)	40.9±12 (23-68)
Education (years)	9.6±2.3 (5-15)	10.1±2.3 (5-15)
Fishing Experience (years)	22.1±8.6 (10-45)	20.7±10.6 (1-40)
Maritime Experience (years)	24.8±7.3 (10-40)	19.4±10.8 (1-45)
RF charter Tour Organization Experience (years)	8.7±2.7 (5-14)	8.20±6.5 (1-20)
Marital Status (numbers)	Married: 14; Single: 7; Widow	Married: 9; Single: 3; Widow 3
Monthly Income (by groups) ^{1*}	3.3±0.6 (2-4)	2.8±0.8 (1-4)
Membership to a cooperative %	86.4	86.7
Social Security %	90.9	93.3
Occupation (%)	Public: 9.1; Retired: 13.6; Commercial fisher: 31.8; Captain: 45.5	Public: 13.3; Retired: 20; Commercial fisher: 33.3; Captain: 33.3

StDev: Standard Deviation, Min: Minimum, Max: Maximum, n: in numbers;

^{1*}Income only comes from RF tours: 1: Below 500 TL; 2:501-1000 TL, 3:1001-1500 TL; 4:1501-2000 TL) *Euro/Turkish Liras (TL) 2013 annual mean exchange rate: 1 Euro =2.53 TL

According to the results of the activity (Table 2), the total number of clients did not show great differences between MPAs. But, the annual mean number of fishers per vessel and the mean number of fishers per tour were higher in Foça MPA. The average length of tour boats in Foça MPA was significantly longer than the ones in Gökova MPA. Also, the average engine powers of the boats were quite high in Foça MPA compared to Gökova MPA. In contrast, no difference was observed between the annual numbers of RF tours in two MPAs. The numbers of anchoring per vessel per tour in both MPAs were also similar. In addition, few RF tour owners declared additional services as sale of bait or consumption of catch on the boat. The majority of the boat owners in both MPAs participate in the fishing with the clients. The regular daily RF time showed similarity between both MPAs being slightly higher for



the winter season compared to summer. In parallel with the higher mean RF tour time in Gökova MPA, the average RF zone distance from the port in Gökova MPA was also higher compared to Foça MPA.

Table 2. Indicators on the RF charter tours and vessels in Foça and Gökova MPAs Mean±StDev (Min-Max) / Percentage %

	Foça MPA	Gökova MPA
Number of fishers per tour	11.4±2.6 (5-25)	8.3±2.7 (5-13)
Annual number of fishers per vessel	436.2±130.5 (100-800)	307.6±156.3 (100-600)
Annual number of tours per vessel	38.2±12.7 (20-60)	37.2±13.5 (20-60)
Total annual fishers of all boats	8,738	4,824
Mean annual hours per vessel	3,044.5	2,554.3
Total annual hours of all boats	66,980	38,315
Group participation rate %	99.8±1.1 (95-100)	97±9.2 (65-100)
Discount in group participation %	0	1.3±5.2 (0-20)
Weekend RF tour organization %	95.2±4.8 (90-100)	92.7±6.8 (80-100)
Number of anchoring per tour	4.7±0.8 (3-6)	4.7±0.9 (3-7)
RF tour time during summer	7.1±2.8 (0-10)	7.2±2.5 (0-10)
RF tour time during winter	7.6±1.7 (6-10)	8.6±1.7 (7-10)
Distance from the harbour	3.9±1.7 (3-12)	5±2.5 (3-10)
Vessel Length (m)	14.3±3.3 (10-23)	10.2±3.4 (3.7-15.3)
Engine Power (HP)	139.2±53.9 (69-280)	49±45.7 (9-135)

There are 16 main species caught during the RF charter tours in both MPAs (Figure 2). The catch amount of each species except Common Dentex (*Dentex macrophthalmus*) and Chub Mackerel (*Scomber japonicus*) were apparently higher in Foça MPA compared to Gökova MPA. In Foça MPA, the biggest share of catch consisted of Comber (*Serranus cabrilla*), Atlantic Bonito (*Sarda sarrda*), Grey Mullet (*Mugil cephalus*), Black Scorpion Fish (*Scorpaena scrofa*), Common Pandora (*Pagellus erythrinus*), Bogue (*Boops boops*) and Horse Mackerel (*Trachurus trachurus*). In Gökova MPA, Octopus (*Octopus vulgaris*), Squid (*Loligo vulgaris*), Two-Banded Annular Seabream (*Diplodus vulgaris*) and Annular Seabream (*Diplodus annularis*), Common Dentex (*Dentex macrophthalmus*) and Chub Mackerel (*Trachurus trachurus*) were found to be the biggest contributors of the total catch. Catch value of species showed differences between MPAs. Common Pandora (*Pagellus erythrinus*), Gilthead Seabream (*Sparus aurata*), European Sea Bass (*Dicentrarchus labrax*) and Red Porgy (*Pagrus pagrus*) got the top species contributing total income in Foça MPA whereas, Gilthead Seabream (*Sparus aurata*), European Sea Bass (*Dicentrarchus labrax*), Common Pandora (*Pagellus erythrinus*), Red Porgy (*Pagrus pagrus*) and Common Dentex (*Dentex macrophthalmus*) got the highest value shares in Gökova MPA (Figure 2).

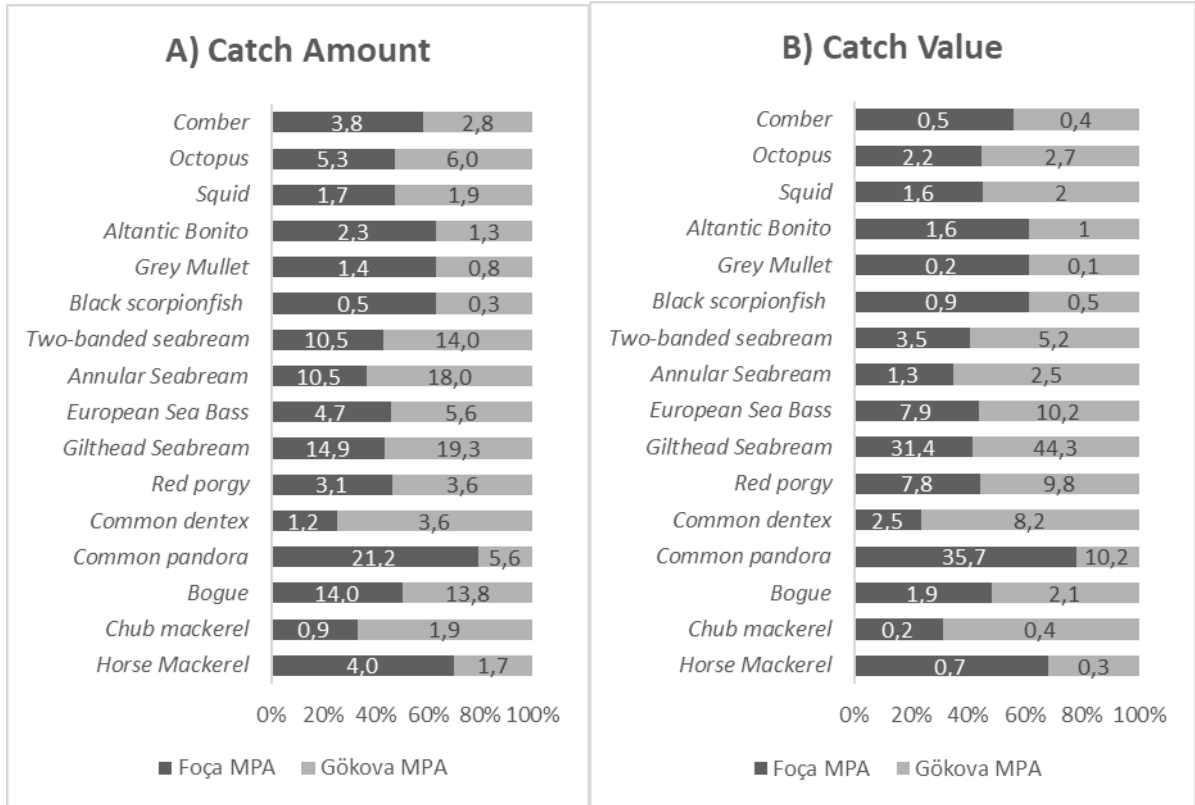


Figure 2. A) Catch amount and B) value share by species in Foça and Gökova MPAs

Mean catch amounts per vessel per tour were similar in two MPAs. However, the maximum amount caught per vessel per tour was significantly higher in Foça MPA. Similarly, total catch amounts of all queried vessels in Foça MPA was around 2 tonnes higher than Gökova MPA (Table 3). Annual fuel, repair-maintenance and other expenses (Table 3) of RF tour boats in Foça were found to be higher than the ones in Gökova MPAs. The mean engine power of boats in Foça MPA was higher by showing similar trend with the money spent for fuel in both MPAs. Also, the fee paid for an individual daily RF charter tour was found to be similar for both MPAs with a distinct difference by doubling the fee as maximum amount paid for a daily tour in Gökova MPA.

Table 3. Costs and benefits of RF charters in Foça and Gökova MPAs Mean±StDev (Min-Max) TL*.

	Foça MPA	Gökova MPA
Fuel	2,240.9±4,171.2 (150-15,000)	1893.3±3,693.1 (150-15,000)
Repair and maintenance	4,568.2±5,215.1 (1,000-20,000)	4,100±4,610.6 (1,500-17,000)
Other	930.2±490.5 (0-1,300)	600-500.4 (0-1,000)
Annual expense per vessel	7,739.27	6,593.33
Tour fee per fisher	42.5±8.4 (30-50)	45.67±17.9 (25-100)
Annual number of fishers per vess	436.2±130.5 (100-800)	307.6±156.3 (100-600)
Annual gross income	18,538.5	14,049.9
Annual net income	10,799.2	7,456.6
Mean catch per vessel	6.1±2.1 (3-10)	5.7±2.6 (3-10)
Maximum catch per vessel	14.9±5.5 (10-30)	11.9±7.9 (6-30)
Total catch amount for all vessel	6,592	4,774

*Euro/Turkish Liras (TL) 2013 annual mean exchange rate: 1 Euro =2.53 TL

No equipment or related selling activity was observed in both MPAs. Few bait sales were reported in both MPAs with a slight difference for Foça MPA where sales were higher than in Gökova MPA. RF



activity, not only for the vessel hirers but also for the vessel owners, is commonly practiced together with the hirers during the RF tours. Furthermore, consumption of the catch on the vessel was also observed for few vessels in both MPAs (Table 4).

Table 4. Percentage share of other activities related to the RF tours in Foça and Gökova MPAs

	Foça MPA	Gökova MPA
Fishing equipment sell	0	0
Bait Sell	25.5	13.3
Instruction for RF	0	0
Catch with the fishers	90.9	93.3
Consumption on the vessel	18.2	20

Discussion

The current study illustrated first time information on social and economic dimensions of RF charters in two Turkish MPAs. The results were compared between these MPAs. The socio-demographic profile of the operators did not show considerable differences between MPAs. On the other hand, main differences were observed in catch, effort, vessel characteristic and economic indicators.

Considering catch composition, the fishing activity did not vary much between MPAs. The fishers on the RF charters target certain species with almost similar types of fishing gear including hand-lines, rod and lines as it was observed for boat fishers in the previous study (Tunca et al., 2016). In terms of the highest amount and value shares in total catch, Common Pandora and Gilthead Seabream were two leading species in Foça and Gökova MPA, respectively.

Middle aged profile of the owners in both MPAs were also similar to the fishers coming into this site and other sites in the Mediterranean and the Black Sea (Morales-Nin et al., 2005; Lloret, 2008; Veiga et al., 2010; Ünal et al., 2010; Tunca, 2012; Aydın et al., 2013; Tunca et al., 2016). Further similarities in RF experience, being lower than a decade, were also observed between the fishers and the owners in both MPAs (Tunca et al., 2016). Regarding the fishing and maritime experience of the owners, almost all of them had over two decades' experience in both MPAs by being slightly higher for the owners in Foça MPA. However, the beginning of the charter fishing tours was dating back to a decade ago for the owners in both MPAs and has not revealed a significant difference between MPAs.

RF charters proved its magnitude and importance in two sites. Mean catch amounts per vessel per tour did not show considerable difference between two MPAs; however, the maximum amount caught per vessel per tour was significantly higher in Foça MPA. Similarly, total catch amounts of all queried vessels in Foça MPA was around 2 tonnes higher than Gökova MPA. This difference would be expected considering the difference in the number of queried owners that were higher in Foça MPA.

Catch composition in both MPAs did not show great difference compared to the results of the previous study conducted on shore and boat fishers in both MPAs. Sparids in both Foça and Gökova MPAs were dominantly caught species that represents the similar habitat types of species in both MPAs (Lombarte et al., 2012). According to the results of Tunca et al. (2016) grey mullet was not dominated in total catch share as this species mostly caught by shore fishers in Gökova MPA.

Although travel distance for fishing in Foça MPA was slightly less than travel distance for Gökova MPA, the high engine power in Foça MPA is the result of using vessel that were formerly used for trawl fishing or other fishing methods. Therefore, the engine sizes of these boats were much higher compared to the others. Furthermore, this difference in Foça MPA also resulted in higher annual expenses per vessel compared to the vessels in Gökova MPA.

The majority of the RF charter vessels was also active for summer touristic site tours. The potential of considerable RF charter demand exists in two MPAs as the results showed its profitability being the gross income and net income per tour boat reasonably high in both MPAs. There were 3 highly biased/unreal responses for the annual costs of the vessels determined during the study that is showing the high negative returns of charter fishing. But, almost doubled income results in Foça MPA may apparently be the result of difference between the life costs in Muğla and İzmir provinces where MPAs are located.

A number of differences were observed for catch amount and value shares between MPAs. Although, Annual Seabream and Two-Banded Seabream catch amounts considerably contributed to the total catch in both MPAs, the similar contributions were not observed for the total value in both MPAs.



Similar cases were also observed for Bogue and Horse Mackerel. In contrast, European Sea Bass, Gilthead Seabream and Red Porgy were three of the species that had lower share in catch amount but, they had the highest shares in total catch value in both MPAs. Common Pandora was the only species that got the highest shares in both catch amount and value in Foça MPA whereas, Gilthead Seabream led both the catch amount and value in Gökova MPA.

Lastly, if we compare commercial fishing catch value and recreational fishing charter catch values in both MPAs, total annual catch value from queried vessel owners in Foça MPA reached over 150,000 €. Previously estimated commercial value for Foça MPA reached around 4.5 Million Euros (Bann & Başak, 2011a). Additionally, market value of catch by 130 shore-based and boat-based fishers in Foça MPA were previously reported as over 20,000 € (Tunca et al., 2016). In Gökova MPA, catch value by charter fishing vessels reached over 80,000 €; however, market value of catch by 130 shore-based and boat-based fishers in Gökova MPA reached over 5,000 € (Tunca et al., 2016). In addition, total commercial landing value for Gökova MPA was previously reported as 230,000 € (Bann & Başak, 2011b). As we see from the numbers above, there is exact bias and underestimation due to under reporting and research biases. It is apparent that all kinds of RF activities provide a huge market value through catch although sales, expenditures, jobs generated by RF were not mentioned and investigated in detail.

Conclusion

The economic role of RF charters does matter in both MPAs. There are considerable amounts of recreational tour captains and vessel owners organize RF tours except the summer season. Additionally, the existence of commercial fishermen raises a debate on if RF tours are generating extra income for commercial fishermen or not. Some fishermen left commercial fishery and bought a charter fishing boat. At weekends, hundreds of recreational fishing enthusiasts go fishing by dozens of charter boats. It is now evident that small-scale fishermen have a new partner named “RF Charters”, on their fishing grounds. Welcomed or not they are the users of both area and living resources. They are the fisheries stakeholders anymore, and the principles of monitoring, control, and surveillance should be implemented to them as well by also including their activities in management schemes under fisheries and maritime law. In addition to the socio-economic effects of the issue, it is also necessary to investigate its ecological and biological effects.

Acknowledgements

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References

- Bann, C., Başak, E. 2011a. The economic analysis of Foça Special Environmental Protection Area. Economic Assessment reports for Foça and Gökova in the framework of environmental economics principles. Project PIMS 3697: The Strengthening the System of Marine and Coastal Protected Areas of Turkey. Technical Report Series 2: 76 pp.
- Bann, C., Başak, E. 2011b. The economic analysis of Gökova Special Environmental Protection Area. Economic Analysis reports for Foça and Gökova in the framework of environmental economics principles. Project PIMS 3697: The Strengthening the System of Marine and Coastal Protected Areas of Turkey. Technical Report Series 3: 80 pp.
- Ditton, R.B., 2008. An international perspective on recreational fishing. p.1-376. In: Global Challenges in Recreational Fisheries. Ystein, A. (Ed). Oxford, UK, Blackwell.
- Ellender, B. R., Weyl, O. L. F., Winker, H., Stelzhammer, H., & Traas, G. R. L. (2010). Estimating angling effort and participation in a multi-user, inland fishery in South Africa. *Fisheries Management and Ecology*, 17(1), 19–27. <http://doi.org/10.1111/j.1365-2400.2009.00708.x>
- EIFAC Code of Practice For Recreational Fisheries., 2008. SEC/EIFAC/ OP42. FAO. Rome,



- Aydın, M., Tunca, S., Karadurmuş, U., Durgun, D., 2013. Valuation of recreational fishing benefits: A snapshot from Ordu, Turkey. *Ege J Fish Aqua Sci* 30(4): 147-154. doi: 10.12714/egejfas.2013.30.4.01
- Diogo, H. and Pereira, J.G., 2013. Recreational Boat Fishing Pressure on Fish Communities of the Shelf and Shelf Break of Faial and Pico Islands (Azores Archipelago): Implications For Coastal Resource Management. *Acta Ichthyologica Et Piscatoria*, 43 (4): 267–276. Doi:10.3750/AIP2013.43.4.02
- GFCM (General Fisheries Commission for The Mediterranean), 2010. Report of the Transversal Workshop on the Monitoring of Recreational Fisheries in The GFCM Area. Scientific Advisory Committee 13th Session. Palma de Mallorca, Spain. 30 p.
- Kıraç, C. O. & Güçlüsoy, H. 2008. Foça ve Akdeniz Foku; Foça Özel Çevre Koruma Bölgesi'nde Akdeniz Fokunun (*Monachus monachus*) Korunması ve İzlenmesi. T.C. Çevre ve Orman Bakanlığı - Özel Çevre Koruma Kurumu Başkanlığı Yayınları, Ankara. 48 p.
- Lloret, J., Zaragoza, N., Caballero, D., Riera, V., 2008. Biological and socioeconomic implications of recreational boat fishing for the management of fishery resources in the marine reserve of Cap de Creus (NW Mediterranean). *Fisheries Research*, 91, 252–259.
- Lombarte, A., Gordo, A., Whitfield, A.K., James, N.C., Tuset, V.M., 2012. Ecomorphological analysis as a complementary tool to detect changes in fish communities following major perturbations in two South African estuarine systems. *Environ. Biol. Fish* 94 (4), 601–614.
- Morales-Nin, B., Moranta, J., Garcia, C., Tugores, M.P., Grau, A.M., Riera, F., Cerda, M., 2005. The recreational fishery off Majorca Island (western Mediterranean): some implications for coastal resource management. *ICES Journal of Marine Sciences*, 62, 727–739.
- Steinback, S.R., 1999. Regional Economic Impact Assessments of Recreational Fisheries: An Application of the IMPLAN Modelling System to Marine Party and Charter Boat Fishing in Maine, *North American Journal of Fisheries Management*, 19:3, 724-736, DOI: 10.1577/1548-8675(1999)019<0724:REIAOR>2.0.CO;2
- Tunca, S., Ünal, V., Miran, B., 2012. A preliminary study on economic value of recreational fishing in Izmir Inner Bay. Aegean Sea (Turkey). *Ege Journal of Fisheries and Aquatic Science*. Vol. 29. Issue. 2. ISSN 1300 1590.
- Tunca, S., Ünal, V., Miran, B., Güçlüsoy, H., Gordo, A., 2016. Biosocioeconomic Analysis of Marine Recreational Fisheries: A Comparative Case Study from Eastern Mediterranean, Turkey. *Fisheries Research*, 174, 270–279 Doi: 10.1016/j.fishres.2015.10.025
- Veiga P., Ribeiro, J., Gonçalves, J.M.S., and Erzini, K., 2010. Quantifying recreational shore angling catch and harvest in southern Portugal (north-east Atlantic Ocean): implications for conservation and integrated fisheries management. *Journal of Fish Biology*, 76, 2216-2237.
- Ünal, V., Acarlı, D., Gordo, A., 2010. Characteristics of marine recreational fishing in Çanakkale Strait (Turkey). *Mediterranean Marine Science*. 11(2):315-330.



Susceptibility of two whitefly (*Bemisia tabaci*) (Hemiptera: Aleyrodidae) strains to insecticides from Oman

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Abstract

Tobacco or Silverleaf whitefly, *Bemisia tabaci* (Gennadius) is an economically important polyphagous agricultural pest worldwide with wide host range. Various chemical insecticides have been used to control *B. tabaci*, which has developed resistance most insecticides all over the world. *Bemisia tabaci* adults and nymphs were collected from a greenhouse and an organic farm in Oman and reared on eggplants in separate cages. A Potter tower Leaf-Residue bioassay method was used to test the susceptibility of newly emerged *B. tabaci* adults against Deltamethrin 2.5EC (pyrethroid), Thiamethoxam 25WG (neonicotinoid) and Spinosad 480SC (spinosyn). Seven concentrations of each insecticide were used in the bioassays. The 48 hr LC₅₀ values of Pairidaeza and AES-strains for Deltamethrin, Thiamethoxam and Spinosad were calculated. A low level of 6-fold resistance against Deltamethrin and 1.7-fold against Spinosad was detected while no resistance was detected against Thiamethoxam. The calculated baseline LC₅₀ values can be used in resistance detection and monitoring programs in Oman.

Keywords: Insecticide resistance, *Bemisia tabaci*, Deltamethrin, Thiamethoxam, Spinosad

Introduction

Whitefly (*Bemisia tabaci*) is one of the most important pests worldwide. It is a polyphagous pest having more than 315 host plants and is a major pest of vegetables and ornamental crops. Whitefly damages the crops in two ways, directly by feeding on phloem sap of host, and indirectly by transmitting viral diseases and secreting honey dew on which sooty mold develops that affects photosynthesis (Hill, 1987).

Whiteflies are usually controlled with insecticides sprays. More than 50 conventional insecticides are registered for use against *B. tabaci*. The repeated use of the same active ingredients and application of excessive doses of insecticides within a given cropping season has led to the development of insecticide resistance in *B. tabaci* (Denholm *et al.*, 1998; Horowitz *et al.*, 2007). *Bemisia tabaci* has shown resistance to more than 40 active ingredients of insecticides (Arthropod Pesticide Resistance Database).

The objective of this research was to determine the susceptibility (LC₅₀) of two *B. tabaci* strains, one from a greenhouse and one from an organic farm, to three selected insecticides. The base line LC₅₀ values could be used in insecticide resistance detection and monitoring programs in Oman.

Material and Methods

The *B. tabaci* adults and nymphs were collected from two locations in Oman. AES-strain was collected from Agricultural Research Station, SQU greenhouse and Pairidaeza-strain from Pairidaeza organic farm in AlBatinah. Both strains were reared on eggplants in separate cages at ARS, Sultan Qaboos University during March and April 2018.

Seven dilutions of each formulated insecticide were prepared with deionized water. The concentrations for Deltamethrin 2.5EC were between 0.25 and 180 µg/mL, for Thiamethoxam 25WG were between 0.19 and 135 µg/mL, and Spinosad 480SC were between 0.73 and 533 µg/mL. A 2 ml



solution of each of the selected insecticides were applied onto the prepared Petri-dishes containing leaf discs by using Potter tower at 70KPa. Treated dishes were dried for 3-4 hours before release of *B. tabaci* adults.

Adults of *B. tabaci* were immobilized by placing them on the cooling device ((2-3°C)) and adults were gently transferred into the sprayed Petri dishes using a small fine brush. Petri dishes were then wrapped with paraffin. Each sprayed Petri dish contained around 10 *B. tabaci* adults and each insecticide and each concentration was replicated four times. Mortality was observed 48 hours after the transferring of the *B. tabaci* into the sprayed Petri dishes. Corrected mortality was calculated by using Abbott's formula (1925). Lethal Concentrations values were calculated for each insecticide by using PoloPlus Version 2.0. Resistance ratio (RR) was calculated by dividing LC₅₀ of AES-strain by LC₅₀ of the Pairidaeza-strain.

Results

In the AES-strain, the highest concentration of 180 µg/mL of Deltamethrin gave 70% mortality (Table 1). The lowest mortality of 14.1% was recorded in the lowest concentration of 0.25 µg/mL. The highest concentration of 135 µg/mL of Thiamethoxam gave 94.9% mortality. The lowest mortality of 14.9% was recorded in the lowest concentration of 0.19 µg/mL. The highest concentration of 533 µg/mL of Spinosad gave 100% mortality. The lowest mortality of 9.9% was recorded in the lowest concentration of 0.73 µg/mL.

Table 1. Percent corrected mortality in the two strains of *B. tabaci* adults recorded 48 hrs after treatment by three insecticides.

Deltamethrin			Thiamethoxam			Spinosad		
Concentration µg/mL	% corrected mortality		Concentration µg/mL	% corrected mortality		Concentration µg/mL	% corrected mortality	
	AES-Str	Pairidaeza-Str		AES-Str	Pairidaeza -St		AES-Str	Pairidaeza -St
180	69.9	100	135	94.9	100	533	100	100
60	64.6	79.9	45	89.6	89.9	178	79.9	89.9
20	44.5	64.2	15	69.2	74.5	59.3	69.4	79.2
6.67	29.7	49.4	5	64.4	64.4	19.8	49.5	54.5
2.22	24.2	39.5	1.67	49.8	54.8	6.6	34.8	39.7
0.74	14.9	34.6	0.56	29.9	19.7	2.2	14.7	29.9
0.25	14.1	19.9	0.19	14.9	14.3	0.73	9.9	14.9
LC₅₀	42.70	6.99		3.09	3.08		25.59	15.08
RR		6.1		1.0			1.7	

In the Pairidaeza-strain (organic farm), the highest concentrations of Deltamethrin, Thiamethoxam and Spinosad gave the 100% mortality. The lowest concentrations of Deltamethrin, Thiamethoxam and Spinosad gave 19.9%, 14.3% and 14.9% mortality

For the AES-strain, the calculated LC₅₀ value for was 42.7 µg/mL, 3.09 µg/mL and 25.59 µg/mL was for Deltamethrin, Thiamethoxam and Spinosad, respectively (Table 1; Figure 1). For the Pairidaeza-strain the calculated LC₅₀ value for were 6.99 µg/mL, 3.08 µg/mL and 15.08 µg/mL for Deltamethrin, Thiamethoxam and Spinosad, respectively. A low level of 6-fold resistance (RR) against Deltamethrin and 1.7-fold against Spinosad was detected while no resistance was detected against Thiamethoxam. These are the baseline LC₅₀ values and can be used in resistance detection and monitoring programs in Oman.

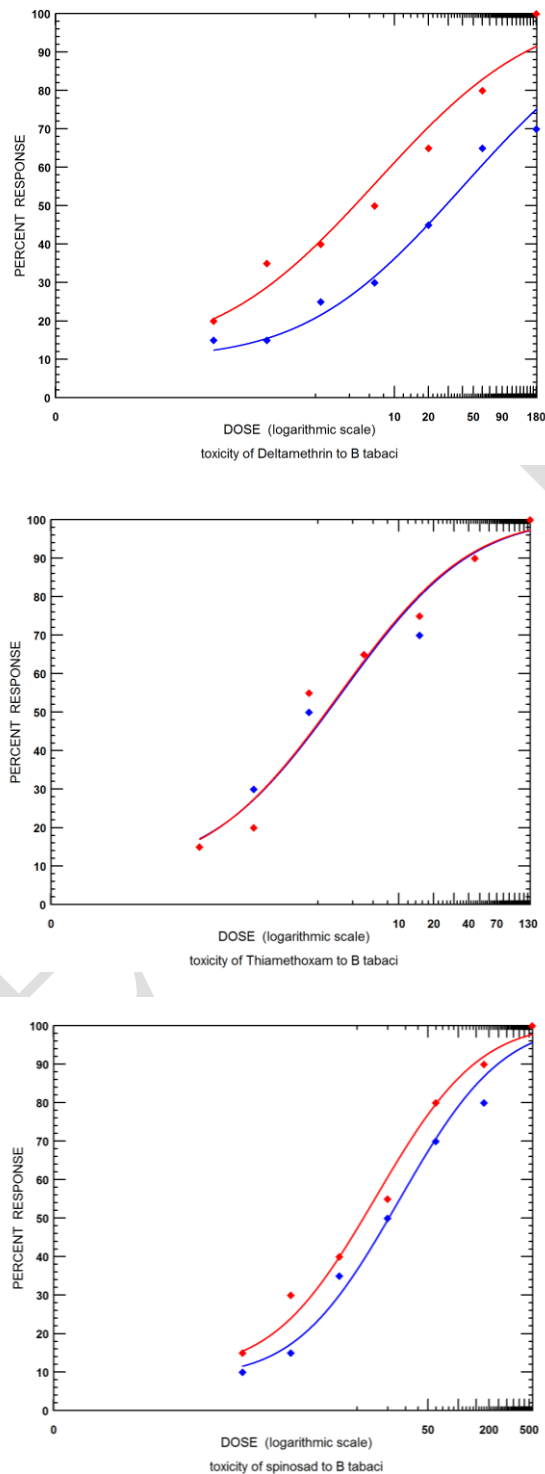


Figure 1. Dose-response regression lines of the AES-strain (Red) and Pairidaeza-strain (Blue) after treatment with Deltamethrin, Thiamethoxam and Spinosad.

Discussion

Resistance of *B. tabaci* to pyrethroids and OPs is certainly due to their systematic use for more than 30 years (Brévault, 2014). The Q biotype of whitefly present in the Middle East, Spain and Arizona (USA) is resistant to many of the commonly used insecticides for managing whiteflies, including the



pyrethroids, neonicotinoids, pymetrozine and insect growth regulators (Horowitz et al., 2007; Wang et al., 2010; Castle and Prabhaker, 2013).

Due to the development of resistance, safe and cost effective insecticides are being depleted rapidly; control of the resistant populations and strategies to slow down insecticide resistance evolution is based on the optimum use of existing compounds. The reason is that Deltamethrin has been widely used for the last several decades throughout Oman. Insecticides belonging to different mode of action could potentially be used in resistance management for whitefly control in Oman.

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References

- Castle, S.J. and Prabhaker N. (2013). Monitoring Changes in *Bemisia tabaci* (Hemiptera: Aleyrodidae) Susceptibility to Neonicotinoid Insecticides in Arizona and California. *Journal of Economic Entomology* 106(3):1404-13
- Denholm, I., Cahill, M., Dennehy, T.J. and Horowitz, A.R. (1998) Challenges with managing insecticide resistance in agricultural pests, exemplified by the whitefly *Bemisia tabaci*. *Philosophical Transactions of the Royal Society of London Series B-Biological Sciences*, 353, 1757–1767.
- Hil, D.S. (1987). *Agricultural Insect Pests of Temperate Region and Their Control*. Cambridge: University Press. 659pp.
- Horowitz, R., Denholm, I. and Morin, S. (2007) Resistance to insecticides in the TYLCV vector, *Bemisia tabaci*. *Tomato Yellow Leaf Curl Virus Disease* (ed. H. Czosnek), pp. 305–325. Springer, Netherlands.
- Brévault, T., Martin, T. And Glitho, I. (2010). Insecticide resistance in field populations of *Bemisia tabaci* (Hemiptera: Aleyrodidae) in West Africa.
- Wang Z, Yan H, Yang Y, Wu Y, 2010. Biotype and insecticide resistance status of the whitefly *Bemisia tabaci* in China. *Pest Management Science*, 66:1360-1366.



Extraction and characterisation of collagen and odorless gelatine from fish by-products and their possible uses in different sectors

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Abstract

Nowadays, pharmaceutical, cosmetic and food industry are looking for innovative, sustainable and eco-friendly products and marine products arouse the curiosity and the interest of several researchers. Recently, the pathological risk of mammalian collagen and gelatine used in the previously mentioned sectors are pinpointed in term of transmitted diseases and the products are banned in several countries for socio-cultural reasons. For some years, converting fish processing by-products and waste products into new value-added products or biomolecules has become a commercially important research area. Marine collagen and gelatine extracted from “waste-fishes” or fish by-products can be used as alternative solutions to replace those from mammals. Climate change and increasing sea water temperatures bring marine species into new environment. That is the case of mediterranean sea where we record an increasing number of invasive alien species such as pufferfish which is considered totally as waste. The present study describes how to extract, characterize and evaluate different uses of marine collagen to make economical and ecological benefits from these invasive species. Acid soluble collagen (ASC) and pepsin soluble collagen (PSC) are extracted from the skin and bones of fishes. Sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE), high performance liquid chromatography (HPLC) and Fourier transform infrared (FTIR) are used to identify type of collagen and its properties. Quality of the product is also evaluated by different methods such as denaturation temperature and viscosity measurements and amino-acid content. Microbiological, tetrodotoxin (TTX) and heavy metal analyses are made to evaluate the safety.

Keywords: Climate change, invasion, *L. sceleratus*, waste material, new value-added products, marine collagen



Active biomonitoring of the mussel *Mytilus galloprovincialis* with integrated use of micronucleus assay and physiological indices to assess harbor pollution

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Abstract

The individuals of the mussel *Mytilus galloprovincialis* collected from a non-contaminated site (Chaib Rasso) were transplanted for a period of one, three and six months at Ghazaouet harbor (GH), areas with a strong gradient of pollution. The micronucleus test (MN) was selected to monitor the impact of contamination, along with some physiological biomarkers (condition index CI and organo-somatic indexes RI and GSI). The results show a negative correlation of MN variation in gill cells with CI but a positive correlation with transplantation duration. However, a significant correlation was found between the indexes. Moreover, the findings indicate that MN in the hemolymph and gills cells of transplanted mussels at GH are significantly higher than those of the reference site. However, no significant differences were noted between the three transplants at the two organs. Monitoring the physiological status of mussels, in parallel with the biomarker measurements, is found to be useful in assessing the impact of contaminants.

Keywords: Active biomonitoring, Micronucleus, Physiological indices, Hemocytes, Gills, Ghazaouet harbor, *Mytilus galloprovincialis*.



A Phytosociological research on the surroundings of Sürgü Dam (Sürgü / Doğanşehir / Malatya)

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Abstract

The study area is located within the boundaries of Sürgü town belonged to Doğanşehir district of Malatya province in Eastern Anatolia Region. The study area in the Irano-Turanian phytogeographic region is under the influence of Mediterranean climate which is dry in summer and very cold in winter. In the vegetation study carried out according to the Braun-Blanquet method, seven syntaxa (associations) are identified, which two of them are belonged to the degraded forest vegetation, three of them are belonged to the steppe vegetation and two of them are belonged to the riparian vegetation. All of the syntaxa are new for the scientific world. The degraded forest associations are: *Thymo kotschyani*–*Juniperetum oxycedri* ass.nova and *Securigero varia*–*Quercetum cerridis* ass.nova. The steppe associations are: *Gundelio armata*–*Fumanetum aciphyllae* ass.nova, *Phlomido kurdica*–*Astragaletum gummiferi* ass.nova and *Helichrysi plicati*–*Polygonetum setosi* ass.nova. The riparian associations are: *Rubo sancti*–*Salicetum cinerea* ass.nova and *Salici cinerea*–*Elaeagnetum angustifoliae* ass.nova.

Keywords: Phytosociology, Sürgü, Doğanşehir, Malatya, Turkey



Slipping practises in Turkish purse seine fishery

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Abstract

Slipping practises is very common in purse seine fishery due to the market and regulatory reasons. However, there is no information about this issue in Turkish Fisheries. The present study aims to describe current slipping practises in Turkish purse seine fishery. Juvenile fish are generally slipped over the headline of the purse seine net in the Aegean Sea, whereas jelly fish are slipped by larger mesh size netting sheet which is rigged on the bunt in the Sea of Marmara. In contrast, slipping practises are not observed in the Black Sea purse seine fishery, due to the use of undersized fish in the fish meal and oil industry. As a result, the amount of fish slipped in Turkish Seas should be correctly determined by reliable data collection method and then the release of the unwanted catch should be regulated in cooperation with fishermen who have great experience doing this practice.

Keywords: Slipping, Purse Seine Fishery, Turkey.

Introduction

Purse seines, particularly for small pelagic species, are generally considered as a non-selective fishing gear once a target shoal has been encircled, primarily because of the small mesh sizes used in the main body of the net (Marçalo et al., 2019). A variety of economic (catch quality, market price/demand) and regulatory (quotas, sizes, protected species) reasons cause to *slipping* release of the unwanted catch out of the net while it is still in the water. Due to aforementioned reasons, there has been a common practice of discarding unwanted catch by *rolling* the fish over the headline of purse seine net in British mackerel fishery (Lockwood et al., 1983), in western Australian Sardinops fishery (Mitchell et al., 2002), in Norwegian mackerel (Huse and Vold, 2010) and herring (Tenningen et al., 2012) fisheries, in Spanish anchovy fishery and Portuguese sardine fishery (Marçalo et al., 2019).

Although slipping practices are frequently applied in Turkish seas, particularly in the Sea of Marmara, no scientific studies have been carried out to date about this issue. The present study aims to describe and discuss the current slipping practises in Turkish purse seine fishery.

Slipping Practises

Aegean Sea

Slipping is not a common method of releasing unwanted catch out of the bunt of purse seine net in the Aegean Sea. Because fishermen never aim to catch fish schools that undersized and also the undersized fish are selected and released to the sea by a sieving (grading) machine on the upper deck of the purse seiner. Slipping is rarely applied for the two reasons; the release of juvenile fish due to identification of commercial fish schools inaccurately in sonar/echo sounder views (Fig. 1) and slipping of excessive catch due to lack of vessel storage capacity in small purse seiners.

Sea of Marmara

Excluding the jellyfish from the bunt is a common slipping method for purse seine fishery in the Sea of Marmara. For this aim a sheet of netting piece called *pelte*, larger size and thicker diameter, is rigged on the bunt-end of the purse seine net. The jellyfish mass on the netting piece are slipped by rolling



over the headline (floating line) after partially hauling or drying-up the net while it is still in the water (Fig. 2). Small sizes fish e.g. anchovy easily pass from this mesh size when hauling and slipping operations are practised. At the final stage, the pelte net is opened from left side and aggregated fish in the bunt is transferred by a fish pump on the deck of the purse seiner (Fig. 3). The purpose of the slipping method is different from conventional slipping procedure used by North Atlantic countries e.g. Norway, Portugal and Spain (Marçalo et al., 2019). The ordinary slipping procedure aims to release crowded fish in bunt over the headline due to state of market and fisheries regulations (i.e. size and quota).



Figure 1. Slipping the juvenile fish over the headline of the purse seine net in the Aegean Sea.



Figure 2. Release of jellyfish over the headline by hauling a slip net in the Sea of Marmara.



Figure 3. Opening the slipping net and pumping of the fish in the bunt by a fish pump.



Black Sea

Despite slipping practises are useful for survival of the released fish, there is not any application of the slipping in the Black Sea fisheries. The situation can be explained as the undersized (below the minimum landing size) anchovy mostly/commonly may be used as raw material in the fish meal and oil industry.

Discussion and Conclusion

Two different slipping techniques are practised in Turkish purse seine fishery. However, the aims of the slipping techniques are different between each other. Although ordinary slipping practises are rarely applied by the Aegean purse seiners for regulation (undersized or banned fish) and market reasons, this process is only used to exclude jellyfish from the bunt of the net in the Sea of Marmara by all purse seiners. Because, the separation of the commercial catch from jellyfish could be impossible, if fish and jellyfish are directly pumped together to the deck of a purse seiner. However, there is no information regarding slipping amounts and the survival rate of the species that slipped out of the net and there is not any regulation on releasing of unwanted catches in Turkish purse seine fishery, as well.

The preventative action as not to catch of unwanted fish can be considered as the most appropriate solution in the first place. For this, hydro-acoustic technologies are being examined as the most promising technological solution, with the potential for describing species composition, size frequency distribution and catch biomass (Marçalo et al., 2019). However, it is easy to release if the whole of the catch is to be slipped out of the bunt, as in the Aegean Sea. If only a part of the catch is to be released as alive, more control over the opening and release process is required. This control mechanism should be placed before the crowding and pumping processes. As far as we know, the latest part of catch in transferring stage could be released as dead or alive, due to lack of vessel storage capacity in Turkish purse seine fishery. However, the lengths of most purse seiners were extended by the time of progress in order to improve storage capacity.

Crowding duration and inappropriate slipping practise cause higher mortality in releasing of unwanted catch (Lockwood et al., 1983; Huse and Vold, 2010; Tenningen et al., 2012). According to European Union regulation “Landing Obligation”, the slipping of mackerel and herring should be completed before 80-90% of the net is hauled (the point of retrieval) to prevent the higher mortality, in NW European waters and the North Sea (Marçalo et al., 2019).

In conclusion, methods and regulations for releasing unwanted catch, which increase the high survival rate for slipped catch, should be developed in cooperation with the purse seine fishermen who have great experience doing this practice in Turkish Seas.

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References

- Huse, I., & Vold, A. (2010). Mortality of mackerel (*Scomber scombrus* L.) after pursing and slipping from a purse seine. *Fisheries Research*, 106, 54-59. doi.org/10.1016/j.fishres.2010.07.001.
- Lockwood, S.J., Pawson, M.G., & Eaton, D.R. (1983). The effects of crowding on mackerel (*Scomber scombrus* L.) - Physical condition and mortality. *Fisheries Research*, 2, 129-147. doi.org/10.1016/0165-7836(83)90114-5.
- Marçalo, A., Breen, M., Tenningen, M., Onandia, I., Arregi, L., & Gonçalves, J.M.S. (2019). Mitigating Slipping-Related Mortality from Purse Seine Fisheries for Small Pelagic Fish: Case Studies from European Atlantic Waters. In S.S. Uhlmann, C. Ulrich, S.J. Kennelly (Eds), *The European Landing Obligation* (pp. 297-318). Switzerland: Springer Nature.
- Mitchell, R.W., Blight, S.J., Gaughan, D.J., & Wright, I.W. (2002). Does the mortality of released *Sardinops sagax* increase if rolled over the headline of a purse seine net? *Fisheries Research*, 57, 279-285. doi.org/10.1016/S0165-7836(01)00354-X.



Tenningen, M, Vold, A., & Olsen, R.E. (2012). The response of herring to high crowding densities in purse-seines: survival and stress reaction. *ICES Journal of Marine Science*, 69, 1523-1531. doi.org/10.1093/icesjms/fss114.

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Effect of environmental factors on biofilm formation by clinical and environmental *Vibrio vulnificus* strains

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Abstract

Biofilm formation by clinical and environmental strains of *Vibrio vulnificus* were tested under different temperature (24°C, 30°C and 37°C), pH (5.5, 7.5, and 8.5) and iron concentration (18, 30, 50, 100, and 200 µM) conditions. Although all strains produced biofilms at 37°C, host body temperature, higher biofilm was produced at 24°C, a temperature that would be encountered in the marine environment. For all strains, biofilm production at 24°C was often two to three times greater than at 30°C and 37°C in all three trials. The general trend for the pH trials was for highest biofilm production at pH 5.5 by all strains. All *V. vulnificus* strains (i.e. environmental and clinical) produced ~33% more biofilm at pH 5.5 than at pH 7.5 or 8.5. Our study also found a direct correlation between free iron concentration in growth medium and biofilm production by *V. vulnificus*. Biofilm formation by *V. vulnificus* was increased with increasing iron concentration up to 200 µM. Upon comparing clinical and environmental strains, we observed that clinical strains produced more biofilm than environmental strains at 24°C and at lower pH. With regards to temperature and pH, higher biofilm production appears to be a trait of clinical strains and could be considered a virulence factor.

Keywords: *Vibrio vulnificus*, Biofilm, Clinical, Temperature, pH, Iron



Selective enrichment for clinical strains of *Vibrio vulnificus* based on virulence correlating gene

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Abstract

Traditional enrichment and maintenance media for *Vibrio vulnificus* were tested for selective preference for clinical or environmental strains. Brain Heart Infusion Broth (BHIB), Alkaline Peptone Water (APW) and Luria Bertani (LB) media adjusted to 5-10% salinity were inoculated with seawater collected from different locations in Galveston Bay, TX, USA. In addition, APW and BHIB, with adjusted to the salinity gradients that of APW, were inoculated with equal concentrations of clinical and environmental strains and incubated for 20 h at 35°C in the laboratory. *Vibrio vulnificus* specific hemolysin (*VvhA*) genes with a SYBR Green quantitative PCR (qPCR) assay were employed to determine a total number of *V. vulnificus*. To distinguish clinical strains from mixed isolates, we used a SYBR Green qPCR assay that quantifies the clinical variant of the virulence correlating gene (*vcgC*). Based upon the isolate enrichment results, enrichment of seawater with BHIB, APW, and LB resulted in a higher percentage of clinical strains in BHIB but not in APW or LB in most samples. Laboratory enrichment with known strains indicated that BHIB selected for clinical strains (85%) as indicated by the percentage of *vcgC* to *vvhA* genes. The selective preference of the BHIB medium with 10% salinity for clinical strains revealed that iron plays an important role in the selection of clinical strains as well as the infection of the human host.

Keywords: *Vibrio vulnificus*, Selective enrichment, Clinical, *vcgC*, *vvhA*



Analysis of Biodiversity and Ecological Data by R Software Packages

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Abstract

There are numerous ways to statistically analyze biodiversity and ecological data. One of the current and popular approaches is to apply related R software environment packages to data. R is a programming language and open-source software package which is publicly available software created by Ross Ihaka and Robert Gentleman in the 1990s. R is a comprehensive software environment for statistical analyses, data management, modeling, simulation and graphical visualization for almost all fields in scientific research. The aim of this study is to present related R software environment packages to manage and analyze biodiversity and ecological data. The R software environment has more than 100 different packages to directly analyze biodiversity and ecological data. In this study, different ecological examples from the most common packages such as vegan, EnvStats, ecodist, BiodiversityR, EcoIndR, DiversityOccupancy, EcoHydRology, simecol, ade4 and vegetarian were presented. The above packages include a broad range of analyses such as descriptive community and vegetation diversity, similarity and dissimilarity indices, modelling of ecological data, simulation of ecological dynamic systems, cluster analysis, spatial data analysis in ecology, phylogenetic and evolutionary data analysis of biodiversity and community ecology. In conclusion, the numbers of R packages and functions for biodiversity and ecological data analysis have been growing in the last years. The related researchers can check and apply appropriate R packages to their data from freely available books, articles, and online resources.

Keywords: R software environment, R packages, vegan, analysis of biodiversity



Distribution and morphological traits of *Patella* species in Al-Hanya rocky intertidal coast, eastern Libya Mediterranean Sea

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Abstract

The present study aimed to study distribution and morphological traits of patella species present in Al-Hanya intertidal, typical of eastern Libya Mediterranean Sea. 977 patellae collected randomly during 2018 winter were found to consist of 576 *Patella rustica*, 400 *Patella cearulea* and one *Patella ulyssiponensis*. *P. rustica* and *P. cearulea* of different sizes were seen firmly attached to shallow pits (scars) on surface of the rocky intertidal, especially at the wave break region, many times in aggregates, above or below the waterline, with *P. rustica* generally occupying higher levels than *P. cearulea*, or in shallow tidal pools occurring at low tide. Rims of shells matched perfectly those of pits. The empty pits that were covering most of the rocky intertidal indicated that Al-Hanya had been inhabited by patellids for decades. The presence of *Patella ulyssiponensis* reported in the present study is the first record of this species in Libya.

P. rustica was larger than *P. cearulea*, otherwise they look alike; shells were brownish from outside, the sole was brownish in *P. rustica* and blackish in *P. cearulea*. Shell biometric parameters measured for each patellids were Live weight (LW), corresponding empty shell weight (ESW), shell length (SL), shell width (SW), shell width at the apex (SWA), shell height (SH), shell length from apex to anterior end (SAA) and radula length (RL). SL, SH, SW and RL of *P. ulyssiponensis* were 23.33, 11.12, 18.49 and 4.2mm. LW and ESW were 1.98 and 1.06g. All shell biometric parameters of *P. rustica* were significantly higher than those of *P. cearulea*. Linear, power and logarithmic regressions of the shell biometric parameters with SL (as an indicator of growth) were established for both patellae.

Means of shell shape parameters (shell length from apex to posterior end, shell base radius, shell conicity, shell cone eccentricity, shell base ellipticity) of both species were close. Their regressions vs. SL indicated that shell shape does not change much during growth. Logarithmic regressions of base perimeter, base surface area, shell and total surface area of exposure and radula relative size (RL/SL) vs. shell volume showed that these parameters relatively decrease during growth. RL/SL was 0.282 for *P. rustica* and 0.1539 for *P. cearulea*.

Keywords: Limpet, *Patella rustica*, *Patella cearulea*, *Patella ulyssiponensis* Libya, Mediterranean Sea

Introduction

Patellae (limpets) are common gastropods in all rocky inertial shores where they occur in large numbers, firmly attached to scars cut on surfaces of rocks to avoid been ripped off by strong waves, turbulent currents and predators. *Patella* density is a sensitive indicator of healthiness of the intertidal zone. *P. caerulea*, *P. aspera*, *P. rustica*, *P. ferruginea*, *P. intermedia* and *P. nigra* inhabit the Mediterranean Sea (Espinosa *et al.*, 2007, Ayas *et al.*, 2008); of these, only *P. rustica* and *P. cearulea* are known to occur in eastern Libya. Shell and radula morphology are the common methods used for identifying patellae species. Many of patellids morphological traits are adaptations to cope with the harsh environmental conditions of the rocky intertidal where waves and currents, and high temperature and desiccation resulting from exposure during low tide, prevail (Kent, 1998); for example, Fischer-Pierr



(1934) stated that limpet shells become progressively taller on moving from upper sublittoral to infra littoral and higher levels, probably as a response to decreased turbulence.

The present study aimed to establish distribution and morphological traits of patella species present in Al-Hanya intertidal. Al-Hanya is a small inlet landing site typical of those found scattered along Libya eastern Mediterranean coast.

Materials and methods

The study site: Patellids used in the present study were collected from Al-Hanya (32° 51' N, 21° 31' E) rocky intertidal and its frequent small tidal pools. The area is clear from pollution and destructive anthropogenic activity; biodiversity is high. Patches of *Possidonia oceanica* stands are present within the upper sublittoral.

Field observations and collection of the study sample: Close observations were made on the nature of Al-Hanya rocky intertidal and the distribution of patellae on it, then 977 patellae were collected randomly during winter 2018. The sample consisted of 576 *Patella rustica*, 400 *Patella cearulea* and one recently dead *Patella ulyssiponensis*. Careful survey of several extensions of the area did not reveal the presence of other *P. ulyssiponensis*.

The measurements taken: In the laboratory, the shell parameters shown in Table 1 were measured for individuals of the collected sample with digital vernier caliper and sensitive balance; then radulae were removed from “head regions” and prepared for length measurements and microscopic examination by cleaning with bleach and distilled water, followed by dehydration through alcohol.

Calculation of shell shape parameters: These parameters were (Table 2) calculated from the measured shell parameters according to Cabral (2007). Trends of change of these parameters during growth were established by their linear, power and logarithmic regressions with shell length (Cabral, 2007; Boukicha *et al.*, 2013).

Table 1. Shell morphometric parameters measured in the present study for *P. rustica* and *P. cearulea* (according to Cabral, 2007)

Measured shell parameters	
LW	Live Weight: Whole shell weight (shell + soft tissues)
ESW	Empty Shell Weight: Corresponding shell weight after removing the soft tissues
SL	Shell Length: Greatest distance between anterior and posterior ends.
SW	Shell Width: Greatest distance perpendicular to the anterior axis.
SH	Shell Height: Greatest vertical distance from apex of the shell to the plane of aperture
SWA	Shell Width at Apex
SAA	Shell Apex Anterior: Greatest distance between apex and anterior end.
SAP	Shell Apex Posterior: Greatest distance between apex and posterior end.
RL	Radula length



Table 2. Shell shape parameters established in the present study for *P. rustica* and *P. cearulea* following Cabral (2007).

Calculated shell parameters	Acronym	Calculated as
Shell Base Radius	BR	$(SL+SW)/4$
Shell Conicity	C	SH/SL
Shell Cone Eccentricity	CE	SAA/SAP
Shell Base Ellipticity	BE	SW/SL
Shell base eccentricity	BEc	SWA/SW
Shell Base Perimeter	BP	$2\pi \times BR$
Shell Base Surface Area	BS	$\pi \times BR^2$
Shell Surface Area	SA	$3.6 \times BR \times \sqrt{(BR^2 + ((4/3) \times (SH$
Total Surface Area of Exposure	TSAE	BS + SA
Shell Volume	SV	$[(\pi \times BR^2 \times SH)/2]$
Radula relative size	RRS	RL/SL RL/SH

Results

Distribution of patella in Al-Hanya rocky intertidal: *P. rustica* and *P. cearulea* of different sizes were seen firmly attached to shallow scars on surfaces of rock of Al-Hanya intertidal (Fig. 1a,b), especially at the wave break region, above or below the waterline with *P. rustica* generally occupying higher levels than *P. cearulea*, or in the shallow tidal pools existing at low tides. The distribution was even in some places and patchy in others, many times in aggregates. The highest concentration encountered was 113 individuals per m². Rims of shells match perfectly those of the scars. The multitude of empty scars of various sizes that were covering most of the rocky intertidal (Fig. 1b) indicates that the area had been home for patellids since decades. The single *Patella ulyssiponensis* collected seems to be originating from infra- or sub littoral and casted ashore by waves. The shell was thin, whitish to brown and shallow (Fig. 2), its rims were a bit fragile. SL: 23.33, SH: 11.12, SW: 18.49 and RL: 4.2 mm. LW and ESW were 1.98 and 1.06 g.



a

b

Figure 1. a: Al-Hanya rocky intertidal zone; b: *P. rustica* and *P. cearulea* of various sizes firmly attached to their scars on exposed rocks. Observe the empty scars.



Figure 2. The *P. ulyssiponensis* collected in the present study: SL: 23.33, SH: 11.12, SW: 18.49 mm

P. rustica was somewhat larger than *P. cearulea*, otherwise the two species look similar, the shell was brownish from outside, and the sole was brownish in *P. rustica* and blackish in *P. cearulea*. Means of all measured parameters of *P. rustica*, except LW, were significantly higher than those of *P. cearulea* (Tables 3). Shell lengths, SL, (mean \pm standard deviation) of *P. rustica* and *P. cearulea* were 25.01 ± 3.69 and 22.97 ± 4.24 cm corresponding to mean live weights, LW, of 2.76 ± 1.43 and 2.39 ± 1.6 g. Empty shell weights, ESW, were 1.4 ± 0.69 and 1.3 ± 0.95 g. Weights of the soft body, MW, were 1.36 ± 1.59 and 1.09 ± 1.86 g.



Table 3: Means of measured shell parameters of *P. rustica* (r) and *P. cearulea* (c); lengths in mm, weights in g. Different superscripts indicates significantly different means

Parameters	No. and species	Mean ± StD	P
LW	420 r	2.76±1.43 ^a	0.392
	100 c	2.39±1.6 ^a	
ESW	420 r	1.4±0.69 ^a	0.036
	100 c	1.3±0.95 ^b	
MW	420 r	1.36±1.59	
	100 c	1.09±1.86	
SL	576 r	25.01±3.69 ^a	0.000
	400 c	22.97±4.24 ^b	
SW	576 r	21.28±3.41 ^a	0.000
	400 c	17.79±4.57 ^b	
SH	576 r	13.90±2.71 ^a	0.000
	400 c	10.22±2.33 ^b	
SWA	576 r	16.77±3.56 ^a	0.000
	400 c	13.41±4.68 ^b	
SAA	576 r	11.17±5.06 ^a	0.000
	400 c	10.19±2.27 ^b	
SAP	576 r	13.75±2.23 ^a	0.000
	400 c	12.15±2.71 ^b	
RL	321 r	7.00±1.34 ^a	0.000
	100 c	3.68±0.73 ^b	

Correlations between measured shell parameters were weak to high in *P. rustica* and moderate to high in *P. cearulea* (Table 4). Linear, power and logarithmic regressions of these parameters with shell length, SL, showed that magnitudes of these parameters increased with growth, as indicated by SL, (Tables 5). Some preliminary evidences suggest that this trend is not of similar pace in younger and grownup *P. cearulea*, for example, the double distribution apparent in Figs. 3a,b.



Table 4. Pearson's correlations between measured shell parameters of the two patellids

Pearson's correlations – <i>P. rustica</i>							
Parameters	LW	ESW	SL	SW	SH	SWA	SAA
ESW	.903**						
SL	.572**	.579**					
SW	.568**	.581**	.945**				
SH	.479**	.510**	.795**	.795**			
SWA	.510**	.494**	.777**	.811**	.685**		
SAA	.270**	.291**	.342**	.328**	.251**	.241**	
SAP	.435**	.446**	.798**	.776**	.635**	.626**	.221**

Pearson's correlations – <i>P. cearulea</i>							
Parameters	LW	ESW	SL	SW	SH	SWA	SAA
ESW	.954**						
SL	.801**	.787**					
SW	.801**	.785**	.901**				
SH	.762**	.723**	.932**	.701**			
SWA	.792**	.764**	.58**1	.901**	.569**		
SAA	.768**	.735**	.864**	.538**	.860**	.655**	
SAP	.739**	.738**	.806**	.913**	.738**	.654**	.552**

** . Correlation is significant at the 0.01 level (2-tailed)



Table 5. Linear, power and logarithmic regressions of measured shell parameters of *P. rustica* and *P. cearulea* with shell length as an indicator of growth

Parameters:	Equation	<i>Patella rustica</i>				<i>Patella cearulea</i>			
		a	b	r	R ²	a	b	r	R ²
LW vs.	Lin	0.22	-2.66	0.57	0.32	0.27	-4.26	0.80	0.6
	Pov	1.90	0.006	0.55	0.31	2.53	0.001	0.73	0.5
	Logarithm	4.86	-12.76	0.53	0.28	6.22	-17.4	0.75	0.5
ESW vs.	Linear	0.10	-1.25	0.57	0.33	0.15	-2.58	0.78	0.6
	Pov	1.87	.003	0.55	0.30	3.18	3.98	0.63	0.4
	Logarithm	2.37	-6.17	0.54	0.29	3.63	-10.25	0.74	0.5
SW vs.	Lin	0.87	-0.67	0.95	0.90	0.80	-0.64	0.74	0.8
	Pov	0.80	1.01	0.94	0.89	0.71	1.02	0.71	0.5
	Logarithm	-45.07	20.68	0.93	0.87	-38.23	17.97	0.73	0.5
SH vs.	Lin	-0.59	0.58	0.78	0.62	0.51	-1.57	0.93	0.8
	Pov	0.47	1.05	0.80	0.65	0.27	1.15	0.92	0.8
	Logarithm	-30.23	13.70	0.78	0.61	-25.66	11.51	0.92	0.8
SWA vs.	Lin	0.63	0.89	0.65	0.43	0.64	-1.29	0.58	0.3
	Pov	0.70	0.97	0.69	0.48	0.42	1.08	0.61	0.3
	Logarithm	-23.31	15.30	0.66	0.43	-31.26	14.33	0.57	0.3
SAA vs.	Lin	0.51	-1.80	0.37	0.14	0.46	-0.44	0.80	0.7
	Pov	0.34	1.07	0.78	0.62	0.37	1.05	0.87	0.7
	Logarithm	-27.93	12.19	0.37	0.13	-22.31	10.42	0.85	0.7
SAP vs.	Lin	0.50	1.17	0.83	0.69	0.51	0.30	0.80	0.6
	Pov	0.71	0.91	0.87	0.76	0.54	0.98	0.78	0.6
	Logarithm	-24.59	11.95	0.82	0.67	11.62	-24.07	0.80	0.6
RL vs.	Lin	0.15	3.04	0.42	0.17	0.063	2.14	0.40	0.1
	Pov	0.58	1.04	0.38	0.15	0.43	0.89	0.40	0.1
	Logarithm	3.564	-4.483	0.40	0.16	1.53	-1.16	0.40	0.1

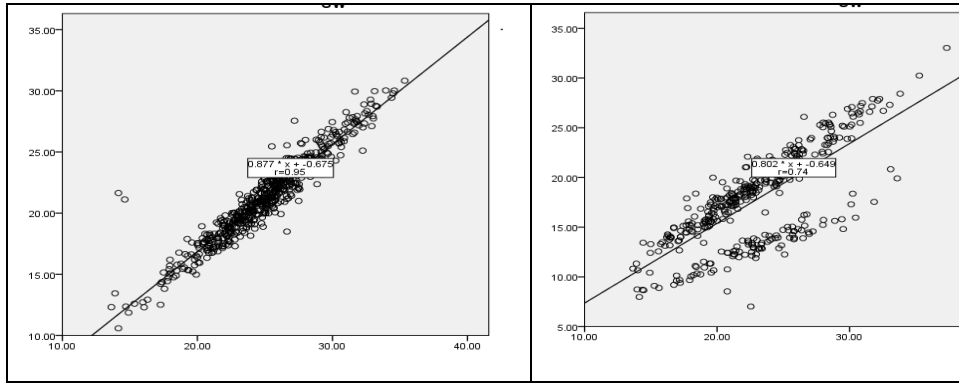


Figure 3a. Linear regressions of SW (Y axis) vs. SL (X axis) of *P. rustica* (left) and *P. cearulea* (right)

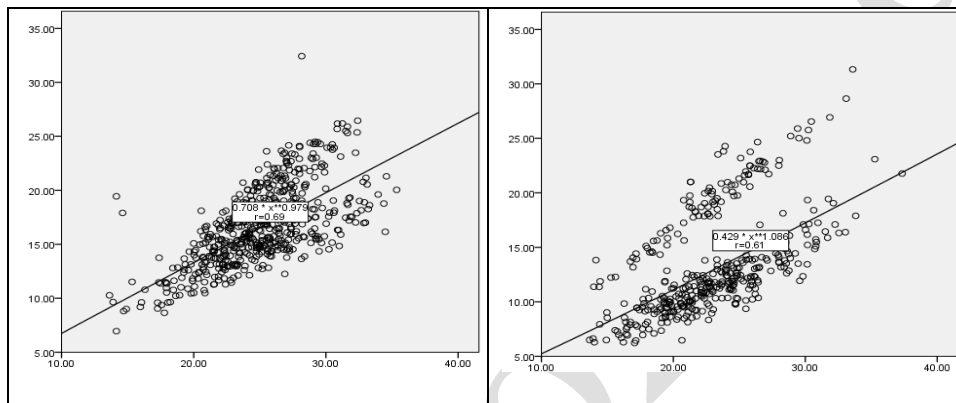


Figure 3b. Power regressions of SWA (Y axis) vs. SL (X axis) of *P. rustica* (left) and *P. cearulea* (right)

Calculated shell shape parameters

Shell conicity (C), shell cone eccentricity (CE), shell base ellipticity (BE), shell surface area (SA), total surface area of exposure (TSAE) and radula relative size (BRS) whether based on (RL/SL) or (RL/SH) were higher in *P. rustica* than in *P. cearulea* (Table 6). On the other side, shell base radius (BR), shell base eccentricity (BEc), shell base perimeter (BP), shell base surface area (BS) and Shell volume (SV) were higher in *P. cearulea* than in *P. rustica*. BR, C, CE, BE, BP homologues were significantly different.

Table 6. Calculated shell shape parameters of *P. rustica* (r) and *P. cearulea* (c)

Calculated parameters	Acronym	Patella	Mean ± St D	P
Shell Base Radius (mm)	BR	r	11.785±2.043	0.0
		c	12.751±6.846	
Shell Conicity	C	r	0.555±0.068	0.0
		c	0.443±0.039	
Shell Cone Eccentricity	CE	r	0.816±0.336	0.0
		c	0.860±0.200	



Shell Base Ellipticity	BE	r	0.850±0.053	0.0
		c	0.774±0.130	
Shell Base Eccentricity	BEc	r	0.789±0.114	0.1
		c	0.816±0.404	
Shell Base Perimeter (mm)	BP	r	74.01±12.933	0.0
		c	80.078±42.996	
Shell Base Surface Area (mm ²)	BS	r	442.659±151.242	0.0
		c	584.141±548.258	
Shell Surface Area (mm ²)	SA	r	536.362±176.321	0.1
		c	697.896±645.338	
Total Surface Area of Exposed (mm ²)	TSAE	r	979.012±327.563	0.1
		c	1282.037±1193.596	
Shell Volume (mm ³)	SV	r	2783.068±1194.04	0.1
		c	4471.633±5344.452	

Linear regressions of shell shape parameters with shell length indicate that shell shape of the two patellae doesn't change much during growth (Table 7). However, (base perimeter/shell volume), (shell surface area/shell volume) and (total surface area/shell volume) significantly decrease during growth (SL).

Table 7. Linear regressions of shell shape parameters of *P. rustica* and *P. cearulea*.

*: indicates significance at ≤ 0.05 level

Calculated shell parameters	Patella species	a	b	R ²
Shell conicity C vs. SL: (SH/SL) vs. SL	r	0.500	0.002*	0.01
	c	0.375	0.002*	0.10
cone eccentricity CE vs. SL: (SAA/SAP) vs. SL	r	0.677	0.004*	0.03
	c	0.815	0.001*	0.00
base ellipticity BE vs. SL: (SW/SL) vs. SL	r	0.792	0.002*	0.04
	c	0.753	0.000*	0.00
Base eccentricity (BEc vs. SL: (SWA/SW) vs. SL)	r	0.813	-0.001*	0.01
	c	0.754	0.002*	0.00
(RL/SL) vs. SL	r	0.397	-0.004*	0.09
	c	0.242	-0.003*	0.25
Log (Base perimeter/Shell volume) vs. SL	r	-0.664	-0.037*	0.84

	c	-0.449	-0.041*	0.91
Log (Shell surface area/Shell volume) vs. SL	r	-2.45	-0.019*	0.68
	c	-0.083	-0.022*	0.87
Log (Total surface area/Shell volume) vs. SL	r	0.001	-0.0194*	0.66
	c	0.166	-0.022*	0.87

Radula morphology

Basic morphology and microscopic anatomy of radulae of *P. rustica* and *P. cearulea* were similar. There were rows of median rachidian teeth (R) alternating with lateral (L) and marginal (M) teeth and cupids (C) as in (Fig. 4). However, the radula of *P. rustica* was much longer than that of *P. cearulea*, 7.00 ± 1.34 mm compared to 3.68 ± 0.73 mm (mean + St D, Table 3). Correlations of radula length with shell parameters of *P. rustica* and *P. cearulea* were weak to moderate (Table 8) but linear, power and logarithmic regressions had low coefficients of determination (Table 5). Mean radula relative sizes in relation to shell length (SL) and shell height (SH) of *P. rustica* and *P. rustica* were significantly different (Table 9).

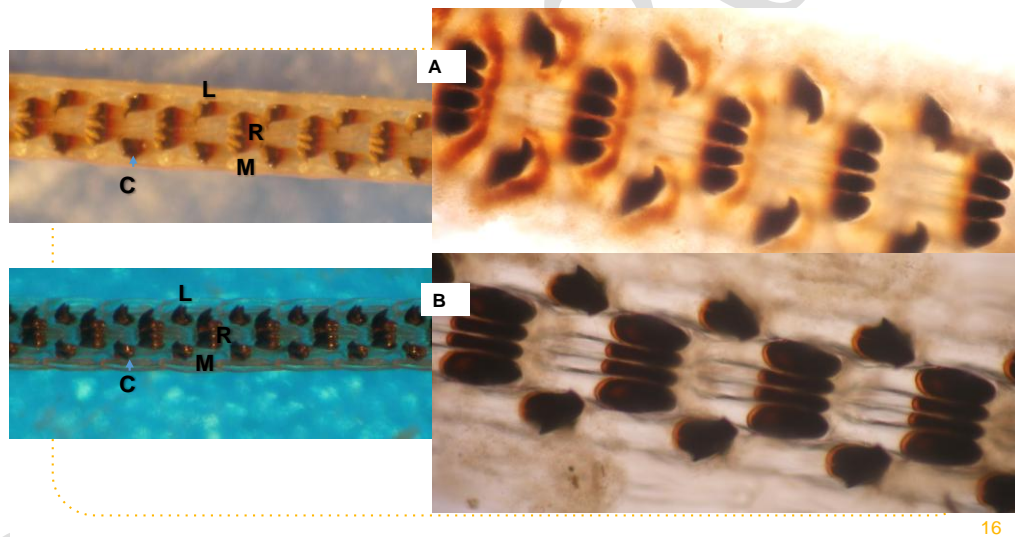


Figure 4. Microscopic anatomy of *P. cearulea* radula ribbon (A). (L): lateral teeth; (M): Marginal teeth. (R): rachidian teeth; (C): cupid. *Patella rustica* radula ribbon (B)

Table 8. Pearson's correlations of radula length with shell parameters of *P. rustica* and *P. cearulea*

Species	LW	ESW	SL	SW	SH	SWA	SAA	SAP
<i>rustica</i>	.608**	.660**	.424**	.437**	.426**	.376**	.162**	.320**
<i>cearulea</i>	.675**	.70**	.662**	.465**	.652**	.423**	.197**	.404**



Table 9. Radula relative size in relation to shell length (SL) and shell height (SH) of *P. rustica* (r) and *P. cearulea* (c). Table 8. Pearson's correlations of radula length with shell parameters of *P. rustica* and *P. cearulea* (c)

Radula relative size	RRS (RL/S)	r	0.283±0.056]	0.000
		c	0.154±0.034	
	RRS (RL/S)	r	0.504±0.119	0.000
		c	0.340±0.084	

Discussion

Fifty nine percent of Al-Hanya patellids were *P. rustica*, and 41 % were *P. cearulea*. These patellids generally occupied the mid rocky intertidal, especially around the shoreline and in tidal pools, where they were found attached firmly to scars of their own make. *P. rustica* generally occupied higher intertidal levels than *P. cearulea*. Rims of shells match perfectly those of the scars. Empty scars of all sizes that were seen covering most of the mid rocky intertidal indicated that Al-Hanya has been a favorable habitat for patellids since long time. Only one, recently dead, *Patella ulyssiponensis* was collected, apparently originating from deeper water. The present study is the first record of this species in Libya. Ayas (2010) found that *P. caerulea* and *P. rustica* constituted 88.89% and 11.11% in Mersin - Viranã...â Ehir region of the northeastern Mediterranean Sea; *P. caerulea* was found in mediolittoral and upper infralittoral zones, whereas *P. rustica* was mainly distributed in supralittoral zones. Davies (1969) stated that in the Mediterranean Sea, *P. rustica* occurs in the upper intertidal zone and *P. cearulea* and *P. aspera* (= *P. ulyssiponensis*) in a lower level. MarLIN (The Marine Life Information Network) stated that common limpet adheres tightly to its home scar so that it is very difficult to pry off. The low profile shells protect limpets from crashing waves and strong currents, and overheating and drying during exposure.

P. rustica and *P. cearulea* of the present study appeared to be somewhat similar. However, measurements showed that they are different, the former was a little larger, more conical and had a brownish sole compared to the black sole of the latter. Growth of *P. rustica* and *P. cearulea* was positively allometric, i.e. increase in weight during growth was faster than increase in length, shell shape however doesn't changes much. Preliminary evidences indicated that the pace of body increase in younger patellae, especially of *P. cearulea*, was different from that of grownups. Cabral (2007) however, reported that shell growth in European Atlantic *P. rustica* and *P. ulyssiponensis* was basically isometric.

Comparison of values of measured and calculated shell parameters with those obtained in previous studies is difficult because of environmentally induced high morphometric plasticity. Nevertheless, values of BE and CE for *P. cearulea* of the present study and Cabral (2007) were 0.8505 and 0.8206, and 0.8162 and 0.743 in order; BEc and C were 0.7888 and 0.930, and 0.5554 and 0.439. Mauro *et al.* (2003) underlined the importance of a genetic approach, as compared to morphological approach in discriminating Mediterranean *P. caerulea*, *P. aspera* and *P. rustica*.

Theoretically, the lowest risk of dislodgment for a limpet is associated with a centered apex, and C or BE ratio of ca 0.53 (Cabral, 2007). In the present study, both *P. caerulea*, *P. aspera* deviate from this optimum. Such deviation was also reported by Cabral. Cabral also stated further that in limpets, decreasing BP/SV or SA/SV ratios results in lower soft body temperature and desiccation. The BP/SV ratio of *P. rustica* and *P. caerulea* of the present study was 0.0266 and 0.0179; the SA/SV ratio was



0.1927 and 0.1561, but it is *P. rustica* (inhabit higher littoral level), rather than *P. caerulea*, which needs to guard itself more against overheating and desiccation.

Radulae of *P. rustica* and *P. caerulea* were basically similar. Nevertheless relative radula size and teeth morphology can be used for distinguishing between the two patellids. Radula growth occurred at lower pace than body growth. Similar conclusion was reported by Cabral (2007) and Ayas (2010). Cabral stated that radula relative size increased with increasing level in the shore, suggesting that this might be due to a decreasing abundance of algae with increasing shore level. This is consistent with results obtained in the present study; radula relative size of *P. rustica* was greater than that of *P. caerulea* which occupies a lower level.

The highest patella density encountered in the present study of 113 individual per m² may be explained by the suitability of Al-Hanya rocky littoral for patella settlements, absence of pollution and destructive anthropogenic activities, and that patella are not consumed in Libya. Limpets are usually eaten by people throughout their range (MarLIN). Marine fishers in neighboring Egypt consider *P. rustica*, *P. caerulea* and large periwinkles delicacy food, but, thanks to God, Libyan fishers and coastal people do not yet consider them edible. Al-Hanya littoral is, at present, very healthy, however, prevention is better than cure, and measures, which should include protected areas (MPAs), must be thought of from now.

References

- Ayas, Deniz, (2010). Distribution and morphometric characteristics of patella specie (Archaeogastropoda) in Mersin - Viranã...â€Ehir region of the northeastern Mediterranean Sea *Journal of FisheriesSciences com* · January 2010.
- Ayas, D., Almis, M. and Kaya, U.L. (2008): Distribution and morphometric characteristics of Patella (Archaeogastropoda) in Mersin-karaduvar Region of the northeastern Mediterranean Sea, *Journal of fisheries science.com*,2(3):570-575.
- Boukhicha, J., BenHassine O.K. and Tlig-Zouari, S. (2013): Morphological evidence for adaptive diversification of sympatric Mediterranean *Patella limpets*. *Rapp. Comm. int. Mer.Medit.*,40.
- Cabral.J. P. (2007): Shape and growth in European Atlantic *Patella limpets* (Gastropoda, Mollusca) Ecological implications for survival. *Web Ecology* 7:11-21.
- Davies, S. P. (1969). Physiological ecology of *Patella*. III. Desiccation effects. – *J. Mar. Biol. Assoc. UK* 49: 291–304.
- Espinosa, F., Guerra-Garcia, J.M. and Carlos Garcia-Gomes, J.C. (2007): Sewage pollution and extinction risk: an endangered limpet as a a bioindicators, *Biodiversity and conservation*, 16: 377-397.doi:10.1007/s10531-005-3014-3.
- Fischer-Piette, M.E. (1934): Remarques de systematique et de biogeographie sur les Patelles des cotes francaises, *Bulletin du Museum National d'Histoire Naturelle* 6 280–285.
- Kent B.W., 1988. Making dead oysters talk. Techniques for analyzing oysters from archaeological sites, Maryland Historical Trust, Historic St. Marys City, Jefferson Patterson Park and Museum.
- MarLIN. The Marine Life Information Network. Oceana: common Limpets: <https://oceana.org/marine-life/cephalopods-crustaceans-other-shellfish/common-limpet>
- Mauro, A., Arculeo, M., Parrinello, N., (2003): Morphological and molecular tools in identifying the Mediterranean limpets *Patella caerulea*, *Patella aspera* and *Patella rustica*. *Journal of Experimental Marine Biology and Ecology*, 295, 131-143.



Biological strategy for the rehabilitation of saline soils in the perspective of sustainable agricultural development

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Abstract

The current finding on the combined effects of climatic and anthropogenic factors concludes that arable land is becoming increasingly unavailable due to degradation resulting among others from soil salinity. In fact, 20% of the world's cultivated land and about 50% of the irrigated land are affected by salinity. It has been estimated that about 30% of the available land will be lost in the next 25 years; this figure is likely to change by up to 50% by 2050. The introduction and development of halophilic species is a possible approach for phytoremediation of soils contaminated by salinity and requires knowledge of certain mechanisms involved, such as cationic mineral management at the plant level under this salted constraint. The proposed work is based on an analysis of the Na⁺, K⁺ and Ca⁺⁺ cationic responses of juvenile plants of two species of atriplex, *Atriplex halimus* L. and *Atriplex canescens* Pursh Nutt, submitted to NaCl stress at 100, 300 and 600 mM.l⁻¹ of Hoagland solution to determine the salinity tolerance threshold for each species. The results show a variability of the cationic status of the two species related to the NaCl effects according to the organs, species and NaCl concentration. Indeed, Na⁺ accumulates strongly in the leaves of both species, with greater leaf richness for *Atriplex halimus* L. whatever the NaCl concentration of the medium. On the other hand, K⁺ evolves more in the leaves of *Atriplex canescens* and root trapping of Na⁺. Ca⁺⁺ is distributed practically in a balanced way in organs of both species with lower concentrations compared to Na⁺ and K⁺. On the other hand, *Atriplex canescens* has a higher *Relative Salt-Susceptibility Index (R.S.S.I)* and the ratio K⁺/Na⁺ than *Atriplex halimus* L.

Keywords: food needs, soil salinity, rehabilitation, phytoremediation, halophytes, atriplex, cations



The semi-electronic fish auction: an innovation, developed by Urla-Iskele (Izmir, Turkey) Fishery Cooperative

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Abstract

The fish marketing chain in Urla is actually rather simple. Trading occurs directly in the fishing port via fish auction by the Urla-Iskele fishery cooperative. Small-scale fishermen (SSF) deliver their daily catch to the cooperative every morning before 10.00 am and cooperative staff sells them via public auction within one hour to final consumer (local residents and restaurants). Occasionally, the remaining catch is stored in a cold room storage or transported to wholesale fish market. The cooperative receives a 10% share of the sale. Iskele fishery cooperative has been established in 1988. Number of members are 45 at the present time. An 'e-auction system' has been developed by the cooperative management staff in the last year for easy progress and complete sales inputs. Thus, this presentation aims to introducing the new system that also unique for Turkey.

Keywords: Fish auction, fishery cooperative, Urla, Izmir.

Introduction

A cooperative has variable capital partnership established by real and legal persons in order to provide and protect certain economic interests and especially the needs of their partners or livelihoods with their legal and personal contributions through mutual assistance, solidarity and guarantee. The main purpose of fishermen cooperatives; it consists of providing rationally and economically needs of real persons, who do not have sufficient economic power for their occupations and livelihoods by mutual assistance (Ünal and Yercan, 2006). According to Turkish Laws, fishery cooperatives depend on law of agricultural cooperatives (no. 1163, date of acceptance: 24 Apr. 1969, official gazette no: 13195).

The fish marketing chain in Urla is actually rather simple. Trading occurs directly in the fishing port via fish auction by Urla-Iskele fishery cooperative. Small-scale fishermen (SSF) deliver their daily catch to the cooperative every morning before 10.00 a.m. and cooperative staff sells them via public auction within one hour to final consumer (local residents and restaurants). Occasionally, the remaining catch is stored in a cold room storage or transported to wholesale fish market. The cooperative receives a 10% share of the sale.

The Urla-Iskele fishery cooperative has been established in 1988. Number of members are 45 at the present time. There is regularly fish auction in every morning at 10.00 a.m. An 'e-auction system' was developed by the cooperative management staff in the last year for easy progress and complete sales inputs. Thus, this presentation aims to introducing the new system that also unique for Turkey.

This study was carried out by observation of fish auction, interviewing with the manager and practical training with the manager of the cooperative in İskele, Urla during May and June 2019.

The Semi-electronic Fish Auction

The Urla-Iskele Fisheries Cooperative has recently been got into a new e-system that more transparent, reliable and electronic storage of the auction system. System is concerning with weighing, barcode identification and computer storage. So, we called 'semi-electronic fish auction system' due to absence of e-button for the customers. The steps of new system show in Table 1 and Figure 1-2.



Table 1. Steps of e-auction in Urla-Iskele fishery cooperative.

Steps	Process
1	Main monitor with 3 options: preparation, sales, reporting
2	When logging into the system, the user must select and enter his password. After logging into the system, it is determined who uses the system and performs the operation.
3	Fish are divided into plates according to their species and weights (usually 1.5 kg).
4	After weighing the fish, the species and weight information are directed to the main computer for the auction.
5	A card is selected to identify the fish information to the card and the system is identified to the computer by barcode reader.
6	After the card identification process is performed, it is determined from the main computer who the fish are?
7	After determining who the fish are, we meet three options.
8	After the multi-plate option, the plate number menu appears.
9	After, the species on plate are determined.
10	If the same monger has another fish, after the type has been determined, the process can be continued by clicking on the continue button after reading the new card with a barcode reader.
11	The sales card loaded with fish information is placed on the plate and prepared for selling for the auction.
12	The auction starts for the plate after the card is read by the barcode reader.
13	After the barcode is read by the barcode reader, information about the fish monger, fish and price is displayed on the screen in the auction area.
14	The same information are entered to the main computer.
15	The price determined in the auction is also entered into the computer.
16	There is a second computer in the auction area which allows the fish to be weighed and placed on the plates during the auction.
17	After the sale of the auction is continued with the reporting option. After clicking on the reporting option, you can enter the user name and password again and log into the system.
18	After entering the reporting section, a very detailed menu appears.
19	When we enter the daily sales report, it can give us the end of day whole report.
20	When we print the end-of-day report, a large invoice detail appears.
21	When we clicking to the fish sales reports section, we can go to the date range that we want and reach the data about which fish species are sold and how much.
22	In the Fishermen's Report section, the date range and the fish sales data can be accessed by selecting the fisherman.
23	A selected fisherman and his fish list.
24	Customers with running accounts (i.e., restaurants).
25	Total debts of customers with running accounts.
26	Daily computer storage of the producers name, fish, price, amount and their plate numbers.
27	All data can be copied within a certain date range.

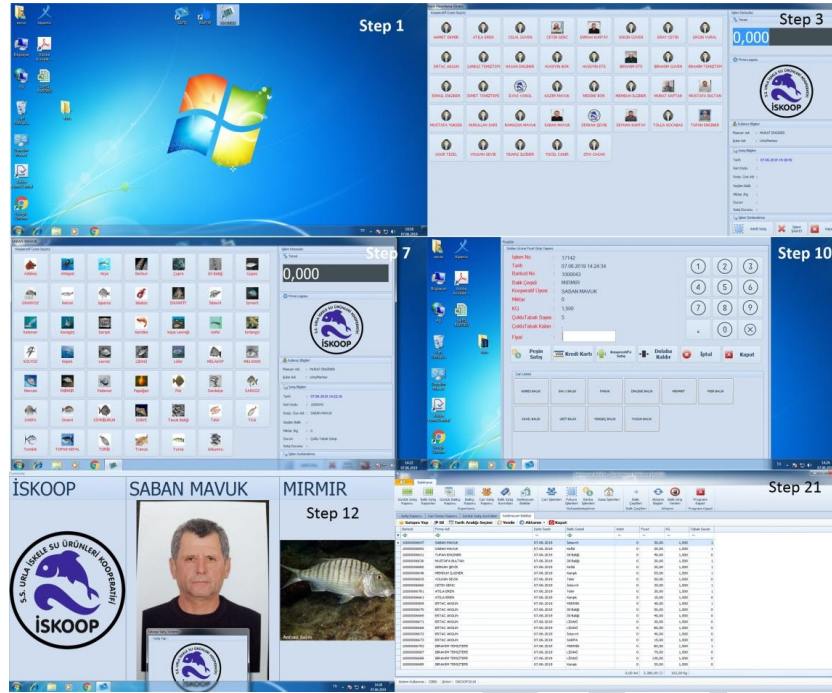


Figure 1. Some selected screenshots of computer process.



Figure 2. The barcode card (Step 11), barcode reader (Step 12), screen in the auction area (Step 13), second computer in auction area (Step 16).

Benefits of the e-auction system

- Fast and transparent data recording,
- Ease of accounting after the sales,
- Accountability against to the partners,
- Possibility of providing healthy data to the government institutions,
- Ease to record of commission values earned,
- Knowledge on which period and what kind of fish was caught,
- Knowledge on which species and how much fish were caught,
- Which cooperative provides how much input?
- Facilitation of supervision of cooperatives,



- To have an idea about regional activities in the light of the data obtained,
- Perhaps, the income of small-scale fishermen can be documented and facilitated agricultural loan use.

Conclusion

It is concluded that this electronic auction system is easy, understandable and safe to operate. The most important advantage is the fact that the daily auction sales information can be accessed retrospectively by quantity, price and individual. In addition, the information stored primarily to the District Directorate of the Ministry of Agriculture and Forestry, Turkey Statistical Institute, Ministry of Finance (Revenue Administration), University, etc. it is also important that it can provide accurate and instant information to many institutions. The system can provide accurate evidence of disputes with fishermen and retailer tradesmen in account-casting operations. In terms of fishery science, seasonal distribution dimensions of fishes obtained from the castings can be demonstrated bio-economically. Fishing power planning can be done in order to find buyers from the real value of fish. When the system goes to backwards to monthly, annual, five-year and so on it can be provide strong data supporting for academic studies. However, the actual area and depth of the fishing, and the unit effort parameters such as the number of fishing gears, soak time, boat length, horse power seem to be a lack of this system. When these aforementioned parameters are added to the system, the catch per unit effort (CPUE) as an important result for the fishery science can be detected. And finally, this new system should be propagated to the other fishery cooperatives.

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Reference

Ünal V., & Yercan, M. (2006). Fishery cooperatives in Turkey and their importance for fishermen (*in Turkish*). *Su Ürünleri Dergisi*, 23, 221-227.



First occurrence of *Ligula* sp in endemic cyprinid *Ladigesocypris irideus* (Ladiges, 1960) From Ula Reservoir (Mugla, Turkey)

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Abstract

The tapeworm, *Ligula* sp. (Diphyllobothriidae), is reported as the first record from the endemic cyprinid, Anatolian ghizani, *Ladigesocypris irideus* (Ladiges, 1960) collected from Ula Reservoir, Mugla province, southwestern Turkey. With its complex life cycle, cestods of *Ligula* reach their plerocercoid stage in fish abdominal cavity as their second host. In this study plerocercoids of *Ligula* sp. were found in 37.5 % of the fish from output of Ula Reservoir. This is also the first record of this parasite from southwestern Anatolia which is an evidence of increasing spread of this group in non-infected parts of Turkey mainly through the forced biological invasion. As an effective factor of fish population loss, it's important to monitor and manage the spread of this parasite especially for the endemic and endangered fish species of the basin.

Keywords: Cyprinids, Parasite-host, Freshwater fish, Mugla



Analysis of the small-scale fisheries landings in the Foça MPA (Turkey) for the second half of 1990s

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Abstract

The purpose of the study is to present and analyze the daily marine fisheries landings data by small scale fishery (SSF) collected from the Foça town fish market auction between 1994 and 1998. A total of 57 452.5 kg of marine fisheries landings was recorded comprising 55 % demersal fish species, 39 % pelagic fish species, 5% Cephalopods and 1% Crustaceans. It is suggested to collect and estimate the marine commercial landings including the discard data so as to better manage the fisheries in particular at the important fishing towns and MPAs.

Keywords: Izmir Bay, small scale fishery, landing, MPA.

Introduction

The town of Foça is situated at the entrance of Izmir Bay on the central Aegean coast of Turkey and about 50 km north of the Izmir metropolitan area. It is one of Turkey's 18 Special Environmental Protection Areas (tvk.csb.gov.tr). In 1991, Foça was selected as a Pilot Monk Seal Conservation Area (PMSCA) where industrial fisheries, including purse-seine fishery and trawling, were banned in 1992, in order to implement the National Strategy for the Conservation of the Monk Seal issued by the National Monk Seal Committee of Turkey (Güçlüsoy & Savaş, 2003).

At the time of the present study, a fleet of approximately 41 artisanal fishing boats - comprising 26 full-time (FT) and 15 part-time (PT) - has been reported to operate from the port of Foça (Ünal, 2001; 2003). Fishermen usually worked between the coastline and the 60 m isobath. Most boats were open-hulled, smaller than 10 m in length, and powered by inboard engines ranging from 5 to 28 HP and with a capacity of 0.5 to 1.5 tons. Fishing trips usually lasted between 4 and 12 hours at night. The average number of fishing days for FT artisanal fishermen was calculated as 203 days and for PT artisanal fishermen as 136 days for the 1999 and 2000 fishing seasons (Ünal, 2001; 2003).

In Foça, among the fishing gears used are trammel and gill nets and bottom longlines. The lengths of the trammel and gill nets are usually 600-1200 m and 600-1500 m, respectively. Bottom longlines are set on or close to the sea bed, and consist of a series of baited hooks - either with size no. 8 or no. 14 - on a line (Güçlüsoy, 2008a). The characteristics of these fishing gears were described previously by Güçlüsoy (2008b). The interaction of SSF with endangered monk seal was also delivered by Güçlüsoy (2008a; 2008b). To date, landing records were only given in provincial level by Turkish Statistical Institute (e.g. TUIK, 2018), and no record was available on landings in town level. Therefore, the purpose of the study is to analyze the daily marine fisheries landings data by small scale fishery (SSF) collected from the Foça town fish market auction between 1994 and 1998.

Material and Methods

The marine fisheries landing data by SSF was collected on a daily basis at the Foça fish market during auction time between 11 April 1994 and 30 December 1998 (Table 1).



Table 1. The total landings data, at genus or species level, recorded in the Foça fish market from 1994 to 1998.

Demersal	kg	Salema, <i>Sarpa salpa</i> (Linnaeus, 1758)	6 74
Scorpaena spp.	38	Common dentex, <i>Dentex dentex</i> (Linnaeus, 1758)	31
Mullus spp.	5 03	Sharpnout seabream, <i>Diplodus puntazzo</i> (Walbaum, 1792)	16
Common sole, <i>Solea solea</i> (Linnaeus, 1758)	4 80	Total	31 42
Brown meagre, <i>Sciaena umbra</i> Linnaeus, 1758	2	Pelagic	
Red pogry, <i>Pagrus pagrus</i> (Linnaeus, 1758)		Leerfish, <i>Lichia amia</i> (Linnaeus, 1758)	36
Lophius spp.	8	European anchovy, <i>Engraulis encrasicolus</i> (Linnaeus, 1758)	
Tub gurnard, <i>Chelidonichthys lucerna</i> (Linnaeus, 1758)	4	Trachurus spp.	1 40
White grouper, <i>Epinephelus aeneus</i> (GeoffroySaint-Hilaire, 1817)		Mugilidae spp.	16 64
Meagre, <i>Argyrosomus regius</i> (Asso, 1801)	40	Chub mackerel, <i>Scomber japonicus</i> Houttuyn, 1782	22
Common pandora, <i>Pagellus erythrinus</i> (Linnaeus, 1758)	1 07	Bluefish, <i>Pomatomus saltatrix</i> (Linnaeus, 1766)	11
Dusky grouper, <i>Epinephelus marginatus</i> (Lowe, 1834)	1	Atlantic bonito, <i>Sarda sarda</i> (Bloch, 1793)	25
Largehead hairtail, <i>Trichiurus lepturus</i> Linnaeus, 1758		European pilchard, <i>Sardina pilchardus</i> (Walbaum, 1792)	5
John dory, <i>Zeus faber</i> Linnaeus, 1758	4	Round sardinella, <i>Sardinella aurita</i> Valenciennes, 1847	22
European flounder, <i>Platichthys flesus</i> (Linnaeus, 1758)	27	European barracuda, <i>Sphyræna sphyraena</i> (Linnaeus, 1758)	2
European hake, <i>Merluccius merluccius</i> (Linnaeus, 1758)	26	Atlantic mackerel, <i>Scomber scombrus</i> Linnaeus, 1758	18
Pink dentex, <i>Dentex gibbosus</i> (Rafinesque, 1810)	1	Garfish, <i>Belone belone</i> (Linnaeus, 1760)	
European eel, <i>Anguilla anguilla</i> (Linnaeus, 1758)	1	Bogue, <i>Boops boops</i> (Linnaeus, 1758)	2 69
Gilthead seabream, <i>Sparus aurata</i> Linnaeus, 1758	2 47	Total	22 19
Black seabream, <i>Spondyliosoma cantharus</i> (Linnaeus, 1758)	2	Cephalopods	
Annular seabream, <i>Diplodus annularis</i> (Linnaeus, 1758)	72	Common octopus, <i>Octopus vulgaris</i> Cuvier, 1797	1 18
Picarel, <i>Spicara smaris</i> (Linnaeus, 1758)	4	European squid, <i>Loligo vulgaris</i> Lamarck, 1798	1 46
Common two-banded seabream, <i>Diplodus vulgaris</i> (GeoffroySaint-Hilaire, 1817)	63	Musky octopus, <i>Eledone moschata</i> (Lamarck, 1798)	
Smooth-hound, <i>Mustelus mustelus</i> (Linnaeus, 1758)		Cuttlefish, <i>Sepia officinalis</i> Linnaeus, 1758	39
European seabass, <i>Dicentrarchus labrax</i> (Linnaeus, 1758)	2 38	Total	3 04
Saddled seabream, <i>Oblada melanura</i> (Linnaeus, 1758)	2 14	Crustaceans	
Blotched picarel, <i>Spicara maena</i> (Linnaeus, 1758)	16	European lobster, <i>Homarus gammarus</i> (Linnaeus, 1758)	29
Sand steenbras, <i>Lithognathus mormyrus</i> (Linnaeus, 1758)	1 18	Caramote prawn, <i>Penaeus kerathurus</i> (Forskål, 1775)	49
White seabream, <i>Diplodus sargus</i> (Linnaeus, 1758)	1 88	Total	78

The landed species were identified according to FishBase, www.fishbase.org and the nomenclature was verified by both FishBase and WoRMS, www.marinespecies.org during preparation of the present proceeding. The descriptive statistics analysis of the data was performed by MS-Excel.

With the aim to compare mean landings per trip among the years, the following steps were followed: in order to test for normality and homoscedasticity, data was evaluated by using the tests of Kolmogorov-Smirnov (Zar, 1999) and examining Skewness and Kurtosis (Tabachnick & Fidell, 2013). Since the datasets and their log transformed versions did not pass the normality test, non-parametric procedures were applied (Zar, 1999). Therefore, the data sets were analysed with Kruskal-Wallis H test to compare mean landings per trip among the years. Mann Whitney-U test was also used to detect differences among the years. All these statistical analyses were performed by SPSS 20.0.

Results and Discussion

A total of 57 452.5 kg of marine fisheries landings - comprising 55 % demersal fish species, 39 % pelagic fish species, 5% Cephalopods and 1% Crustaceans - was obtained by SSF in Foça between 1994 and 1998. With regards to species diversity, a total of 31 demersal fish species, 13 pelagic fish species, 4



cephalopod species and 2 crustacean species were identified (Table 2). The descriptive statistics of the landing data is delivered in Table 2. The most important genus/species regardless of their value for SSF in Foça can be given as Mugilidae spp., Salema, *S. salpa*, Mullus spp., Common sole, *S. Solae*, Bogue, *B. boops*, Gilthead seabream, *S. aurata*, and European seabass, *D. labrax*.

Table 2. The descriptive statistics of marine fisheries landings between 1995 and 1998.

	Year	Days	Mean (kg/d)	Std.D	Min (kg)	Max (kg)	Total (kg)	Trips	Mean (kg/trip)
All	1995	135	112.2	71.0	8.5	335.0	15 151	1 373	11.03
	1996	185	49.4	31.3	2.0	143.5	9 138	828	11.04
	1997	259	84.0	69.0	5.0	525.0	21 752	1 639	13.27
	1998	210	54.3	36.5	1.0	229.5	11 410	986	11.57
	Total	789	72.8	59.4			57 452	4 826	11.90
Demersal	1995	135	62.2	45.1	0.0	233.0	8 398	1 373	6.12
	1996	185	22.2	17.4	0.0	95.5	4 108	828	4.96
	1997	259	48.0	42.4	1.0	240.5	12 437	1 639	7.59
	1998	210	30.8	26.3	0.0	123.5	6 476	986	6.57
	Total	789	39.8	37.3			31 420	4 826	6.51
Pelagic	1995	135	40.9	36.1	0.0	213.5	5 522	1 373	4.02
	1996	185	23.7	19.8	0.0	99.5	4 381	828	5.29
	1997	259	29.9	31.0	0.0	261.5	7 732	1 639	4.72
	1998	210	21.7	21.8	0.0	112.5	4 563	986	4.63
	Total	789	28.1	28.3			22 199	4 826	4.60
Cephalopods	1995	135	6.2	5.3	0.0	33.0	835.5	1 373	0.61
	1996	185	3.3	6.7	0.0	48.5	609.0	828	0.74
	1997	259	5.2	8.1	0.0	62.5	1 340	1 639	0.82
	1998	210	1.2	2.2	0.0	12.5	261.0	986	0.26
	Total	789	3.9	6.5		62.5	3 046	4 826	0.63
Crustaceans	1995	135	2.9	4.5	0.0	34.5	394.5	1 373	0.29
	1996	185	0.2	0.9	0.0	8.5	40.0	828	0.05
	1997	259	0.9	2.7	0.0	22.5	242.0	1 639	0.15
	1998	210	0.5	1.6	0.0	11.5	110.0	986	0.11
	Total	789	1.0	2.8			786.5	4 826	0.16

After Kruskal-Wallis H test, the differences (p-value) between the years' mean landings per trips according to Mann-Whitney-U test are given in Table 3.

Table 3. Statistical differences for the mean landings per trips among the years calculated by Mann-Whitney-U test.

	1995-1	1995-1	1995-1	1996-1	1996-1	1997-1
All	0.48	0.00	0.90	0.00	0.45	0.00
Demersal	0.00	0.00	0.91	0.00	0.00	0.00
Pelagic	0.00	0.21	0.92	0.02	0.00	0.30
Cephalo	0.00	0.22	0.00	0.00	0.00	0.00
Crustace	0.00	0.00	0.00	0.00	0.01	0.03

* Denotes statistically differences.

At the time of the study, although we do not have any data on the fishing gear effort/fishing power at the sea, the Foça marine fisheries landings showed typical multi-gear/multi species fishery that is also a main characteristic of SSF in the Mediterranean (FAO, 2018). It is also worth noting that among 50 marine species no alien species were recorded as marketed. We found out that there were some differences among the mean landings per trip among the years. This may be because we cannot normalize the data



according to fishing effort. Moreover, the landings were not only brought to the auction, they were and still nowadays are also sold directly to consumers, fish mongers or restaurant owners by the fishers. Finally, it is worth noting that as there were no samplings during the first three months of 1994 (including most of the winter period), most probably the average daily landings of 1994 are biased high.

Because the authors could not get any estimation nor any data from neither from TUIK Izmir Regional Directorate nor from Foça Forestry and Agriculture Town Directorate, we cannot compare our findings with State figures. We believe, it is important to collect and estimate the marine commercial landings including the discard data sin order to better manage the fisheries in particular at the important fishing towns and MPAs.

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References

- FAO (2018). *The State of Mediterranean and Black Sea Fisheries*. General Fisheries Commission for the Mediterranean. Rome.
- Güçlüsoy, H., & Savaş, Y. (2003). Status of the Mediterranean monk seal, *Monachus monachus*, in the Foça Pilot Monk Seal Conservation Area, Turkey. *Zoology in the Middle East*, 28, 5-16. DOI:10.1080/09397140.2003.10637951
- Güçlüsoy, H. (2008a). Interaction between monk seals, *Monachus monachus* (Hermann, 1779), and artisanal fisheries in the Foça Pilot Monk Seal Conservation Area, Turkey. *Zoology in the Middle East*, 43,1, 13-20. DOI:10.1080/09397140.2008.10638264
- Güçlüsoy, H. (2008b). Damage by monk seals to gear of the artisanal fishery in the Foça Monk Seal Pilot Conservation Area, Turkey. *Fisheries Research*, 90, 70-77. DOI:10.1016/j.fishres.2007.09.012
- Tabachnick, B.G., & Fidell, L.S. (2013). *Using Multivariate Statistics*, 6th ed. Pearson Education Inc., USA.
- TUIK (2018). *Fisheries Statistics 2017 (in Turkish)*. Turkish Statistics Institution, Ankara.
- Ünal, V. (2001). *An Investigation on Socio-Economic Analysis of Foça Fishery and its Evaluation from the Sustainability Point of View (in Turkish)*. Ph.D. Thesis, Ege University, Institute of Natural and Applied Science, Izmir.
- Ünal, V. (2003). Socio-economic analysis of part time small-scale fishery, Foça (Aegean Sea). *Journal of Fisheries and Aquatic Sciences*, 20, 165-172. DOI:10.12714/egejfas.2003.20.1.5000157054
- Zar, J.H. (1999). *Biostatistical Analysis*, 4th ed. Prentice - Hall, USA.



Temporal variation of Gastropoda and Scaphopoda (Mollusca) species along the Sugözü coast (İskenderun Bay, Levantine Sea)

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Abstract

The aim of the study is to investigate the temporal variations of the soft-bottom molluscan species distributed along the Sugözü coast in İskenderun Bay. The benthic material was collected in 12 sampling sites at depths between 2 and 19 m by using a van Veen grab sampler in the period between February and October in the year 2009. A total of 74 species were identified belonging to 27 families of the classes Gastropoda and Scaphopoda. The most dominant species in the area were *Finella pupoides* Adams A., 1860 (43% in spring) and *Bittium reticulatum* (Da Costa, 1778) (43% in fall, 48% in winter, 28% in summer). Besides, *F. pupoides* was with the highest frequency index values in the seasons. Of the identified taxa, 12 species were found to be with alien origin.

Keywords: Gastropoda, Scaphopoda, Mollusca, Sugözü, İskenderun Bay, Temporal variation

Introduction

Sugözü coast is located in the north-western region of İskenderun Bay which has been exposed to alien species invasion due to its proximity to the Suez Canal and intense maritime shipping traffic. In the area is also located one of the largest imported coal power plant of Turkey. Therefore, the intense coal transportation by ships probably also facilitates the invasion of alien species to the area through the ballast waters.

The preliminary data on alien gastropod species of İskenderun Bay can be encountered in the study by Barash & Danin (1977). Afterwards, many studies have been carried out on the alien species of İskenderun Bay (Kinzelbach, 1985; Enzenross & Enzenross, 1987; Çevik & Öztürk, 2001; Bitlis-Bakır et al., 2012; 2016; Öztürk et al., 2015) along with some other studies including the native molluscs of the area (Houart, 2000; Çevik & Ergüden, 2004).

The study by Bitlis-Bakır et al. (2012) attempt attention as the most comprehensive work on the molluscs of İskenderun Bay in which was listed 424 mollusc species. Besides, Bitlis-Bakır et al. (2016) analyzed the temporal variations during the years 2012, 2013 2014 of mollusks in the northwestern part of İskenderun Bay.

The aims of the present study is to determine the composition of the gastropod and scaphopod species on the soft bottoms in Sugözü coast and analyze the temporal variations.

Material and Methods

Benthic samples were collected at 12 sampling sites in depths from 2 to 19 m during the months February, May, July and October in 2009 by using a van Veen grab (0.1 m²) (Figure 1). The taken material was sieved with a 0.5 mm mesh and fixed in 4% seawater-formalin solution in the field and, in the laboratory, it was sorted to the taxonomic groups under a stereomicroscope and preserved in 70% ethanol. Later on, the mollusc specimens were identified and counted. Some of the ecological features of the sampling sites are given in Table 1.

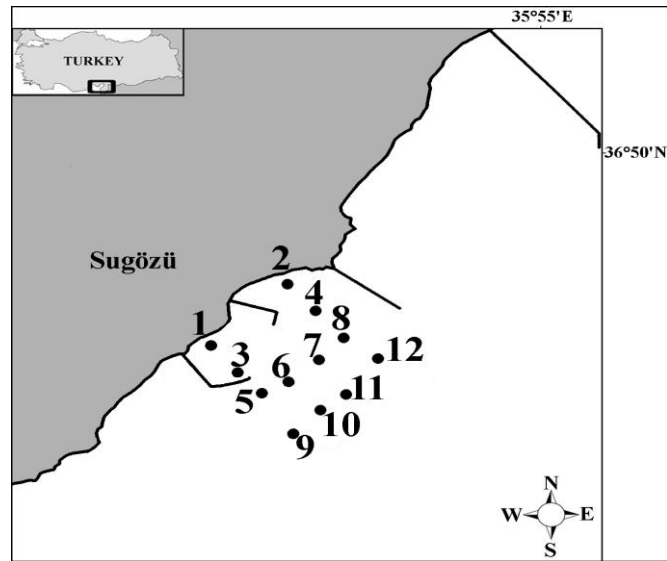


Figure 1. Map of the study area with location of sampling sites.

Table 1. The coordinates, biotopes and depths of the sampling sites.

Stations	Coordinates		Biotope	Depth (m)
	Latitude-Longitude			
1	36°49'49.20"N	35°52'57.00"E	Sand	4.5
2	36°50'14.40"N	35°53'31.20"E	Fine sand	3.3
3	36°49'37.80"N	35°53'09.60"E	Mud	7.2
4	36°50'03.00"N	35°53'44.40"E	Muddy sand	6.6
5	36°49'29.40"N	35°53'21.00"E	Muddy sand	9.6
6	36°49'34.20"N	35°53'32.40"E	Muddy sand	10.2
7	36°49'42.60"N	35°53'46.20"E	Muddy sand	11.5
8	36°49'51.60"N	35°53'57.60"E	Muddy sand	11.7
9	36°49'13.20"N	35°53'35.40"E	Mud	18
10	36°49'22.20"N	35°53'47.40"E	Mud	19
11	36°49'28.20"N	35°53'59.40"E	Mud	18.5
12	36°49'43.20"N	35°54'13.20"E	Mud	18.5

In order to analyze the community structure, Bellan Santini's (1969) dominance index (D), Soyer's (1970) frequency index (F), Shannon-Weaver's (1949) diversity index (\log_2 base) (H'), Pielou's (1975) evenness index (J') were calculated for each sampling site in four seasons (winter, spring, summer, autumn). The systematic classification are given according to WoRMS (World Register of Marine Species, August, 2019).

The identified species have been deposited at ESFM (Museum of Faculty of Fisheries, Ege University, İzmir, Turkey).

Results

As a result of the faunistic analysis of sampled material, a total of 74 mollusc species belonging to 27 families and 2 classes (Gastropoda and Scaphopoda) were revealed. The class Gastropoda was represented by 71 species and Scaphopoda by 3 species. Among the identified taxa, 40 species were determined in the benthic samples taken in summer, 38 species in autumn, 29 species in spring and 22 species in winter (Table 2). In the present study, the most abundant species were *Finella pupoides* Adams A., 1860 (43%) in spring and *Bittium reticulatum* (Da Costa, 1778) in three seasons (43% in autumn, 48% in winter and 28% in summer).

According to the frequency index values, *F. pupoides* and *B. reticulatum* were found to have constant distribution in the region during autumn (58%, 75%), winter (50%, 58%) and summer (67%,



83%), although in spring season *F. pupoides* and *Cerithidium diplax* (Watson, 1886) were with the highest frequency values (67%) (Table 2).

Table 2. The number of species (S), the number of specimens (N), frequent and dominant species according to seasons.

Seasons	S	N (birey/m ²)	Frequency index values (%)	Dominance (%)
Autumn	3	12600	<i>C. scabridum</i> (50%), <i>S. brachystoma</i> (50%), <i>F. pupoides</i> (58%), <i>C. diplax</i> (58%), <i>B. reticulata</i> (75%), <i>T. pygmaea</i> (75%)	<i>B. reticulatum</i> (43%)
Winter	2	6820	<i>C. diplax</i> (42%), <i>F. pupoides</i> (50%), <i>T. pygm</i> (50%), <i>B. reticulatum</i> (58%)	<i>B. reticulatum</i> (47.8%)
Spring	2	5840	<i>F. pupoides</i> (67%), <i>C. diplax</i> (67%)	<i>F. pupoides</i> (42.6%)
Summer	4	5730	<i>F. pupoides</i> (67%), <i>B. reticulatum</i> (83%)	<i>B. reticulatum</i> (28.1%)

Seasonal variations in the number of species and specimens, diversity and evenness indices at all stations are presented in Table 3. The number of species was generally high at station 1 in spring (13 species), in autumn (16 species) and winter (10 species) except for summer season. The largest number of species was determined at station 6 (28 species) and station 7 (13 species) in summer, respectively. The highest number of specimens was encountered at station 1 (2540 spc.m⁻²) in spring, at station 7 (2300 spc.m⁻²) in summer, at station 4 (3810 spc.m⁻²) in autumn and at station 2 (3950 spc.m⁻²) in winter (Table 3).

Table 3. Temporal variation in community parameters at the sampling sites in seasons.

Station	Number of species				Number of specimens (specimens/m ²)			
	Sp	Su	A	W	Sp	Su	A	W
1	13	4	16	10	2540	40	1920	1520
2	3	11	10	10	70	800	700	3950
3	6	0	1	3	520	0	10	50
4	2	9	21	6	40	480	3810	270
5	12	10	13	2	1980	410	3020	40
6	9	28	9	4	210	1430	1490	60
7	6	13	8	11	180	2300	930	770
8	5	4	9	4	90	70	640	70
9	1	2	3	1	10	20	40	20
10	1	1	1	1	30	10	10	50
11	6	1	1	0	100	10	30	0
12	2	4	0	2	70	160	0	20
Station	Evenness index				Diversity index			
	Sp	Su	A	W	Sp	Su	A	W
1	0,4	1,0	0,6	0,7	1,5	2,0	2,3	2,3
2	0,7	0,5	0,7	0,5	1,1	1,7	2,3	1,6
3	0,6	0,0	0,0	1,0	1,4	0,0	0,0	1,5
4	0,8	0,7	0,5	0,6	0,8	2,3	2,4	1,7
5	0,5	0,8	0,5	0,8	1,8	2,6	1,9	0,8
6	0,9	0,8	0,6	1,0	2,9	3,9	1,8	1,9
7	0,9	0,6	0,7	0,6	2,3	2,2	2,2	2,1
8	0,9	0,9	0,7	0,9	2,2	1,8	2,2	1,8
9	0,0	1,0	0,9	0,0	0,0	1,0	1,5	0,0
10	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
11	0,9	0,0	0,0	0,0	2,4	0,0	0,0	0,0
12	1,0	0,7	0,0	1,0	1,0	1,4	0,0	1,0



As for the evenness index values at stations, the highest value ($J' = 1$) was found at station 12 in spring, at stations 1 and 9 in summer, at stations 6 and 12 in winter and at station 9 ($J' = 0.9$) in autumn. The highest diversity index values ($H' = 2.9$ and 3.9) were calculated at station 6 in spring and in summer, respectively. Whereas, the largest diversity values were determined in different stations in autumn (station 4, $H' = 2.4$) and in winter (station 1, $H' = 2.3$) (Table 3).

Of the identified species, 12 species were with alien origin and their number was changed between 7 and 9 according to seasons (9 species in winter and summer and 7 species in autumn).

Discussion

A total of 74 mollusc species belonging to 27 families were determined in the present study of which the class Gastropoda was represented by the majority of species and families (25 families and 71 species) followed by Scaphopoda with 2 families and 3 species only. The gastropods *Tritia pygmaea* (Lamarck, 1822) was with wide distribution along Sugözü coast in autumn and winter seasons. It is known as a species forming dense populations in the polluted areas (Çınar et al., 2006; 2012, Moreira et al., 2010).

The results of the present study can be compared with the studies carried out previously along the coasts of İskenderun Bay by Bitlis et al. (2016) and Mersin Bay by Çınar et al. (2012). Bitlis et al. (2016) encountered 94 species belonging to the class Gastropoda and 2 species belonging to Scaphopoda in the summer season of 2012, 2013 and 2014 near Botaş Oil Filling Facility in İskenderun bay. *B. reticulatum* and *F. pupoides* were similarly found as the abundant species in studies carried out by Bitlis et al. (2016) and Çınar et al. (2012). Furthermore, *B. reticulatum*, *F. pupoides* and *C. diplax* were widely distributed in the region (Bitlis et al. 2016).

The majority of the alien species determined in the present study (9 species) were lessepsian migrant entered the Mediterranean Sea through the Suez Canal and the other ones (*C. diplax*, *Cerithidium perparvulum* (Watson, 1886), *Conomurex persicus* (Swainson, 1821) are known to be introduced by shipping traffic (Çınar et al., 2011).

It is a known fact that *C. diplax* and *F. pupoides* are alien species which can affect the mollusc composition in the distribution area (Bitlis et al. 2016 and Çınar et al. 2012), and in the present study they were found to be widely distributed in İskenderun Bay.

The number of species was the highest in the summer season. It was decreased during autumn and was the lowest one through the winter season, although the number of specimens was high during autumn and winter. The fact may be due to the increase of abundance of *B. reticulatum*, *C. diplax* and *F. pupoides*. The temporal variations were similar to the findings noted by Çınar et al. (2012), where was stated that the abundance of alien species was high through autumn and winter seasons.

The present study showed that İskenderun Bay is exposed to intensive settlements of alien gastropods, and the benthic communities may have spatial and temporal variations, which should be investigated in further studies.

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References

- Barash, A. & Danin, Z. (1977). Additions to the Knowledge of Indo-Pacific Mollusca in the Mediterranean. *Conchiglie*, 13 (5-6): 85-116.
- Bellan-Santini D. (1969). Contribution à l'étude des peuplement infralittoraux sur substrat rocheux (Etude qualitative et quantitative de la franch Superiere). *Recherche Travaux Station Marine Endoume, France*, 63(47): 9- 294.
- Bitlis-Bakır, B., Öztürk, B., Dogan, A. & Önen, M. (2012). Mollusc Fauna of Iskenderun Bay with a checklist of the Regon. *Turkish Journal of Fisheries and Aquatic Sciences*. 12: 171-184. DOI: 10.4194/1303-2712-v12_1_20.
- Bitlis-Bakır, B., Öztürk, B., Dogan, A. & Türkçü, N. (2016). Temporal variation of the soft-bottom molluscan fauna in Northwestern Iskenderun Bay (Levantine Sea). *Oceanological and Hydrobiological Studies*. 45 (4): 445-452. DOI: 10.151/ohs-2016-0038.



- Çevik, C. & Ergüden, D. (2004). Fauna of the Polyplacophora (Mollusca) between Samandag (Hatay) and Anamur (Mersin) of the Northeast Mediterranean Coasts of Turkey. In B. Öztürk & A. Salman (Eds.), 1st National Malacology Congress, 1-3 September 2004 (pp. 87-91). *Turkish Journal of Aquatic Life*, Istanbul, Turkey.
- Çevik, C. & Öztürk, B. (2001). A new lessepsian mollusc *Hypselodoris infucata* (Ruppell & Leuckart, 1828) (Gastropoda: Nudibranchia) for the coasts of Turkey. *Turkish Journal of Zoology*, 25: 27-30.
- Çınar, M.E., Bilecenoglu, M. Öztürk, B. & Can, A. (2006). New records of alien species on the Levantine coast of Turkey. *Aquatic Invasions*, 1(2): 84-90. DOI: /10.3391/ai.2006.1.2.6.
- Çınar, M.E., Bilecenoglu, M., Öztürk, B., Katakın, T., Yokes, M.B., Aysel, V., Dağlı, E., Açıık, Ş., Özcan, T. & Erdoğan, H. (2011). An updated review of alien species on the coasts of Turkey. *Mediterranean Marine Science*, 12: 257-315.
- Çınar, M.E., Katakın, T., Öztürk, B., Dağlı, E., Açıık, S., Bitlis, B., Bakır, K. & Doğan, A. (2012). Spatio-temporal distributions of zoobenthos in Mersin Bay (Levantine Sea, eastern Mediterranean) and the importance of alien species in benthic communities. *Marine Biological Research*, 8: 954-968.
- Enzenross, L. & Enzenross, R. (1987). Studie über das Vorkommen von Mollusca und Crustacea an der türkischen Küste (Mittelmeerküste und Ägäis). *Ravensburg, Unveröffentlichtes Manuskript*, 1-17.
- Houart, R. (2000). New species of Muricidae (Gastropoda) from the northeastern Atlantic and the Mediterranean Sea. *Zoosystema*, 22: 459-469.
- Kinzelbach, R. (1985). Lessepsische Wanderung: neue Stationen von Muscheln (Bivalvia: Anisomyaria). *Archiv für Molluskenkunde*, 115(4-6): 273-278.
- Moreira, J., Aldea, C. & Troncoso, J.S. (2010). Temporal dynamics of gastropod fauna on subtidal sandy sediments of the Ensenada de Balona (NW Iberian Peninsula). *Helgoland Marine Research*, 64: 311-320. DOI: 10.1007/s10152-009-0186-3.
- Öztürk, B., Recevik, M. & Geyran, K. (2015). New alien Molluscs in the Mediterranean Sea. *Cahiers de Biologie Marine*, 56: 205-212.
- Pielou, E.C. (1975). Ecological diversity. John Wiley Interscience Publ. London.
- Shannon, C.E. & Weaver, V. (1949). A mathematical theory of communication. *Universities Press*, Illinois, Urbana.
- Soyer J. (1970). Bionomie benthique du plateau continental de la cote catalana Française, III. Les Peuplements de Copepodes Harpacticoides (Crustacea). *Vie Milieu*, 21: 377-511.
- WoRMS Editorial Board (2019). World Register of Marine Species. Retrieved August 2019, from <http://www.marinespecies.org> at VLIZ. doi:10.14284/170



Impact of Acute Toxicity of Cadmium on the Nutritional value of *Donax trunculus*: Variation of Carbohydrate contents

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Abstract

In the present study we are interested in cadmium, a heavy metal frequently found in aquatic ecosystems located in urbanized and industrialized areas. This work aims to evaluate the impact of cadmium on the nutritional value of a bivalve mollusc *D. trunculus* using amounts of carbohydrate biomarker.

The experiments were conducted during the sexual activity period. Samples were collected from EL Battah site (remote site of polluting sources) and raised in the laboratory under controlled conditions. Cadmium was added to the sea water at two sublethal concentrations (CL 10-96h = 0.94 mg / L and CL 25-96h = 1.60 mg / L for females, CL 10-96h = 1.15 mg / L and CL 25 -96h = 2.02 mg / L for males), previously determined (Merad & Soltani, 2016), the effects were examined at different exposure and restoration times.

The results show a decrease in carbohydrate levels during the exposure period and a recovery of these levels during the treatment period in both sexes. In addition, the results also show that females accumulate more carbohydrate reserves and mobilize more energy than males.

Keywords: *Donax trunculus*, cadmium, pollution, carbohydrate levels, Bioindicator.



An Investigation of How Aquatic Insects (Arthropoda: Insecta) Effect on Water Quality of Riva Stream (Istanbul)

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Abstract

In this study aquatic insects were collected between March 2018 to January 2019 with seasonal sampling at five stations of Riva Stream (Istanbul). 2194 individuals, 58 taxa belonging to Ephemeroptera (4 taxa), Odonata (5 taxa), Heteroptera (3 taxa), Trichoptera (4 taxa), Lepidoptera (1 taxon), Coleoptera (10 taxa) and Diptera (31 taxa) were determined. Considering the percentages of species dominance, *Simulium* sp. was the most dominant species with 42.07%. *Baetis* sp. (13.45%) and *Chironomus riparius* Meigen, 1804 (10.48%) were recorded as the second and third dominant species.

Within the scope of the study, the sources of pollution were determined by evaluating the biotic indices in Asterics 3.01 (AQEM, 2002) together with the biological data. According to water quality results, ST4 and ST5 as Class II; ST2 and ST3 as Class III-IV and ST1 were determined as Class II –III level. Also, various physico-chemical parameter average values (water temperature (°C), pH, dissolved oxygen (%), salinity (ppm), conductivity (µS/cm), PO₄-P (µg/L), NO₃-N (µg/L), NO₂-N (µg/L) were calculated.

Keywords: Water quality, Asterics, aquatic insects, macrobenthic invertebrates, physico-chemical parameters.

Introduction

Aquatic insects are the main group of arthropods in which at least one stage of their life revolves in water. Mostly they inhabit in the water during the primary stages before they become terrestrial adults (e.g. Ephemeroptera, Odonata, Plecoptera, Trichoptera and Megaloptera). Semi-aquatic insects are only associated with aquatic and semi-aquatic vegetation, water surface or boundaries of water habitats (Merritt and Cummins, 1996).

They play important ecological roles in ensuring the proper functioning of freshwater ecosystems. The best indicators for biological evaluation and the abiotic environment of the water body directly affect the distribution, population density and diversity of freshwater insects (Solanki and Shukla, 2015). The diversity of aquatic insects species is valuable for humans and animals for a variety of reasons, of which four are particularly important. These are the roles of insects (1) in food nets, (2) in biomonitoring, (3) in fishing and (4) in controlling harmful weeds (Nair et al, 2015).

Riva Stream is a 70 km long water reservoir surrounded by the Northern Forests and located on the South-North direction of the Asian side of Istanbul. It has approximately 859 km² water collection basin. The stream is born in Gebze Tepecik Village and flows from Beykoz Riva to the Black Sea (Figure 1).

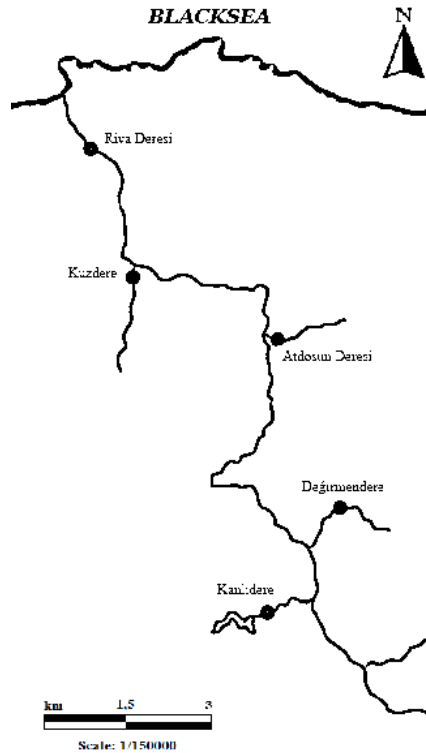


Figure 1. Map of Riva Stream.

Table 1. Coordinates of stations.

No	Stations	N	E
ST1	Riva	41.12763	29.13521
ST2	Kuzdere	41.10963	29.13978
ST3	Kanlıdere	41.07127	29.16175
ST4	Atdosun	41.10403	29.16333
ST5	Değirmendere	41.08222	29.17393

The aim of this study is to determine aquatic insect fauna which is one of the important organism groups and to measure various physicochemical parameters affecting these insects in order to approach water quality of Riva Stream which is very important resource for Istanbul province.

Material and Methods

Aquatic insect samples were collected from five stations of Riva Stream (Riva, Kuzdere, Kanlıdere, Atdosun and Değirmendere) by seasonal sampling between March 2018 to January 2019 (Table 1). The samples were collected with 0.5 mm mesh size D-frame handnet against the direction of water flow within an 1 m² area unit. The bottom sediment was fixed with ethyl alcohol and washed from the measured sieves under high pressure water and preserved with 75% ethyl alcohol in the laboratory. The dominance (%) of taxa was calculated according to sample number [D = (n / N) * 100].

Some physico-chemical parameters (water temperature (°C), pH, dissolved oxygen (mg/L), salinity (ppm) and conductivity (µS/cm)) were measured by multiparameter devices during sampling. The depth (cm) of streams between two sides forming the boundary between water and soil were measured, also the width (cm) were measured by steel tape measure. The flow rate measurements were made by FP211 Global Water Flow. Various chemical parameter values such as PO₄-P (µg/L), NO₃-N (µg/L) and NO₂-N (µg/L), were analyzed according to the standard method (Boyd and Tucker, 1992)

The biological data obtained within the scope of the study were evaluated with the biotic indexes in Asterics 3.01 (AQEM, 2002) programme and Riva Stream's water quality were determined.



Results

As a result, 2194 individuals, 58 taxa belonging to Ephemeroptera (4 taxa), Odonata (5 taxa), Heteroptera (3 taxa), Trichoptera (4 taxa), Lepidoptera (1 taxon), Coleoptera (10 taxa) and Diptera (31 taxa) were determined.

Considering the percentages of species dominance, *Simulium* sp. was the most dominant species with 42.07%. *Baetis* sp. (13.45%) and *Chironomus riparius* (10.48%) were recorded as the second and third dominant species (Table 2).

Table 2. Dominancy (%) of taxon of aquatic insects at the stations.

Ordo	Family	Taxon name	D (%)
Ephemeroptera	Baetidae	<i>Baetis</i> sp.	13,45
		<i>Cloeon</i> sp.	0,05
	Caenidae	<i>Caenis</i> sp.	0,05
	Heptageniidae	<i>Heptagenia</i> sp.	1,23
Odonata	Coenagrionidae	<i>Ischnura elegans</i> Vander Linden, 1820	0,14
	Gomphidae	<i>Gomphus</i> sp.	0,05
		<i>Ophiogomphus cecilia</i> (Fourcroy, 1785)	0,27
	Libellulidae	<i>Orthetrum brunneum</i> (Fonscolombe, 1837)	1,64
	Platycnemididae	<i>Platycnemis pennipes</i> (Pallas, 1771)	3,01
Heteroptera	Nepidae	<i>Nepa cinerea</i> Linnaeus, 1758	0,05
	Corixidae	<i>Corixa</i> sp.	0,09
	Gerridae	Gerridae Gen. sp.	0,05
Trichoptera	Glossomatidae	Glossomatidae Gen. sp.	0,09
	Helicopsychidae	<i>Helicophysche</i> sp	0,05
	Hydropsychidae	<i>Hydropsysche</i> sp.	0,87
	Hydroptilidae	Hydroptilidae Gen. sp.	0,05
Lepidoptera	Pyralidae	Pyralidae Gen. sp.	0,23
Coleoptera	Dytiscidae	<i>llybius</i> sp.	0,05
		<i>Dytiscus</i> sp.	0,14
	Scirtidae	<i>Elodes</i> sp.	0,05
	Gyrinidae	<i>Gyrinus</i> sp.	0,09
	Hydrophilidae	<i>Hydrophilus</i> sp.	0,18
		<i>Paracymus</i> sp.	0,05
	Dytiscidae	<i>Hygrotus</i> sp.	0,05
	Noteridae	<i>Noterus clavicornis</i> (De Geer, 1774)	0,23
	Chrysomelidae	<i>Plateumaris</i> sp.	0,09
Curculionidae	<i>Bagous</i> sp.	0,05	
Diptera	Chironomidae	<i>Ablabesmyia</i> sp.	0,59
		<i>Chironomus plumosus</i> (Linnaeus, 1758)	5,47
		<i>Chironomus riparius</i> Meigen, 1804	10,98
		<i>Chironomus tentans</i> Fabricius, 1805	1,00
		<i>Endochironomus albipennis</i> (Meigen, 1830)	0,96
		<i>Eukiefferiella brevicar</i> (Kieffer, 1911)	0,05
		<i>Halocladus fucicola</i> (Edwards, 1926)	0,50
		<i>Kiefferulus tendipediformis</i> (Goetghebuer, 1921)	0,36
		<i>Micropsectra radialis</i> Goetghebuer, 1939	0,27
		<i>Micropsectra</i> sp.	0,14
		<i>Microtendipes chloris</i> (Meigen, 1818)	0,09
		<i>Procladius (Holotanypus)</i> sp.	4,88
		<i>Paratanytarsus lauterborni</i> (Kieffer, 1909)	0,23



		<i>Paratanytarsus</i> sp.	0,09
		<i>Paratrichocladus</i> sp.	0,09
		<i>Polypedilum nubeculosum</i> (Meigen, 1804)	0,09
		<i>Polypedilum pedestre</i> (Meigen,1830)	0,91
		<i>Polypedilum</i> sp.	0,82
		<i>Procladius (Holotanypus)</i> sp.	3,28
		<i>Prodiamesa olivacea</i> (Meigen, 1818)	0,05
		<i>Tanypus punctipennis</i> Meigen, 1818	2,78
		<i>Tanypus</i> sp.	0,18
	Ceratopogonidae	<i>Atrichopogon</i> sp.	0,05
		<i>Bezzia</i> sp.	0,09
	Dixidae	<i>Dixa</i> sp.	0,05
	Limoniidae	<i>Rhypholophus</i> sp.	0,14
	Psychodidae	<i>Psychoda</i> sp.	0,32
	Rhagionidae	<i>Chrysopilus</i> sp.	0,96
	Simuliidae	<i>Simulium</i> sp.	42,07
	Tabanidae	<i>Tabanus</i> sp.	0,09
	Tipulidae	<i>Tipula</i> sp.	0,14

According to the dominance (%) of order results, Diptera was the most dominant group with 78% because Diptera lives in all types of streams regardless of pollution level. Dominance rates of other orders were Ephemeroptera 9%, Coleoptera and Odonata 5%; Heteroptera, Lepidoptera and Trichoptera was found as 1%. No species of Plecoptera was observed in any stations (Figure 2).

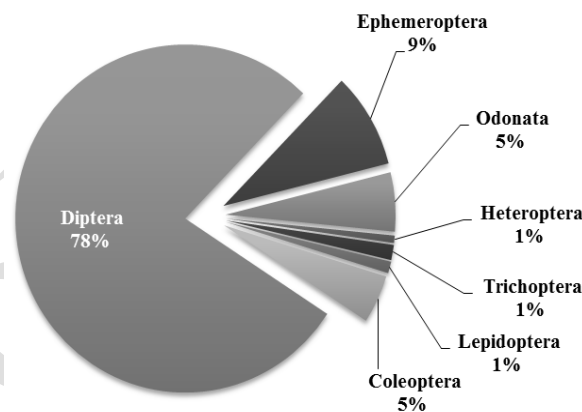


Figure 2. The dominance of order.

When we look at the distribution and frequency of order, it is seen that Diptera has the highest percentage and the most frequent ordo at all stations. Diptera is followed by Ephemeroptera at stations 1 and 2, Trichoptera at ST3, Odonata at ST4 and Coleoptera at ST5 (Table 3).

Table 3. Frequency and dominance (%) of order.

		Ephemeroptera	Odonata	Heteroptera	Trichoptera	Lepidoptera	Coleoptera	Diptera
ST1	Abundance	2	1	-	-	1	1	43
	%	4.167	2.083	-	-	2.083	2.083	89.583
ST2	Abundance	62	4	-	-	-	2	197
	%	23.396	1.509	-	-	-	0.755	74.34
ST3	Abundance	2	1	-	3	-	2	63



	%	2.817	1.408	-	4.225	-	2.817	88.732
ST4	Abundance	17	27	2	5	1	3	114
	%	10.059	15.976	1.183	2.959	0.592	1.775	67.456
ST5	Abundance	2	3	1	-	1	5	31
	%	4.651	6.977	2.326	-	2.326	11.628	72.093

Various physicochemical parameters (water temperature ($^{\circ}\text{C}$), flow rate (m/s), dissolved oxygen (mg/L), pH, salinity (ppm), conductivity ($\mu\text{S}/\text{cm}$), $\text{PO}_4\text{-P}$ ($\mu\text{g}/\text{L}$), $\text{NO}_3\text{-N}$ ($\mu\text{g}/\text{L}$), $\text{NO}_2\text{-N}$ ($\mu\text{g}/\text{L}$) average values were calculated. The values are detailed in Table 4.

Table 4. Average of various physicochemical parameters at stations.

	Depth	Width	W	FR	DO	pH	Sa	Cond	$\text{PO}_4\text{-P}$	$\text{NO}_3\text{-N}$	$\text{NO}_2\text{-N}$
	(cm)	(cm)	($^{\circ}\text{C}$)	(m/s)	(mg/L)		ppm	($\mu\text{S}/\text{cm}$)	($\mu\text{g}/\text{L}$)	($\mu\text{g}/\text{L}$)	($\mu\text{g}/\text{L}$)
ST1	32.8	6700	14.	0.0	5.81	7.8	1.3	1900	223.3	425.1	96.56
ST2	19.6	303.	13.	0.6	8.50	7.9	0.0	440	21.28	416.8	38.49
ST3	27	318.	12.	0.9	9.01	8.0	0.0	130	34.8	262.8	12.84
ST4	24.1	174	13.	0.2	9.46	8.0	0.3	220	46.79	240.2	19.05
ST5	46.5	449	14.	0.1	8.11	7.7	0.2	630	174.3	536.5	95.35

Results of various physicochemical values show that the deepest stations was 5th station with 46.5 cm and the widest station was ST1 with 6.7 m. Water temperature results show that stations value between 12.6 $^{\circ}\text{C}$ and 14.9 $^{\circ}\text{C}$ and flow rate between 0 and 0.9 m/s.

pH between 7.73 and 8.08 and conductivity between 130 and 1900 $\mu\text{S}/\text{cm}$. According to Criteria of Regulation on the Management of Surface Water Quality (2016), ST3 and ST4 were determined as Class I level, ST2 and ST5 were Class I-II level while ST1 is Class II-III level in terms of conductivity. Salinity values of stations were between 0.04 and 1.31 ppm. St1 is the main branch of the stream and the closest station of the sea. Thus, it has highest value.

Dissolved oxygen was between 5.81 and 9.46 mg/L. Criteria of Regulation on the Management of Surface Water Quality (2016) indicates that all stations have Class I level of water quality in terms of dissolved oxygen value except its main branch. It has Class II-III level.

$\text{PO}_4\text{-P}$ was between 21.28 and 223.32 $\mu\text{g}/\text{L}$, $\text{NO}_3\text{-N}$ was between 240.22 and 536.58 $\mu\text{g}/\text{L}$ and $\text{NO}_2\text{-N}$ was between 12.84 and 96.56 $\mu\text{g}/\text{L}$. Criteria of Regulation on the Management of Surface Water Quality (2016) indicates that water quality constitutes to the 1st (ST2, ST3, ST4) and 2nd (ST1, ST5) Class level in terms of $\text{PO}_4\text{-P}$. Both of the highest nitrite and nitrate were observed at ST1 and ST5. It could be dangerous for living organisms.

According to the results of Table 5, the frequency is the highest in the 2nd and 4th stations. At ST1, taxa number is 8, while at other stations the taxa number is ≥ 20 . When the EPT-Taxa [%] is examined, it is determined that ST2 is the most dominant station with 23.396. It is followed by ST4 with 13.018. ST3 is the richest station in terms of EPT taxa, although it ranks 3rd with 7.042.

Table 5. Results of Asterics 3.01

	ST1	ST2	ST3	ST4	ST5
Abundance [ind/m ²]	48	265	71	169	43
Number of Taxa	8	20	22	27	21
EPT-Taxa [%]	4.167	23.396	7.042	13.018	4.651
BMWP (Biological Monitoring Working Party)	12	53	54	74	46
ASPT (Average score per Taxon)	4	5.889	4.356	5.286	5.111



Results of the Indexes were shown that the lowest BMWP, and ASPT values were found at 1st station, while the highest values were found at 4th station for BMWP, and 2nd station for ASPT. According to ASPT scores, 2nd, 4th and 5th stations were polluted less (doubtful quality) (ASPT Value 4-5), while 1st and 3rd stations in which the frequency of Diptera was the highest, were mid-level polluted (ASPT Value 4-5). According to results of BMWP, at the 1st station the water quality was polluted (BMWP score 11-40), at the 2nd, 3rd and 5th stations the water quality was mid-level polluted (BMWP score 41-70) and at the 4th station, the water quality was good (BMWP score 71-100).

Table 6. Water Quality Class of stations.

Water Quality Class	
ST1	II-III
ST2	III-IV
ST3	III-IV
ST4	II
ST5	II

The water quality results according to biological parameters were given in Table 6 in detail. According to the table, ST4 and ST5 as II; ST2 and ST3 as III-IV and ST1 were determined as Class II – III level.

Considering the Riva Stream's biodiversity, determining the pollution situation gains environmental and biological importance. With this study, it is intended to determine aquatic insects diversity and to understand the pollution level by using biotic indexes. It could keep a light on future water quality studies and to contribute to the formation of an infrastructure for biotic indices that can be developed for our country and to the biodiversity inventory.

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References

- Anonymous. 2016. Criteria of Regulation on the Management of Surface Water Quality. TR Official Gazette Nr. 29797, Ankara.
- AQEM., 2002. Manual for the application of the AQEM method. A comprehensive method to assess European streams using benthic macroinvertebrates, developed for the purpose of the Water Framework Directive. Version 1.0, February 2002.
- Askew R. R., 1988. *Keys to the Final-Instar Larvae of European Odonata*, The Dragonflies of Europe, Harely; Colchester-England. 194-211 pp.
- Bryce, D., Hobart, A., 1972. *The biology and identification of the Larvae of the Chironomidae (Diptera)*. Entomologist's Gazete, 23: 175-217.
- Boyd, C.E., Tucker, C.S., 1992. *Water Quality and Pond Soil Analysis for Aquaculture*. Agricultural Experiment Station, Alabama.
- Merritt, R.W., Cummins K.W., 1996. *An introduction to the aquatic insects of North America*. Vol. 3. Kendall/Hunt Publishing Company, pp. 862.
- Nair G.A., Morse J.C., Marshall S.A., 2015. *Aquatic insects and their societal benefits and risks*, Journal of Entomology and Zoology Studies 3(3): 171-177. E-ISSN: 2320-7078.
- Nilsson A. (ed.), 1996. *Aquatic Insects of North Europe. A taxonomic handbook. Vol.1: Ephemeroptera. Plecoptera, Heteroptera, Megaloptera, Neuroptera, Coleoptera, Trichoptera and Lepidoptera*. Apollo Books, Denmark, 274 pp., ISBN 87-88757-09-9.



- Nilsson A. (ed.). 1997. *Aquatic Insects of Northern Europe. A taxonomic handbook*, Vol.2: Odonata. Diptera, Apollo Books, Denmark, 440 pp. ISBN 87-88757-15-3.
- Oscoz J., Galicia D., Miranda R. (ed.), 2011. *Identification Guide of Freshwater Macroinvertebrates of Spain*, Springer, London. 153 pp. ISBN: 978-94-007-1553-0.
- Solanki R., Shukla A., 2015. *Aquatic Insects for Biomonitoring Freshwater Ecosystems: A Report*, International Journal of Science and Research (IJSR). ISSN (Online): 2319-7064.
- Şahin, Y. 1991. *Turkiye Chironomidae Potamofaunasi (The Chironomidae potamofauna of Turkey)*. Tubitak, Project no: TBAG-869, VHAG-347, TBAG-669, TBAG-792, Ankara, 88 pp.
- Zhang Z.-Q. (ed.), 2011. *Animal biodiversity: An outline of higher-level classification and survey of taxonomic richness*, Zootaxa, Magnolia Press, Auckland- New Zealand, 3148: 1-237. ISSN: 1175-5334 (online edition).

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Applied of a new bacterial species isolated from an activated sludge in the denitrification treatment of the wastewater

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Abstract

Denitrification is the key reactions in the nitrogen cycle, which allowed converting the nitrate to atmospheric nitrogen, in a single step or by two successive steps through the intermediate nitrite. These reactions are much recommended in the wastewater treatment, under the action of several denitrifying bacteria. In this communication, we were developed a new denitrifying strain called *Proteus sp S19*, isolated from an Algerian activated sludge. This strain was identified and incubated in a tube of broth containing nitrate. For the denitrification assay, we have incubated the strain *Proteus sp.S19* in a bioreactor contains a synthetic medium rich in nitrite ion, the determinations of residual and produced concentrations of different ions present in the medium before and after the denitrification process was effectuated. The bacterial density of the medium was increased during the denitrification process which was explained by the growth of the *Proteus sp S19* strain in the medium with a denitrification rate of 90%.

Keywords: Denitrifying bacteria, *Proteus sp*, Denitrification, Activated sludge, Wastewater



Fishing Competitions in Turkey and Focus on Alaçatı Big Fish Tournament

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Abstract

This study aimed at the determination of the profile of big pelagic fishing tournaments and fish species in catch composition. The study was conducted by compiling the data of the 2016, 2017 and 2018 Alaçatı Big Fish tournaments. International rules are applied in the competition, which has been implemented in recent years with the theme of promoting sustainable fisheries and developing catch and release fishing without harming the nature. Alaçatı Big Fish competition has been held with 430 participants, 46 organization volunteers and thousands of spectators from 173 sport fishing boats in the last 3 years. In the competition, Blue fin tuna (*Thunnus thynnus* L. 1758), Albacore (*Thunnus alalunga* Bonnaterre, 1788) Swordfish (*Xiphias gladius* L. 1758), Dolphinfish (*Coryphaena hippurus* Linnaeus, 1758), Mediterranean spearfish (*Tetrapturus belone* Rafinesque, 1810), Amberjack (*Seriola dumerili* Risso, 1810) Leerfish (*Lichia amia* L. 1758) species were caught. Blue fin, Albacore Swordfish, Mediterranean spearfish species was released into the sea according to the catch and release principles. As a result, big pelagic fishing competitions, recreational organizations that emphasize the struggle with fish and support sustainable fishing model respectful to nature with catch and release technique. This study profile of the applied large pelagic fishing tournament in Turkey and data about the caught fish were obtained. This study will shed light on the future studies.

Keywords: Fishing competitions, Big pelagic fishes, Bluefin Tuna, Alaçatı big fish tournament

Introduction

The term fishing may be applied to catching other aquatic animals such as shellfish, cephalopods, crustaceans and echinoderms. The term is not usually applied to catching aquatic mammals, such as whales, where the term whaling is more appropriate, or to farmed fish. In addition to providing food, modern fishing is also a recreational sport. Recreational fishing, also called sport fishing, is fishing for pleasure or competition. It can be contrasted with commercial fishing, which is fishing for profit, or subsistence fishing, which is fishing for survival. The most common form of recreational fishing is done with a rod, reel, line, hooks and any one of a wide range of baits. Other devices, commonly referred to as terminal tackle, are also used to affect or complement the presentation of the bait to the targeted fish. Some examples of terminal tackle include weights, floats, and swivels. Lures are frequently used in place of bait. Some hobbyists make handmade tackle themselves, including plastic lures and artificial flies. The practice of catching or attempting to catch fish with a hook is known as angling.

Sport fishing methods vary according to the area fished, the species targeted, the personal strategies of the angler, and the resources available (EAA 2003). It ranges from the aristocratic art of fly fishing elaborated in Great Britain, to the high-tech methods used to chase marlin and tuna. Sport fishing is usually done with hook, line, rod and reel rather than with nets or other aids (Dunn 2000). Among the most common offshore salt water game fish are marlin, tuna, sailfish, shark, and mackerel. Big-game fishing, also known as offshore sportfishing, offshore gamefishing, or blue-water fishing is a form of recreational fishing, targeting large fish such as tuna and marlin which game fishermen regard as having "sporting qualities". Fly fishing, which is the most common fishing competition in America, started in the



1960s. Big-game fishing started as a sport after the invention of the motor boat. Charles Frederick Holder, a marine biologist and early conservationist, is credited with founding the sport in 1898 (Goadby, P. and Holt, H. (1972). Nowadays The amount of people who fish for sport in America about 40 million and reached 30 billion dollars

It is stated that the number of amateur fishermen reaching 8-10 million in Europe creates a trade volume of 25 billion euros per year (Dillon, 2004). The competitions are divided into two as sea and inland water according to the area they are applied. Otherwise fishing tournaments classified according to fishing method, as spinning, angling, harpoon, drifting. Angling and spinning methods are used in the coastal competitions, while most of the competitions with boat are used for trolling or drifting. Considering the history of fishing competitions in Turkey in the 1980s, small-scale start of the competition, is seen as widespread in the 2000s with the development of angling industry

Small regional competitions are organized in order to revive inland waters fishing tourism, to meet people with nature and sometimes to remove uncontrolled fish from the environment. Big pelagic fishing competitions are practiced offshore by fast boats. This study aimed that determination of profile which big pelagic fishing tournaments and fish species in catch composition

Material and Methods

The rules, participants and the caught fish of the International Big Fish Competition held in Alaçatı district of the fountain district of İzmir constitute the material of this study. The Alaçatı big fish competition is conducted in the western part of Kuşadası Gulf Figure 1.



Figure 1. Map of the study area

Meeting with the organizers of the competition, examining the competition rules, observations made in the competition area constitute the methods of this study. The data of the study was compiled with the participation of the contest in 2016, 2017 and 2018, the results and archives of the contest, the meeting with the organizers of the contest and the visit of the Alaçatı Big Fish contest area in 2018

Stages of the competition

Start: The competition consists of 4 days, 2 days fishing, 2 days preparation and evaluation. starts at 7 am with the start of the boats. The boats with low speed can start at 6.30 hours, boats with a speed greater than 10 miles per hour wait at the start line under the control of the referee boats at the entrance of Alaçatı Bay and start to act quickly with the start signal (flare, audible warning) figure 2. For bait drift method, it is advantageous to throw the first fishing rod in the fishing area. The fishing period ends at 15:30. This period of the team that started to fight continues until the end of the fight.



Figure 2. Start of competition

Feeding and Angling: In the fishing area, was feeded with fish that will attract the attention of tuna. The depth of the tuna coming under the boat is determined by echo sounder. The bait at the end of the fishing line is lowered to the depth where the fish is located and the balloon is tied away from the boat.

Fight: Inserting the hook into the mouth of the fish by swallowing the bait is named as a leash. From time to time, the fish is drawn towards the water surface and released in a controlled manner when it wants to dive. All of these practices are defined as combat or fight. As soon as the fight starts, the referee boat is announced and the region and boat name information is given. Other nearby boats expand the fishing area by opening around the fighting boat. The tuna that swallows the food swims deeply and exhibits the escape behavior. In this process, the drag adjustment of the fishing rod should be neither too tight nor too loose. When the fish stops, the person who will fight will take the cane and start to pull the fish by attaching the fighting belt. This can take hours to fight figure 3. In this process to help the person struggling to keep the cane is a cause of disqualification.



Figure 3. Fighting with Tuna

Fish on boat or catch and release: When the fish approaches the boat, the leader can be held with the hand from the moment the fishing line enters from the tip of the reed. After this moment a person can intervene in the fish. Another person may help for sling. If the fish is to be released (catch-and-drop), it is swim gently near the boat with the help of a ram attached to the mouth under the chin. It is expected that the fish will recover by providing oxygenated water to pass through the gills figure 4. The length of the fish is determined by taking a tape measure with a tape measure attached to the line and cut from the point closest to the mouth.



Figure 4. Catch and release

Weighing And Scoring: The fish caught by the crew catching fish are weighed by refer commission. Fish are scored according to their weight, catch and release are scored according to their lenght .

Results

In the last 3 years, 173 sporting fishing boats of the Alaçatı Big Fish competition were held with 430 participants, 46 organization volunteers and thousands of spectators. Although the number of participants in the competition varies each year, there is an overall increase. It is determined that the year 2007 has the lowest number of participants and the year 2014 is the competition with the highest number of participants Figure 5, Figure 6.

Number Of Competitors

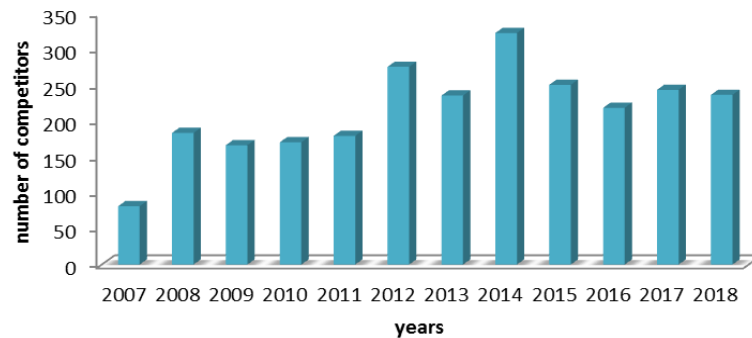


Figure 5. Attending of anglers according to years

Number Of Boats in The Competition

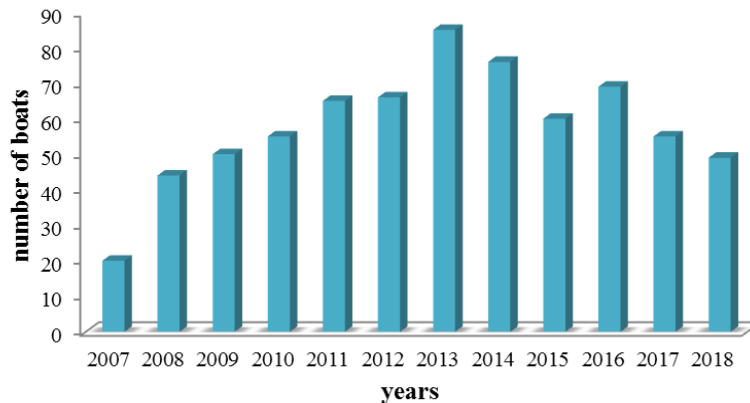


Figure 6. The number of boats according to years



In the competition, Blue fin tuna (*Thunnus thynnus* L. 1758), Albacore (*Thunnus alalunga* Bonnaterre, 1788) Swordfish (*Xiphias gladius* L. 1758), Dolphinfish (*Coryphaena hippurus* Linnaeus, 1758), Mediterranean spearfish (*Tetrapturus belone* Rafinesque, 1810), Amberjack (*Seriola dumerili* Risso, 1810) Leerfish (*Lichia amia* L. 1758) species were caught figure 7. Blue fin, Albacore Swordfish, Mediterranean spearfish species was released into the sea according to the catch and release principles. In addition to being the most caught species in the Alaçatı BigFish competition, tuna is caught and evaluated in different species such as *Dentex gibbosus* and swordfish.

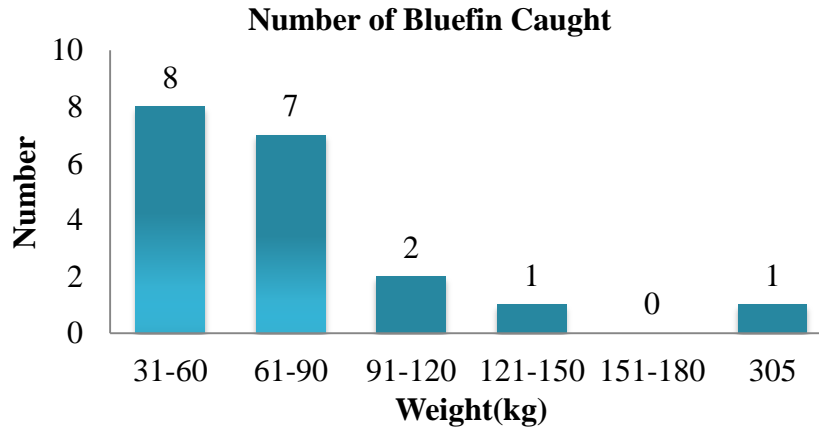


Figure 7. Number of bluefin tuna according to weight

Weights of tuna caught in 2016-2017-2018 are given in figure 7. The biggest tuna caught in the last three years was 305 kg and 8 tuna were mostly caught between 31-60 cm and 7 tuna were caught between 61-90 cm. Bluefin is the number one species catch and release. Most of the catch and release tuna are in the range of 131-160 cm and the largest catch and release tuna is in the range of 191-220 cm figure 8.

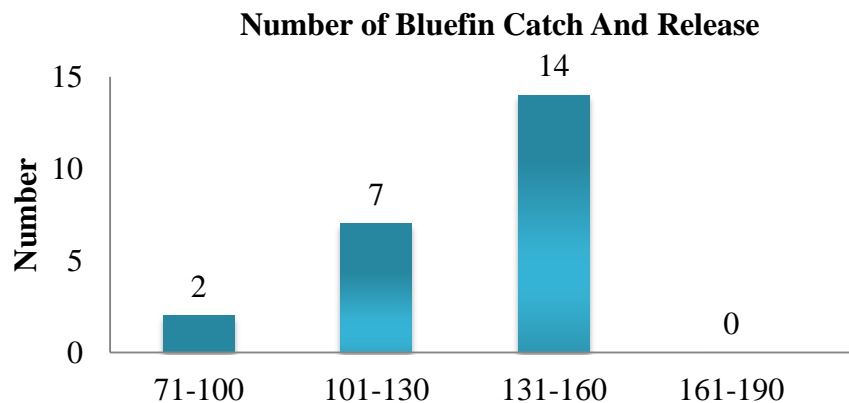


Figure 8. Number of catch and release bluefin tuna according to length

As a result, big pelagic fishing competitions, recreational organizations that emphasize the struggle with fish and support sustainable fishing model respectful to nature with catch and release technique fishery competitions should be perceived and expanded as a social activity that brings people together with nature and creates awareness. In the coming years, catching and dropping all of the caught fish may be recommended for continuity of the species. Competition can be provided a larger base to spread in Turkey

Acknowledgements

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References

- Dillon B., 2004. A bio-economic review of recreational angling for Bass (*Dicentrarchus labrax*). Scarborough Centre for Coastal Studies, University of Hull.
- Dunn, B. (2000). Saltwater Game Fishes of the World. Australian Fishing Network. ISBN 978-1865130101
- EAA (European Anglers Alliance), 2003. Press Release form the European Anglers Alliance (n.d), Europe's 25 million anglers demand equal rights to commercial fishermen. Retrieved June 15 2012 from http://www.eaa-europe.org/fileadmin/templates/eaadocs/EAA_News_Jan_2003_EN%20Correct.p
- Goadby, P. and Holt, H. (1972). Big Fish and Blue Water; Game fishing in the Pacific. Henry Holt & Co. ISBN 978-0-03-091228-3 (good record of the sport before tag-and-release)
<http://mentalfloss.com/article/75364/15-things-you-might-not-know-about-competitive-fishing>
https://en.wikipedia.org/wiki/Recreational_fishing
<https://asafishing.org/wp-content/uploads/2019/02/Sportfishing-in-America-Revised-November-2018.pdf>



Gill Histopathology in the Marine Fish *Psetta maxima* after Acute Exposure to Cypermethrin

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Abstract

The histopathological effects of cypermethrin on the gill tissue of the Turbot, *Psetta maxima* were determined by light microscopy. The fish were exposed to 0.187 ppb l-1 (50% of 96 h LC50) and 0.217 ppb l-1 (70% of 96 h LC50) solutions of cypermethrin for long-term (21 days). The most common gill changes at all doses of cypermethrin were desquamation and necrosis. Besides, aneurism in secondary lamellae, lifting of the lamellar epithelium, oedema, epithelial hyperplasia and fusion of the secondary lamellae were reported.

Keywords: Synthetic pyrethroids; Cypermethrin; Histopathology; *Psetta maxima*; Gill.



Comparison of Turkish and EU legislation for fishing gear used in small-scale fishery

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Abstract

In this study, 4/1 Notification of Turkey related to small-scale fishing gears is compared with the European Union (EU) Council Regulation No. 1967/2006 for the sustainable use of fisheries resources in the Mediterranean. Although EU has recently also initiated to implement a Landing Obligation to control discard in many fisheries, there has been some debate on whether there is sufficient evidence to support the feasibility of such measure in Mediterranean small-scale fisheries. Consequently, some measures have been proposed for the effective implementation of provisions of aligned Turkish Notification with the EU Council Regulation.

Keywords: Fishing Gear, Regulations, Turkey, European Union.

Introduction

Small-Scale Fishery (SSF) in Turkey is an important commercial and traditional activity for contribution to the livelihoods of local community. It plays a significant role in providing an important source of food and to sustainable development, creating added value for other sectors (FAO, 2005, 2018).

Passive gears such as gillnets-entangling nets, longlines and traps are the predominant gears that were used in Turkish SSF. SSF is a part of coastal economy and culture, representing 90% of the Turkish fishing fleet and providing 80% of the onboard employment. Although landing quantity is just over 10%, its revenue is over 50% (FAO, 2018). The average value per kg of its production is slightly higher than that of the large scale. SSF is usually organized by cooperatives since the cooperative system is particularly adapt to cope with the constraints; common marketing of the products (higher revenues), services to fishermen (landing structures, fishing gear supply etc.), allows reaching a minimum level of capitalization and suitable for inclusive growth and democratic decision.

In order to ensure the sustainable development of the SSF, its technical (vessel and gear type), biological (target species, landings), spatial and temporal (depth, season), and social and economic characteristics need to be better understood. Recently, more attention has been paid by the relevant parties and General Fisheries Commission of Mediterranean (GFCM) to improve the characterization of the SSF. For this reason, as a first step, the provisions of “Council Regulation (EC) No 1967/2006 concerning management measures for the sustainable exploitation of fishery resources in the Mediterranean Sea” (EC, 2006) and the relevant provisions of Turkish 4/1 Notification (Anonymous, 2016) were compared for SSF gears. In the second step, some measures were recommended for effective implementation of provisions of aligned Turkish national legislation with Council Regulation No 1967/2006 concerning management measures for the sustainable exploitation of fishery resources.

Turkish Fisheries Legislation with the Special Emphasis to SSF

With the Fisheries Law No. 1380, the Ministry of Agriculture and Forestry has been granted the authority and responsibility to regulate and control fisheries. The main objectives of the Ministry are to ensure sustainability of fish stocks and to protect their habitats. To this end, fisheries management is regulated by “Notifications” published every four year. The objective of the 4/1 Notification is to organize the obligations, limitations and prohibitions related to commercial fishing in order to ensure the protection



and sustainable management of the fishery resources by taking into account the scientific, environmental, economic and social aspects between 1.9.2016 and 31.8.2020. This notification was prepared based on the Fisheries and Aquaculture Law (No. 1380) dated 22.3.1971, and the Fisheries and Aquaculture Regulation dated 10.03.1995 and published in the Official Gazette No. 22223. The prohibitions and restrictions on SSF gears are a part of the technical measures. The aim of these legislation are to reduce excessive fishing pressure on fish stocks, to mitigate the negative impact of fishing gear on the benthic habitats, and to ensure balance between fish stocks and fishing fleet.

Gillnets/entangling nets prohibitions/restrictions

- Total length of the “gillnets/entangling nets” owned by the small-scale vessels cannot exceed 6 000 metres.
- It is forbidden to use monofilament and multi-monofilament nets in marine fishing and also to keep them on board of vessels, fishing shelters and harbours.
- It is forbidden to use driftnets and also to keep them on board of vessels, fishery shelters and harbours.
- Using of gillnets/entangling nets deeper than 22 metres (12 fathoms in height) is prohibited during the closed season of purse seine fishery.
- It is obligatory to mark the trammel nets that left in the sea by flags during the daytime and by light buoys at nights.

Longlines prohibitions/restrictions

- Use of hooks smaller than 7.2 mm gap distance is prohibited in fishing with longlines.
- Use of hooks smaller than 2.8 cm gap distance in longlines used for swordfish is prohibited.
- Fishing of turbot with longlines is prohibited.
- Longlines left in the sea shall be marked with flag buoys at daytime and light buoys at nights.

Turbot fishing regulations/restrictions

- Mesh size of gillnets to be used in turbot fishing cannot be smaller than 400 mm.
- It is obligatory to obtain a license for the turbot fishing with the bottom set gillnets.
- It is obligatory to land turbot at landing sites determined by the Ministry.
- It is forbidden to catch turbot with longline and trammel nets.
- ❖ It is obligatory to market within seven days of the start of fishing ban for those turbot which have been caught before the fishing.
- ❖ Mesh size of the nets to be used in *Sole* and *Plaice* fishing cannot be smaller than 80 mm.

European Union Fisheries Legislation with the Special Emphasis to Mediterranean SSF

Council Regulation (EC) No 1967/2006 of 21 December 2006 concerning management measures for the sustainable exploitation of fishery resources in the Mediterranean Sea, amending Regulation (EEC) No 2847/93 and repealing Regulation (EC) No 1626/94. This Regulation shall apply: (a) to the conservation, management and exploitation of living aquatic resources where such activities are pursued in the maritime waters of the Mediterranean Sea and to marketing of fishery products caught in the Mediterranean Sea.

Restrictions concerning fishing gears

Minimum mesh sizes

1. The use for fishing and the keeping on board of a gillnet shall be prohibited, unless the mesh size in that part of the net having the smallest meshes complies with paragraphs 3 to 6 of this Article.
2. The mesh size shall be determined by the procedures specified in Commission Regulation (EC) No 129/2003 (EC, 2003).
6. (a) Bottom-set gillnets shall not have a mesh size opening smaller than 16 mm.
- (b) For bottom-set gillnets targeting red sea bream, where this species accounts for at least 20% of the catch in live weight, the minimum mesh size shall be 100 mm.

Minimum hook size

The use for fishing and the keeping on board of any longlines with hooks of a total length less than 3.95 cm and of a width less than 1.65 cm shall be prohibited for any fishing vessel using longlines and landing or having on board a quantity of red seabream (*Pagellus bogaraveo*) that constitutes more than 20% of the catch in live weight after sorting.

Dimensions of fishing gears

It shall be prohibited to carry on board or to deploy at sea fishing gear not in compliance with the dimensions specified in Annex II.



Annex II Requirements relating to the characteristics of fishing gear

Bottom-set nets

Trammel nets and bottom-set gillnets

1. The maximum drop of a trammel net shall not exceed 4 m.
2. The maximum drop of a bottom-set gillnet shall not exceed 10 m.
3. It shall be prohibited to have on board or set more than 6 000 m of trammel net, bottom-set gillnet per vessel, taking into account that, as from January 2008, in the case of a single fisherman, such nets may not exceed 4 000 metres, to which a further 1 000 metres may be added for a second fisherman and another 1 000 metres for a third one. Until 31 December 2007, such nets shall not exceed 5 000 metres in the case of single or a second fisherman and 6 000 metres for a third one.
4. Monofilament or twine diameter of the bottom-set gillnet shall not exceed 0.5mm.
5. By way of derogation from paragraph 2, a bottom-set gillnet of maximum length shorter than 500 m may have a maximum drop up to 30 m. It shall be prohibited to have on board or set more than 500 m of bottom-set gillnet when it exceeds the drop limit of 10 m as established in paragraph 2.

Combined bottom-set nets (trammel nets plus gillnets)

1. The maximum drop of a combined bottom-set net shall not exceed 10 m.
2. It shall be prohibited to have on board or set more than 2 500 m of combined nets per vessel.
3. Monofilament or twine diameter of gillnet shall not exceed 0.5 mm.
4. By way of derogation from paragraph 1, a combined bottom-set net of maximum length of 500 m may have a maximum drop of 30 m. It shall be prohibited to have on board or set more than 500 m of combined bottom-set when it exceeds the drop limit of 10 m as established in paragraph 1.

Bottom-set longline

1. It shall be prohibited to have on board or set more than 1 000 hooks per person on board within the overall limit of 5 000 hooks per vessel.
2. By way of derogation from paragraph 1 each vessel undertaking fishing trips longer than three days may have on board a maximum number of 7 000 hooks.

Traps for deep-water crustacean fishery

It shall be prohibited to have on board or set more than 250 traps per vessel.

Surface-set longline (floating)

It shall be prohibited to have on board or set more than:

1. 2 000 hooks per vessel for vessels targeting bluefin tuna (*Thunnus thynnus*) where this species account for at least 70% of the catch in live weight after sorting;
2. 3 500 hooks for vessels targeting swordfish (*Xyphias gladius*) where this species account for at least 70% of the catch in live weight after sorting;
3. 5 000 hooks per vessel for vessels targeting albacore (*Thunnus alalunga*) where this species account for at least 70% of the catch in live weight after sorting;
4. By way of derogation from subparagraphs 1, 2 and 3 each vessel undertaking fishing trips longer than two days may have on board an equivalent number of spare hooks.

Restrictions Concerning Fishing Gears

The biological, social and economic characteristics of the Mediterranean fisheries managed by the European Union (EU) to establish a specific management framework. The management framework has undertaken to apply the precautionary approach in taking measures designed to conserve living aquatic resources and marine ecosystems and to provide for their sustainable exploitation. The Regulation 1967/2006 put into force some rules on prohibited fishing gears and practices, minimum mesh sizes, minimum hook size, dimensions of fishing gears, minimum distances and depths for the use of fishing gears which implement in Mediterranean. The Notification 4/1 Regulating Commercial Fishing and the Notification 4/2 Regulating Recreational Fishing have similar regulations which implement in Turkish Seas. However, EU regulations contain more detailed limitations on small-scale fishing gear than Turkish regulations, particularly length/depth of the gill/entangling nets and number of hooks in longlines. These practices, similar to the limitations of the European Union, should be applied to Turkish SSF as soon as possible due to the increasing pressure on small-scale fishing.

There are a few different arrangements between two applications; the use of monofilament nets is forbidden in Turkish SSF cause to the higher discard rate, whereas there is twine diameter limitation in



gillnets (shall not exceed 0.5 mm) according to EU regulation. The size of the fish caught determines by the hook gap distance in proportion to the size of the fish mouth, but measuring of the hook size differs between the two arrangements.

Recently, the most important issue in many fish stocks is discarding in relation to mortality. The mainly reasons of fishers discard are regulatory (quotas, minimum landing sizes, protected species) and economics (high grading, catch quality, market price/demand). While discarding problems are believed to be mainly in industrial fishing, SSFs are generally considered to have lower discard rates. Therefore, little attention paid by the scientific community to discards in SSF. The EU landing obligation (LO) will implicitly include all SSF provided the species captured are subject to catch limits or minimum sizes in the case of the Mediterranean (Veiga et al., 2016). Currently, there is no LO implementation in Turkish territorial waters whereas fishing, landing and selling of certain species (e.g. sharks and rays, puffer fish) is prohibited and also there is Minimum Landing Size implementation for most commercial species. Although EU has recently also initiated to implement a landing obligation to control (limit/mitigate) discard in many fisheries, there has been some debate on whether there is sufficient evidence to support the feasibility of such measure in Mediterranean small-scale fisheries.

Small-scale fishers imply that it is very difficult to comply with the LO in EU (Villasante et al., 2019). Therefore ecological, institutional and economic barriers to the implementation should be clearly identified. According to Veige et al. (2016) the limited evidence with regard to the feasibility and outcomes of such a measure across European waters, particularly for SSF, is also a potential constraint to the successful implementation of the LO and also this implementation in the short to medium-term is likely to bring more negative social, economic and ecological impacts than benefits.

In conclusion, both regulations aim to protect certain stocks and their environment with prohibitions and more strictly restrictions. In order to mitigate the mortality rate of juveniles and to downgrade the amount of discards at fishing operations, it is proper to increase the mesh size for bottom-set nets and hook size for longlines. The management of fishing effort should be the eminent aim to bring off sustainable fisheries in the Mediterranean Sea. To this end, it is suitable to consider the all dimensions of the main types of passive fishing gears to limit fishing effort.

References

- Anonymous (2016). Notification 4/1. The commercial fish catching regulations in 2012-2016 fishing period (*in Turkish*). Ministry of Food, Agriculture and Livestock, General Directorate of Fisheries and Aquaculture, Ankara, 112 pp.
- EC (2003). Commission Regulation (EC) No 129/2003 laying down detailed rules for determining the mesh size and thickness of twine of fishing nets. Official Journal of the European Communities, L22, 4 pages + 6 Appendix.
- EC (2006). Council Regulation (EC 1967/2006) concerning management measures for the sustainable exploitation of fishery resources in the Mediterranean Sea, amending Regulation (EEC) No 2847/93 and repealing Regulation (EC) No 1626/94. Official Journal of the European Communities, L409, 53 pages + 22 Appendix.
- FAO (2005). Increasing the contribution of small-scale fisheries to poverty alleviation and food security. FAO Technical Guidelines for Responsible Fisheries. No. 10. Rome, 79 pp.
- FAO (2018). The State of Mediterranean and Black Sea Fisheries. General Fisheries Commission for the Mediterranean. Rome, 172 pp.
- Veiga, P., Pita, C., Rangel, M., Gonçalves, J.M.S., Campos, A., Fernandes, P.G., Sala, A., Virgili, M., Lucchetti, A., Brčić, J., Villasante, S., Ballesteros, M.A., Chapela, R., Santiago, J.L., Agnarsson, S., Ögmundarson, Ó., & Erzini, K. (2016). The EU landing obligation and European small-scale fisheries: What are the odds for success? *Marine Policy*, 64, 64-71. [dx.doi.org/10.1016/j.marpol.2015.11.008](https://doi.org/10.1016/j.marpol.2015.11.008)
- Villasante, S., Antelo, M., Christou, M., Fauconnet, L., Frangoudes, K., Maynou, F., Morato, T., Pita, C., Pita, P., Stergiou, K.I., Teixeira, C., Tserpes, G., & Vassilopoulou, V. (2019). The Implementation of the Landing Obligation in Small-Scale Fisheries of Southern European Union Countries. Uhlmann, S.S., Ulrich, K., Kennelly, S.J. (Eds.). *The European Landing Obligation. Reducing Discards in Complex, Multi-Species and Multi-Jurisdictional Fisheries*. Springer Open, ISBN 978-3-030-03308-8, 89-108. doi.org/10.1007/978-3-030-03308-8



Pattern of *Lingulodinium polyedra* cyst distribution in the Black Sea

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Abstract

Spatial distribution and abundance of resting cysts of potentially toxic dinoflagellate *Lingulodinium polyedra* in the Black Sea sediments were investigated. Cysts were widely spread in different depth habitats, identified in 77 % of the analyzed 48 samples with max concentration of 1722 cysts g⁻¹ for full cysts and 265 cysts g⁻¹ for empty cysts. No pattern of *L. polyedra* depth distribution was discriminated. The potential link between seed banks of *L. polyedra* and bloom dynamics is discussed.

Keywords: *Lingulodinium polyedra*, cyst, Black Sea

Introduction

Lingulodinium polyedra is a dinoflagellate common for the Black Sea (Ryabushko, 2003) associated with bloom formation (Zernov, 1913) and production of yessotoxins (YTXs) (Morton et al., 2007). Resting stage formation is a part of its life cycle (Lewis & Hallett, 1997) and *L. polyedra* cysts are among the most widespread and abundant Black Sea dinocysts (Aydın et al., 2015; Mudie et al., 2017). The resting stages of *L. polyedra* have been extensively used as biomarkers for palaeoecology of the Black Sea evolution (Mudie et al., 2001). A link between resting cysts formation and abundance and harmful algal bloom (HAB) events has been well documented (Garcés et al., 2004), thus knowledge on the variability and distribution of resting cysts is essential for understanding phytoplankton dynamics and blooms.

The aim of the study is to map the quantitative and spatial distribution of the resting cysts of potentially toxic dinophyte *Lingulodinium polyedra* in recent Black Sea sediments.

Material and Methods

Surface sediment samples (n=48) were collected using a multicore (the top 0–5 cm of the core) or Van-Veen Grab, by a 10 x 10 cm frame during 5 field surveys between 2008-2016 in Romanian, Bulgarian, Georgian and Turkish waters in spring and summer months (Fig.1). The sampling stations were located in different depth habitats across the Black Sea (coastal (CO) – 0-30m, shelf (SH) – 30-200m and open sea (OS) – >200m). All sediments samples were stored in a dark place at 4°C until the analyses. Quantitative microscopic identification was performed according to Rubino et al. (2017). The frequency of occurrence was calculated by the frequency index (Soyer, 1970), while Bray-Curtis similarity cluster analysis was applied to depict patterns in the spatial distribution of both “full” and “empty” cysts (PRIMER v. 5 package, Primer-E Ltd., Plymouth, UK).

Results

Lingulodinium polyedra cysts were among the dominant resting stages in the sediments along with *Pentapharsodinium tyrrhenicum*, *Calciodinellum albatrosianum*, and *Scrippsiella trochoidea* within a total number of fifty-three dinocysts identified morphologically at species level. The total dinoflagellate cysts abundance ranged from 5 to 6963 cysts g⁻¹ for full cysts and from 6 to 5296 cysts g⁻¹ for empty cysts.

According to the frequency index *L. polyedra* was “constant”, identified in 77 % of the analyzed samples. The resting cysts were found in relative abundance of up to 25 % of all full dinocysts and up to 22 % of the empty dinocysts (Fig. 1A). Densities of *L. polyedra* full cysts were variable and ranged from not detected to 1722 cysts g⁻¹ and for empty cysts they vary between not detected and 265 cysts g⁻¹ (Fig. 2). The highest abundance for full cysts was registered at 28.6 m depth in Ukrainian waters and for empty cysts at 64.7 m depth in Romanian waters.

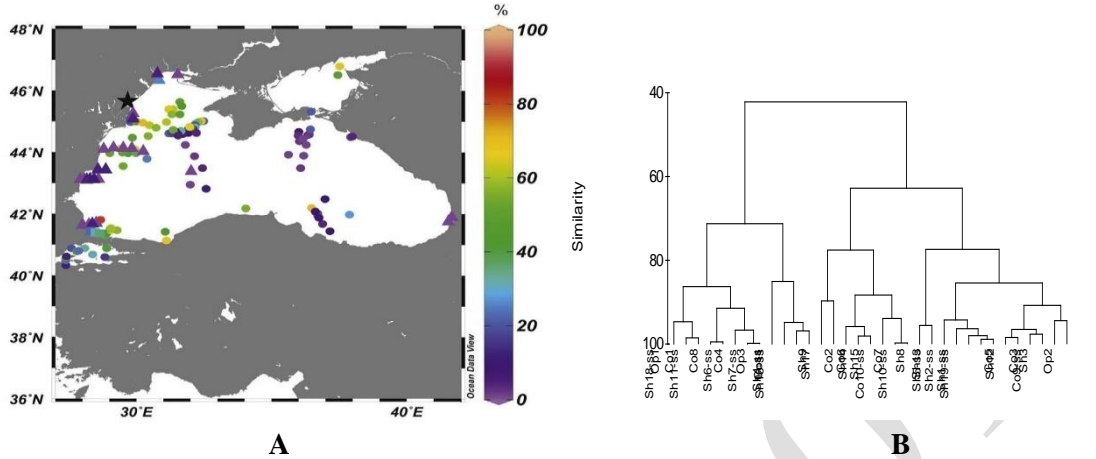


Figure 1. A) Distribution map of *Lingulodinium polyedra* relative abundance (in % of total cysts assemblage). Modified and updated from Mudie et al. (2017). ● – reported by Mudie et al. (2017); △ - data from the current study; □ - data according to Aydin et al. (2015); **B)** Dendrogram - Bray-Curtis similarity (fourth root transformed abundance data (cysts g⁻¹ dw) and depth habitats (CO, SH, OS) in spring and summer (ss)

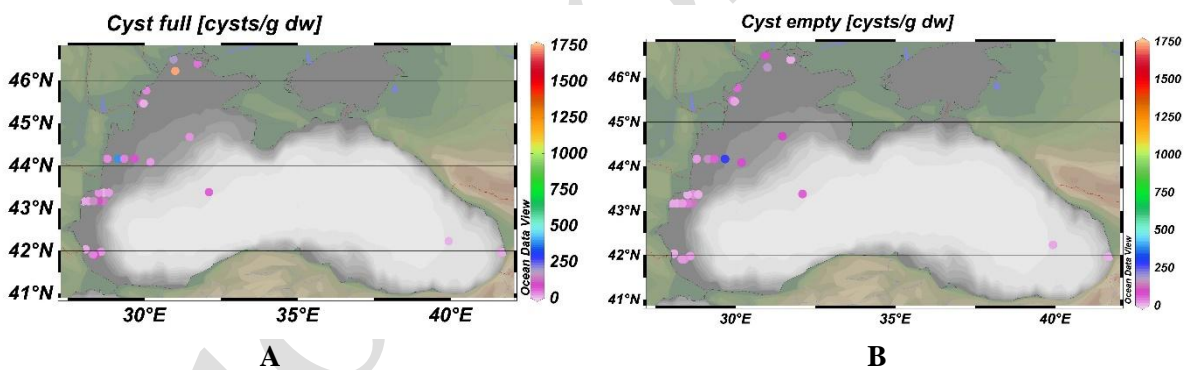


Figure 2. Distribution map of *Lingulodinium polyedra* full cysts (A) and empty cysts (B) abundance (cysts g⁻¹ dw)

No correlation between *L. polyedra* resting cysts abundance (both full and empty) and depth nor a seasonal signal was found although the sampling locations differ significantly in depth and sampling month (Fig.1B). According to the average values calculated for the different depth habitats the highest concentrations for full cysts were recorded at coastal areas (42 cysts g⁻¹ ± 63 SD) followed by shelf (39 cysts g⁻¹ ± 37 SD) and open sea (33 cysts g⁻¹ ± 24 SD). For empty cysts an opposite pattern of the average abundance between the habitats was observed – 17 cysts g⁻¹ ± 23 SD for CO, 35 cysts g⁻¹ ± 45 SD for SH and 46 cysts g⁻¹ ± 39 SD for OS .

Discussion

Resting cysts as a common part of the life cycle of some phytoplankton species (Dale, 1983) appear to be ecologically and evolutionarily advantageous (Anderson et al., 2003). Some of the species producing benthic resting stages are toxic with negative impacts on aquatic ecosystems, public health and economy (Hallegraeff, 1993), i.e. benthic cysts could represent a “dormant threat”. Mapping the distribution of *Lingulodinium polyedra* cysts as an ecologically important dinoflagellate can be very useful for monitoring species dispersal and predicting future bloom initiation. Our data confirmed that the resting



stages of *L. polyedra* are abundant and diversely distributed in the Black Sea sediments. This cosmopolitan potentially toxic dinoflagellate is among the common species for phytoplankton community in the Black Sea (Dzhembekova and Moncheva, 2014) reaching blooming concentrations (Moncheva et al., 2001). Correlation between intense blooms of *L. polyedra* and high cysts abundance has been reported (Peña-Manjarrez et al., 2001) suggesting the sampling areas could be considered potential seed-banks for HAB events initiation in the Black Sea. However further study on the role of environmental conditions in encystment and excystment of Black Sea populations of *L. polyedra* will be essential for understanding the ecology and dynamics of its blooms.

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References

- Anderson, D.M., Fukuyo, Y. and Matsuoka, K., 2003. Cyst methodologies. Manual on harmful marine microalgae, Monographs on oceanographic methodology, 11, pp.165-190.
- Aydin, H., Balci, M., Uzar, S. and Balkis, N., 2015. Dinoflagellate cyst assemblages in surface sediments of southwestern Black Sea and Çanakkale Strait (Dardanelles). *Fresenius Environ Bull*, 24, pp.4789-4798.
- Dale, B., 1983. Dinoflagellate resting cysts: 'benthic plankton.' In: G. A. Fryxell (ed.), *Survival Strategies of the Algae*. Cambridge, Cambridge University Press, pp. 69-136.
- Dzhembekova, N., Moncheva, S. 2014. Recent trends of potentially toxic phytoplankton species along the Bulgarian Black Sea area, Twelfth International Conference On Marine Sciences and Technologies – Proceedings, 321-329, ISSN 1314-0957.
- Garcés, E., Bravo, I., Vila, M., Figueroa, R.I., Masó, M. and Sampedro, N., 2004. Relationship between vegetative cells and cyst production during *Alexandrium minutum* bloom in Arenys de Mar harbour (NW Mediterranean). *Journal of Plankton Research*, 26(6), pp.637-645.
- Hallegraeff, G.M., 1993. A review of harmful algal blooms and their apparent global increase. *Phycologia* 32: pp. 79-99.
- Lewis, J. & R. Hallett, 1997. *Lingulodinium polyedrum* (*Gonyaulax polyedra*) a blooming dinoflagellate. *Oceanography and Marine Biology: an Annual Review* 35: 97-161.
- Moncheva, S., Gotsis-Skretas, O., Pagou, K. and Krastev, A., 2001. Phytoplankton blooms in Black Sea and Mediterranean coastal ecosystems subjected to anthropogenic eutrophication: similarities and differences. *Estuarine, Coastal and Shelf Science*, 53(3), pp.281-295.
- Morton, S.L., Vershinin, A., Leighfield, T. A., Smith, L., Quilliam, M., 2007. Identification of yessotoxin in mussels from the Caucasian Black Sea Coast of the Russian Federation. *Toxicon*, 50, 581-584.
- Mudie, P.J., Aksu, A.E. and Yasar, D., 2001. Late Quaternary dinoflagellate cysts from the Black, Marmara and Aegean seas: variations in assemblages, morphology and paleosalinity. *Marine Micropaleontology*. 43: 155-178.
- Mudie, P.J., Marret, F., Mertens, K.N., Shumilovskikh, L. and Leroy, S.A., 2017. Atlas of modern dinoflagellate cyst distributions in the Black Sea Corridor: from Aegean to Aral Seas, including Marmara, Black, Azov and Caspian Seas. *Marine Micropaleontology*, 134, pp.1-152.
- Peña-Manjarrez, J.L., Gaxiola-Castro, G., Helenes-Escamilla, J. and Orellana-Cepeda, E., 2001. Cysts of *lingulodinium polyedrum*, red tide producing organism in the todos santos bay (winter-spring, 2000). *Ciencias Marinas*, 27(4), pp.543-558.
- Rubino, F., Belmonte, M. and Galil, B.S., 2017. Plankton resting stages in recent sediments of Haifa port, Israel (Eastern Mediterranean)-Distribution, viability and potential environmental consequences. *Marine pollution bulletin*, 116(1-2), pp.258-269.
- Ryabushko, L.I., 2003. Potentially harmful microalgae in the Azov-and-Black Sea basin. *Sevastopol, EKOCI-Gidrofizica Publ.* 288 pp. (in Russian).
- Soyer, J., 1970. Bionomie benthique du plateau continental de la cote catalana Française, III. Les Peuplements de Copepodes Harpacticoides (Crustacea). *Vie Milieu*. 21, 377-511.
- Zernov S.A., 1913. On the problem of studying living organisms of the Black Sea. *St. Petersburg*. 299 p. (In Russian).



Impact of production systems on salt lakes: Case of the complex Chott Merouane and Melghir (Algeria)

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Abstract

Salt lakes are widespread and well distributed in the semi-arid and arid Mediterranean bioclimatic stage in Algeria. We chose to determine the salt lake production system, through Ramsar's site Chott Merouane and Melghir complex for sustainable management of study area.

Through a survey of 155 farmers in the study area, the results show that there is an intensifying farming system at two the sites whose production is characterized by date palm cultivation, while the region of El Feidh (Chott Melghir) this system is well presented by the cereals (soft wheat). a second system of extensive rearing consisting mainly of sheep, goats and camels insinuates the surroundings of the lakes.

The two types of systems can cause a risk of the wetland, namely the intensification of the system near the chotts, has allowed an extraction of groundwater without knowing their consequences on the environment and the breeding in all its forms constitutes a threat to pastoral resources and reduces cover.

Keywords: Farming system, Salt Lakes, Arid, Ramsar, Management, Algeria



Study approach of a strategy with sustainable development of a Ramsar site: Case Lake Réghaïa, Algeria

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Abstract

This study fits in with of the water resources management, sustainable development of Lake Reghaia. Reghaia Lake constitutes the unique Ramsar wetland in Algiers region; it will be classified as national reserve in the future. This wetland is considered hot spot given its geographical location; it is surrounded by several ecosystems (marine, marshes, dunes and forests).

For water quality characteristics, we have tested the: pH, temperature, conductivity, suspended matter (SM), the biochemical oxygen demand (BOD), the chemical oxygen demand (COD), the total nitrogen content (NT), NH_4^+ , NO_3^- , NO_2^- , total phosphorus (PT) and determination of heavy metals (Zn, Cd, Pb). The results of surface water quality showed maximum concentrations for Zn, Pb, in addition to biodegradability tests (DCO/DBO5) which revealed organic pollution.

On the one hand, field surveys showed an apparent disfunction in water resource mobilization due to water overuse. The population perception and focus group (local collectivity) showed much alarming trend for water pollution which generated the degradation of ecosystem biodiversity. The results highlighted the need to initiate an integrated management approach between the different sectors and to develop a shared vision for the territory

Keywords: Ramsar sites, Sustainable development, Water resource, Physicochemical, Survey, Algeria



Mollusc and arthropod shells waste using as qualified materials

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Abstract

Worldwide, large amounts of shell of molluscs are discharged to the environment by seafood producers. Particularly in recent years, the issue of recycling of shellfish waste has gained importance. Instead of releasing the shell wastes to the environment, various industrial products were obtained by re-evaluating them by chemical or biological methods and these products were used in various sectors. Mollusc shells are used extensively in the production of limestone, in animal feed mixtures, in road construction materials and in some chemical processes as well as in ornaments, jewelery design and decoration. In general, chitin, chitosan, carotenoproteins and astaxanthin are produced from shells of arthropods. Chitin and chitosan are used in various scientific fields such as biomedical, food, textile, chemical industries; carotenoproteins and astaxanthins are used as feed additives in culture fish rations as well as coloring and sweetening in food products. When seafood-processing plants dump of shell wastes into the sea without evaluating, they affect the environmental health negatively, and lead to pollution. The evaluation of these shell wastes is very important for the aquaculture industry, public and environmental health. For this reason, efforts to recycle of shell waste should be initiated in Turkey and they should be transformed into economic products.

Keywords: Mollusc, Arthropod, Shellfish waste, Waste management, Shell by-products

Introduction

Molluscs and arthropods having economic value in Turkey are striped venus, Mediterranean mussels, horse mussels, carpet shell, oysters, scallops, kydonia, crayfish, lobster, sea snails, shrimp, blue crab. In the world in 2017, a total of 170,995,437 tons of seafood products were produced, 90,923,545 tons products were capture and 80,071,894 tons products were aquaculture. In our country in 2018, a total of 630.820 tons of seafood products were produced, 354.318 tons products were capture and 276.502 tons products were aquaculture.

In 2018, total of 61.941,1 tons mollusk and arthropod were produced, 61.034,1tons mollusk and arthropods were capture and 907 tons mollusk and arthropods were aquaculture. In our country, production amounts of shellfish and molluscs are given on a yearly basis, but there is no scientific data on the amount and utilization of wastes of these products.

In China, the world's largest producer of shellfish, approximately 10 million tons of shell waste is disposed of each year. Discharge of these wastes into seas and empty lands causes environmental and legal problems (Yao ve ark., 2014; Mo ve ark., 2018). Oyster shell waste is a common problem in many countries, especially in China, South Korea and Taiwan. Approximately 370-700 g of waste shell emerges from each 1 kg oyster shell (Yao ve ark., 2014). 300,000 tons of oyster shells are produced in China and more than 160,000 tons of oyster shells are produced in Taiwan annually (Li ve ark. 2015; Mo ve ark., 2018). In 1993, it was reported that 320,000 tons of oyster shells were produced in South Korea, but only 30% of this production was reused (Yao ve ark., 2014). Galicia, located in the north of Spain, is the second largest mussel producer in the world after China. Approximately, 25,000 tons of mussel shell



waste are produced each year in this region (Martine ve ark., 2017). 25,000 tons of scallop waste are produced annually in Peru (Varhen ve ark., 2017). In Nigeria, after the snail is consumed as a food source for the local population, shell waste is discharged to the environment (Falade, 1995). If these wastes are not handled appropriately, the meat remaining in it will spoil and produce bad odors. These problems adversely affect the quality of life of people living in this environment and cause environmental problems (Yoon ve ark., 2003; Mo ve ark., 2018). It has been reported in studies that these wastes are not actually garbage and these wastes are composed of valuable components such as calcium carbonate and limestone (Yang ve ark., 2005; Martine ve ark., 2017; Felige-sese ve ark., 2011; Varhen ve ark., 2017; Yoon, 2004; Lertwattanaruk, 2012).

Table 1. Quantity of molluscs and arthropods production in Turkey

Species	Quantity (Tonnes)
Striped venus	44532,8
Mediterranean Mussel	1510,8
Carpet Shell	0,8
Whelk (Sea snail)	9672,3
Norway lobster	2,3
Common Lobster, Spiny Lobster	6,6
Shrimp	4536,1
Blue Crab	10,5
Other	761,9

For thousands of years, people have collected seashells for very different purposes. As a result of excavations carried out in caves where people lived in ancient times in many parts of the world, it was determined that seashells were used as ornaments, accessories and tools. Today, shells are used in many areas, from medicine to mathematics and the arts, from heavy metals to composites and materials science. It is also known that seashells have been used as a paint material since ancient times. It is known that very special magenta color obtained from sea snails used by Roman and Byzantine royal families.

➤ **The Usage Area of Molluscs Shells**

- ❖ Construction industry
- ❖ Agricultural areas
- ❖ Feed production
- ❖ Materials science
- ❖ Pharmaceutical industry and medicine
- ❖ Water treatment

Construction industry

Mussel shells are a composite biomaterial with 95-99% by weight of calcium carbonate and the remaining 1-5% with various minerals and other elements (nitrogen, sulfur, phosphorus, potassium and magnesium) (Marin ve Luquet, 2004). Due to the high calcium content of mollusc shells, it is used extensively in lime production, cement mortar and road construction materials.

It is observed that the oyster shell sand used for cement mortar fills the material pores, decreases the absorption rate and increases the compressive strength. In addition, the mortar has a positive effect on the engineering properties. The use of oyster shell sand makes a positive contribution to the recovery and recycling of waste sources, the reduction of natural sand exploitation and the reduction of environmental impact (Wang, et al., 2013). Kuo et al. (2013) stated that the sand made from waste oyster shells is suitable for cement mortar production. Adewuyi et al., (2015) used snail, oyster and mussel shell ash as additives in ready-mixed concrete production. As a result of the study they stated that the strength of concrete increased under the influence of high temperature (300 °C) and sulfate.



Agricultural areas

In agricultural applications, mollusc shells are ground and mixed into the soil in order to increase the pH and calcium content of the soil. Galicia, ranks second after China in mussel production in the world, is the center of mussel production in Europe. The high production means that the shell wastes are high. These wastes are used to regulate the pH of the soil. (Taboada et al., 2010). The acidic soils in Galicia are a common problem that limits the growth of crops. These soils are usually neutralized by adding calcium minerals. Therefore, mussel shells can be used as a calcification agent in acidic soils. This method is traditionally used by farmers. Scientific studies show that the application of mussel shells has a positive effect on the chemical properties of the soil (Taboada et al., 2010).

Feed production

The oyster shell powder produced from oyster shells is added to chicken feed. This product, which is added to feeds, provides a harder structure of egg shells and thus reduces the risk of egg breakage. In addition, this additive meets the calcium requirement of the eggshell and it is stated that it helps to prevent deaths, especially during the incubation period.

The first studies on the addition of oysters as a source of calcium in chicken feeds were conducted in the early 1900s. In another study, it was found that the oyster shell added to the ration significantly increased the fracture resistance (Scott et al., 1971). In terms of shell quality, the research conducted at Cornell University in the 1960s found that the addition of oyster shells to the ration as a source of calcium has more effective results than the calcium carbonate source given in powder form. As a source of calcium, limestone or oyster shells can be added to the diet alone or as a mixture. It is reported that the addition of 2/3 of the calcium source used in the ration in the form of oyster shell and 1/3 of it as powder limestone increases the fracture resistance (Proudfoot & Hulan, 1987; Richter, 1999; Watkins et al., 1977).

Materials science

Sea shells have a very solid structure. The researchers say that mother of pearl, which covers the inside of the oyster and forms the pearl, makes the oyster shell extremely strong and resistant. Material scientists and engineers that affected by the strong structure and formation mechanism of shellfish aimed to obtain nanoscale composite materials based on this durability. These composite materials are especially intended for use in space studies, in the construction of light and robust aircraft armor, in the transport industry and in the construction of light bridges (Ekici, 2012). A group of researchers in the UK combined the calcium carbonate crystals with the styrofoam particles to produce ceramic polymers that are more resistant to breakage and crumbling. In this study, it was discovered that when the material cracks, the polymer extends along the crack and prevents breakage. In this way, it is stated that the energy is absorbed and the strength of the material is increased. In a study conducted in China, sea shells were used as reinforcing materials in polypropylene (PP). The mechanical behavior of PP reinforced with shell showed higher yields at break, tensile strength and elongation from conventional-commercial PP reinforced with calcium carbonate. The result of the study was 2 to 11.1% more durable polypropylenes (Li et al., 2012; Yao et al., 2013).

Pharmaceutical industry and medicine

Calcium from shellfish waste is used as an element supplement in the pharmaceutical sector. In New Zealand, waste mussel shells were used as photocatalysis for the synthesis of hydroxyapatite ($\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$), a calcium phosphate product that can be used in place of bone. In the study, it was concluded that waste mussel shells can be used as photocatalysis for hydroxyapatite synthesis (Shariffuddin et al. 2013).

Also, shell wastes are used in medicine as reinforcing materials for the manufacture of prosthetic and implant materials (Ekici, 2012).

Water treatment



Waste water is cleaned in many countries by expensive filtration systems. It is not possible to use these expensive filtration systems in developing countries. Therefore, in some countries, crushed mussels and oyster shells are used to clean up wastewater containing cadmium, lead, zinc, iron and radioactive materials. Biological aeration filter (BAF) was first developed in Europe and then it is widely used worldwide as a wastewater treatment system because of its advantages over other systems (Allan et al. 1998). It has been proved that the oyster shells used instead of the bioballs used in this system give better results (Liu et al. 2010). Oyster shells are used in wastewater treatment due to their easy availability, characteristic shape, suitable hardness, superior chemical structure and biological stability. Since more than 96% of the shell component consists of CaCO₃, it is possible to release CaCO₃ into the waste water (Yoon, et al. 2003). The shells provide sufficient alkalinity to increase the decreasing pH caused by nitrification in the BAF. The oyster shell is also suitable for removing phosphorus from waste water. Due to these characteristics, it has started to be used in urban wastewater treatment (Liu et al. 2010).

➤ The Usage Areas of Arthropod Shells

The use of chitin and chitosan

Chitin and chitosan, natural, non-toxic biopolymers, are produced from crab and shrimp shell wastes. Chitin and chitosan are used in various fields such as biomedical, food, textile and chemical industries due to their water holding capacity, oil binding capacity and bioactivity (Table 2). Chitosan has gained much importance especially in the medical field. Since the 1960s, studies have been carried out in many Asian countries, mainly in Japan. Chitosan is widely used to provide tissue, especially in wound treatment. In addition, the use of chitosan can be sorted as: medical artificial skin, surgical sutures, artificial blood vessels, controlled drug release, contact lens construction, band-aid, bandage, cholesterol control, tumor inhibitor, antifungal, antibacterial, and hemostatic effect, etc... (Carroad and Tom, 1978; Montazer and Afjeh 2007, Table 3).

Table 2. Food applications of chitin, chitosan and their derivatives in the food industry (Shahidi et al., 1999)

Area of application	Examples
Antimicrobial agent	Bactericidal Fungicidal
Edible film industry	Measure of mold contamination in agricultural commodities Controlled moisture transfer between food and surrounding environment Controlled release of antimicrobial substances Controlled release of antioxidants Controlled release of nutrients, flavours and drugs Reduction of oxygen partial pressure Controlled rate of respiration Temperature control Controlled enzymatic browning in fruits
Additive	Reverse osmosis membranes Clarification and deacidification of fruits and beverages Natural flavour extender Texture controlling agent Emulsifying agent Food mimetic Thickening and stabilizing agent Colour stabilization
Nutritional quality	Dietary fibre Hypocholesterolemic effect Livestock and fish feed additive Reduction of lipid absorption Production of single cell protein Antigastritis agent Infant feed ingredient
Recovery of solid materials from	Affinity flocculation



food processing wastes	Fractionation of agar
Purification of water	Recovery of metal ions, pesticides, phenols and PCB's
	Removal of dyes
Other applications	Enzyme immobilization
	Encapsulation of nutraceuticals
	Chromatography
	Analytical reagents

Table 3. Chitin/Chitosan-Based Commercial Products (Muzzarelli et al. 1986; Singh & Ray 2000)

Product	Application	Manufacturer
Evalson R	Personal care	Chito-Bios, Ancona, Italy
Depolymerized chitosan	Hair care	Wella, Inc., Germany
Noodles containing chitosan	Dietary (hypocholesterolemic agent)	for NihonKayaku, Inc., Tokyo, Japan
Chitin liquid (CM-chitin)	Skin care	Ichimaru Farukosu Inc., Gifu, Japan
Nonwoven chitin fabric	Burn therapy	Yunichika, Inc., Kyoto, Japan
Chitin fiber	Biodegradable suture	Yunichika, Inc., Kyoto, Japan
Chitosan-collagen composite	Artificial skin	Katakurachikkarin, Inc., Tokyo, Japan

The use of carotenoprotein and astaxanthin

The nutritional value of shell fish waste is quite high in terms of protein. These proteins contain significant amounts of natural carotene pigment and astaxanthin pigment. Carotenoproteins and astaxanthins obtained from krill, crab, shrimp and crayfish processing wastes are used as feed additives in culture fish rations and as colorings and sweetening in food products. Carotenoid-containing feeds are used to provide the desired coloration in the meat and eggs of fish grown on farms (Anderson, 2000).

Results

When seafood processing plants dump of shell wastes into the sea without evaluating, they affect the environmental health negatively, and lead to pollution. The evaluation of these shell wastes is very important for the aquaculture industry, public and environmental health. For this reason, efforts to recycle of shell waste should be initiated in Turkey and they should be transformed into economic products.

References

- Adewuyi, A. P., Franklin, S. O., & Ibrahim, K. A. (2015). Utilization of Mollusc Shells for Concrete Production for Sustainable Environment. *International Journal of Scientific & Engineering Research*, 6, 201-208.
- Anderson, S., (2000). Salmon color and consumer, *International Institute of Fisheries Economics and Trade*. 1-4.
- Carroad, P.A. and Tom, R.A. (1978). Bioconversion of Shellfish Chitin Wastes: Process Conception and Selection of Microorganisms. *J. Food Sci.* 43, 1158-1161.
- Demir, A., & Seventekin, N. (2009). Kitin, kitosan ve genel kullanım alanları. *Tekstil Teknolojileri Elektronik Dergisi*, 3(2), 92-103.
- Ekici, Ö. K. (2012). Denizden gelen cevherler deniz kabukları. *TÜBİTAK Bilim ve Teknik Dergisi*. 533, 37-42
- Falade, F. (1995). An investigation of periwinkle shells as coarse aggregate in concrete. *Building and Environment*, 30(4), 573-577.



- Felipe-Sesé, M., Eliche-Quesada, D., & Corpas-Iglesias, F. A. (2011). The use of solid residues derived from different industrial activities to obtain calcium silicates for use as insulating construction materials. *Ceramics International*, 37(8), 3019-3028.
- Kuo, W. T., Wang, H. Y., Shu, C. Y., & Su, D. S. (2013). Engineering properties of controlled low strength materials containing waste oyster shells. *Construction and Building Materials*, 46, 128-133.
- Lertwattanaruk, P., Makul, N., & Siripattaraprat, C. (2012). Utilization of ground waste seashells in cement mortars for masonry and plastering. *Journal of environmental management*, 111, 133-141.
- Li, G., Xu, X., Chen, E., Fan, J., & Xiong, G. (2015). Properties of cement-based bricks with oyster shells ash. *Journal of Cleaner Production*, 91, 279-287.
- Li, H. Y., Tan, Y. Q., Zhang, L., Zhang, Y. X., Song, Y. H., Ye, Y., & Xia, M. S. (2012). Bio-filler from waste shellfish shell: preparation, characterization, and its effect on the mechanical properties on polypropylene composites. *Journal of hazardous materials*, 217, 256-262.
- Liu, Y.X., Yang, T.O., Yuan, D.X., & Wu, X.Y. (2010). Study of municipal wastewater treatment with oyster shell as biological aerated filter medium. *Desalination*, 254, 149-153.
- Mann, A., Mendoza - Espinosa, L., & Stephenson, T. (1998). A comparison of floating and sunken media biological aerated filters for nitrification. *Journal of Chemical Technology & Biotechnology: International Research in Process, Environmental AND Clean Technology*, 72(3), 273-279.
- Marin F, Luquet G. (2004). Molluscan shell proteins. *Comptes Rendus Pale*, 3, 469-492.
- Martínez-García, C., González-Fontebo, B., Martínez-Abella, F., & Carro-López, D. (2017). Performance of mussel shell as aggregate in plain concrete. *Construction and Building Materials*, 139, 570-583.
- Mo, K. H., Alengaram, U. J., Jumaat, M. Z., Lee, S. C., Goh, W. I., & Yuen, C. W. (2018). Recycling of seashell waste in concrete: A review. *Construction and Building Materials*, 162, 751-764.
- Montazer, M., & Afjeh, M. G. (2007). Simultaneous x - linking and antimicrobial finishing of cotton fabric. *Journal of Applied Polymer Science*, 103(1), 178-185.
- Muzzarelli, R. A., Jeuniaux, C., & Gooday, G. W. (Eds.). (1986). *Chitin in nature and technology* (Vol. 385). New York: Plenum Press.
- Proudfoot, F. G., & Hulan, H. W. (1987). Effect on shell strength of feeding supplemental sources of calcium to adult laying hens given insoluble grit during the rearing period. *British poultry science*, 28(3), 381-386.
- Richter, G. (1999). Influence of particle size and calcium source on limestone solubility in vitro, performance and eggshell quality in laying hens. *Archiv fur Geflugelkunde*, 63, 208-213.
- Scott, M. L., Hull, S. J., & Mullenhoff, P. A. (1971). The calcium requirements of laying hens and effects of dietary oyster shell upon egg shell quality. *Poultry Science*, 50(4), 1055-1063.
- Shahidi, F., Arachchi, J. K. V., & Jeon, Y. J. (1999). Food applications of chitin and chitosans. *Trends in food science & technology*, 10(2), 37-51.
- Shariffuddin, J. H., Jones, M. I., & Patterson, D. A. (2013). Greener photocatalysts: hydroxyapatite derived from waste mussel shells for the photocatalytic degradation of a model azo dye wastewater. *chemical engineering research and design*, 91(9), 1693-1704.
- Singh, D. K., & RAY, A. R. (2000). Biomedical applications of chitin, chitosan, and their derivatives. *Journal of Macromolecular Science, Part C: Polymer Reviews*, 40(1), 69-83.
- Taboada, J., Pereira-Crespo, S., & Bande-Castro, M. J. (2010). Use of limestone from mussel shells in acid soil of Galicia (NW Spain). *Treatment and Use of Non-Conventional Organic Residues in Agriculture: Challenges and Opportunities towards Sustainable Management*.
- TÜİK. (2018). Su Ürünleri İstatistikleri. Türkiye İstatistik Kurumu. http://www.tuik.gov.tr/PreTablo.do?alt_id=1005 (03.07.2019).
- Varhen, C., Carrillo, S., & Ruiz, G. (2017). Experimental investigation of Peruvian scallop used as fine aggregate in concrete. *Construction and Building Materials*, 136, 533-540.
- Wang, H. Y., Kuo, W. T., Lin, C. C., & Po-Yo, C. (2013). Study of the material properties of fly ash added to oyster cement mortar. *Construction and Building Materials*, 41, 532-537.
- Watkins, R. M., Dilworth, B. C., & Day, E. J. (1977). Effect of calcium supplement particle size and source on the performance of laying chickens. *Poultry Science*, 56(5), 1641-1647.



- Yang, E. I., Yi, S. T., & Leem, Y. M. (2005). Effect of oyster shell substituted for fine aggregate on concrete characteristics: Part I. Fundamental properties. *Cement and Concrete Research*, 35(11), 2175-2182.
- Yao, Z. T., Chen, T., Li, H. Y., Xia, M. S., Ye, Y., & Zheng, H. (2013). Mechanical and thermal properties of polypropylene (PP) composites filled with modified shell waste. *Journal of hazardous materials*, 262, 212-217.
- Yao, Z., Xia, M., Li, H., Chen, T., Ye, Y., & Zheng, H. (2014). Bivalve shell: not an abundant useless waste but a functional and versatile biomaterial. *Critical Reviews in Environmental Science and Technology*, 44(22), 2502-2530.
- Yoon, G. L., Kim, B. T., Kim, B. O., & Han, S. H. (2003). Chemical–mechanical characteristics of crushed oyster-shell. *Waste Management*, 23(9), 825-834.
- Yoon, H., Park, S., Lee, K., & Park, J. (2004). Oyster shell as substitute for aggregate in mortar. *Waste management & research*, 22(3), 158-170.



Impact of an insecticide/acaricide Oberon (Spiromesifen) on lipids, malondialdehyde and fatty acids composition in snail *Cornu aspersum* used as bioindicator species of soil pollution

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Abstract

The massive use of pesticides has resulted in chronic contamination of all compartments of the ecosystem, whether aquatic, atmospheric and terrestrial, resulting in toxic impacts on non-target organisms. In this context, we evaluated the effect of an insecticide/acaricide belonging to a new class of pesticides of the Ketoenol family, Oberon® 240 (active ingredient Spiromesifen) on a non-target species used as bioindicator species of soil contamination, the snail *Cornu aspersum* (Mollusk, Gastropod). Oberon was administered at two lethal concentrations (LC₅₀) of 5 and 10 µg/ml at 96 hours, used against whiteflies. After topical treatment, a qualitative and quantitative analysis of hepatopancreas fatty acids was performed by gas chromatography (GC). In addition, the effect of this insecticide/acaricide was evaluated on lipid and malondialdehyde (MDA) rates in the same organ. The results obtained revealed a profile of sixteen (16) fatty acids of which three (03) are saturated, four (04) monounsaturated and nine (09) polyunsaturated. Comparison of lipid and fatty acid levels in individuals of *C. aspersum* showed a decrease of total lipids and four fatty acids C16:1 (palmitoleic acid), C20:1 (gadololeic acid), C20:4n-6 (arachidonic acid) and C22:4n-6 (adrenic acid) in snails treated at the two concentrations 5 and 10 µg/ml compared to controls. Moreover, an increase in MDA rates was observed in snails treated at both concentrations compared to controls translating a lipid peroxidation. These results confirm the specific mode of action of Spiromesifen, which is the inhibition of lipid biosynthesis. Furthermore, this study reveal the negative impact of this insecticide on non-target species. Thus, *C. aspersum* can be used as suitable bioindicator species of soil pollution.

Keywords: *Cornu aspersum*, Oberon, Fatty Acids, Lipids, Malondialdehyde, Contamination.



***Ladigesocypris* sp. (Ladiges, 1960) complex: current status of knowledge and implications for conservation of these Cyprinids species endemic to Aegean Region**

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Abstract

Ladigesocypris genus includes small, non-commercial Cyprinids species endemic to some inland waters of Aegean Region. In the past, the species was recognized as *L. ghigii* (Ladiges, 1960), endemic to Rhodes Island (Greece) and the Aegean Region of Turkey. Nonetheless, recent studies suggested that *L. ghigii* should be considered as *Squalius ghigii* (Gianferrari, 1927) restricted only to Rhodes, while the records from Turkey should refer to two different species: *L. mermere* (Ladiges, 1960) and *L. irideus* (Ladiges, 1960). Currently, *S. ghigii* is listed as Vulnerable according to IUCN Red List of Threatened Species whereas *L. irideus* as Near Threatened and *L. mermere* as Data Deficient probably due to the lack of information. In recent years populations of these species exhibited tendencies to decline mainly due to habitat degradation and water abstraction. The aim of this study was to discuss the current state of knowledge on this species complex and to propose conservation measures aimed to the protection of the local populations. Moreover, the need for an integrative study to clarify the taxonomy of these taxa are suggested.

Keywords: *Ladigesocypris irideus*, *Ladigesocypris mermere*, Endemic species, IUCN, Threatened Species.



A preliminary Observation on Relationships of the Liver, Ovary and Body Weights for Short snouted seahorse, *Hippocampus hippocampus* at the Tirebolu Coasts (Black Sea)

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Abstract

In this study, together with of liver, gonad, condition values, it was aimed to determine various morphometric measurements of some body parts of Short snouted seahorse, *Hippocampus hippocampus*, distributed in the vegetated shores of the county Tirebolu for 4 months in 2014. A total of 131 (♀: 70, ♂: 61) specimens was obtained from fishermen fishing in the region. Among the adult individuals examined the female: male ratio in the region is 1: 0.87. The mean standard length (SL, mm) and the average body weight (W, g) of the specimens were calculated as 106.79 ± 17.49 and 1.94 ± 0.49 . However, the SnL-SL relationship and Fulton's condition factor (K) were found as $SnL = 0.0313SL + 1.58$ ($r^2 = 0.23$) and 1.954 ± 9.46 . In addition, the values of the hepatosomatic index (HSI) and gonadosomatic index (GSI) were 9.006 ± 15.11 and 1.159 ± 1.61 , respectively. Consequently, the HSI and K values computed here show that the seahorse species in the Tirebolu coasts (Black Sea) spend their energies on the gonadal growth and growth metabolism during sampling period of four months.

Keywords: Short snouted seahorse, *Hippocampus hippocampus*, distribution, morphology Black Sea.

Introduction

In fishery biology, various physiological computations such as gonadosomatic index (GSI) and hepatosomatic (HSI) index along with basic calculations such as length-weight (LW) relationship and Fulton's condition factor (K) are important parameters which give us information about growth rate and body composition of fish (Rodrigues et al., 2011). With the use of these indexes, consuetudinary fishery implementations are figured out in the easiest and fastest way (Zin et al., 2011).

Studies on determination of length-weight relationship, condition factor, reproductive biology and biometric properties of species have accelerated in the last 15 years not only in the world but also in our country (Can et al., 2002; Koutrakis and Tsikliras, 2003; Valle et al., 2003; Ecoutin et al., 2005; Gurkan and Taşkavak, 2007, Gürkan et al., 2007; Otero-Ferrer et al., 2012, Başusta et al., 2014). Together with the species' current data deficient (DD) status, which has been categorized by the International Union for Conservation of Nature (IUCN; Woodle, 2017), all of these studies indicate that the species needs to update information already.

The condition refers to the change in the amount of nutritive elements stored in the muscle tissues of a fish, although it is considered to be a quantitative parameter. However, the condition of fish is affected by gonad weight and body weight (Mahboob and Sheri, 2002). Zin et al. (2011) claimed that the condition factor might vary according to the different developmental levels of fish and the effects of physiological factors. Differences in condition factor are considered to be a measure of various basic histological and physiological events such as storage of fat in tissues, adaptation to environmental conditions and gonadal development (Zin et al., 2011). Although not very common, the condition factor is also used for the species of the family Syngnathidae (Lin et al., 2006). Similarly, it is a parameter that can be used to determine the condition values of the seahorses which are other members of the family Syngnathidae (Wong and Benzie, 2003; Lin et al., 2006; Gürkan and Taşkavak, 2011).



The gonad weight constitutes a certain part of the body weight of a fish. According to Mahboob and Sheri (2002), gonadosomatic index (GSI) is defined as the ratio of gonadal development to gonadal activity. The GSI values are taken into account in determining the number of the fish spawning as well as monthly or seasonal determination of fish reproduction time (Zin et al., 2011). The relationships between nutrition and fertilization rate, gonad development and ovulation number are studied intensively in many fish species, while studies on gonad development and reproductive efficiency in seahorses are scarce (Lin et al., 2006).

Hepatosomatic Index (HSI) is defined as the ratio of liver weight to total body weight and used as a measure of the energy reserves of an animal, especially in fish. Because hepatosomatic index describes the fish's stored energy, it is considered as a good indicator of recent feeding activity (Zin et al., 2011). Additionally, the relationship between liver weight and body weight was also reported to be due to seasonal changes (Mahboob et al., 2002). Wong and Benzie (2003) also reported the effects of environmental parameters on growth of *Hippocampus whitei* juvenile individuals as well as the relationships of dietary habits with GSI, HSI, reproduction and temperature.

H. hippocampus is included in the Red List (2017) category as Data Deficient (Woodle, 2017). Therefore, the need for detailed information specific to the species is obvious. This study mainly aims to determine the gonadosomatic and hepatosomatic parameters that were not previously specified for the seahorse species, *H. hippocampus* distributed at the Black Sea coasts (Tirebolu), and to evaluate the information related to length-weight relationships.

Material and Methods

Using beach seine-net at the Tirebolu coasts, a total of 131 (♀: 70, ♂: 61) specimens were obtained from commercial fishermen fishing in the Tirebolu region for four months (November, December, January and March) in 2014. The specimens were transported to the laboratory in plastic containers containing 70% alcohol. Standard length (SL; total length of head length, body length and tail length; the standard protocol developed for seahorses) was used to measure the specimens. In addition, each fish was weighted (W) with a digital scale. For the gonadosomatic index values (GSI), the equation $GSI = [W_g \times (W - W_g)^{-1}] \times 100$ (Ricker, 1975) was used and Fulton's condition factor (K) was calculated according to the formula $K = W / L^3 \times 100$ (Martinez and Vasquez, 2001) where W is the whole body weight in grams and L is the length in cm; the factor 100 is used to bring K close to a value of one. And hepatosomatic value (HSI) was computed with the formula $HSI = W_{liver} / W_{body} \times 100$ (Le Cren, 1951). Microsoft Office Excel software were used to analysis data.

Results and Discussion

The values of the mean±SD standard length, the mean weight and the mean±SD snout length were calculated as 106.79 ± 17.49 , 1.94 ± 0.49 and 4.98 ± 0.71 , respectively, for a total of 131 (♀: 70, ♂: 61) specimens examined in this study. When these values were compared with various studies on the same species conducted in different regions, it is seen that both the standard length values and snout length values of Aegean Sea populations (Gürkan et al., 2007) are greater than those given in present study. On the other hand, the length and weight values of a study carried out by Gürkan and Çulha (2008) in the western Black Sea coast of Turkey indicated the presence of relatively small and thin specimens in that region. The change in ecological factors between the latitudes that have an effect in the distribution of seahorses is shown to cause differences in reproduction (Vincent, 1990). Therefore, different populations of the same species on a regional basis make it possible to have different levels of standard length, snout length and weight values in different ecological environments.

In this study, female: male ratio of the specimens examined from Tirebolu was found to be 1: 0.87. According to Gurkan et al. (2007), this ratio was 1:0.30 in Aegean Sea. The difference between sex ratios of the two studies may be due to the difference in the number of samples and the sampling time.

The relationship between standard length and condition in the species *H. hippocampus* is given in Figure 1 and the change in condition according to months is shown in Figure 2.

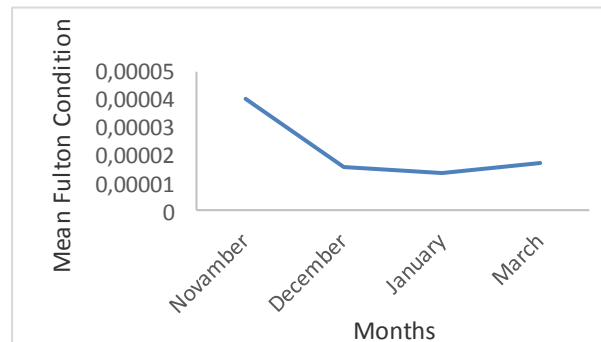
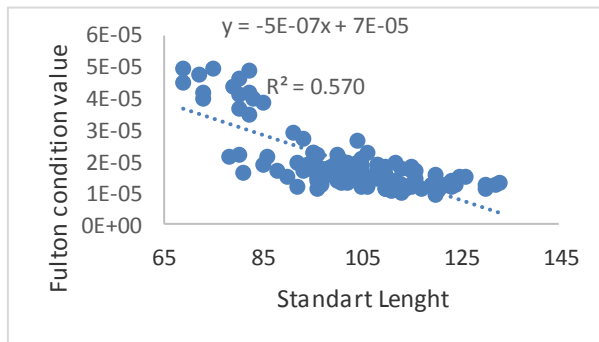


Figure 1. Standard size-Fulton's condition relation. Figure 2. Fulton's condition changes by Months.

Accordingly, the mean \pm SD condition value (Fulton's condition) was determined as $1.954 \pm 0.0.946$. This value is higher than the mean condition value of the *H. hippocampus* specimens from Aegean Sea given by Gürkan and Taşkavak (2011) and the mean condition value of the eastern Black Sea population given by Baştusta et al. (2014). As claimed by various researchers (Wong and Benzie, 2003; Zin et al., 2011), the difference in fitness values may be related to regional differences, as well as the temperature affecting metabolic activities may also affect the storage of fat in the body and hence the low index values. However, in the present specimens examined from Tirebolu, the high condition values determined in four different months indicates that individuals have a regular diet regime (Figure 2).

The GSI represents the gonadal development of fishes as well as the mature individuals. In this study, the mean GSI results obtained for only four months are given in Figure 3.

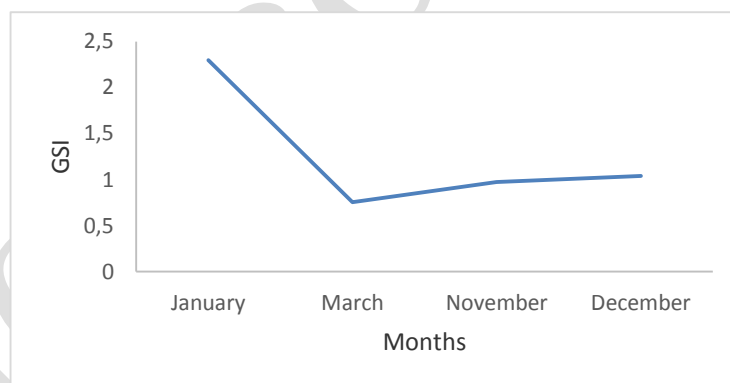


Figure 3. GSI shift by months.

According to this, the highest GSI value of the seahorse specimens in Tirebolu was in January (2.29 ± 2.03), while the lowest value was in March (0.75 ± 0.93). Therefore, it may be argued that reproduction time of seahorses in the region is between December and January. Water temperature significantly affects reproduction time in seahorses (Lin et al., 2006). However, Garrick-Maidment (2013) and Park and Kwak (2015) reported that the *H. gutturalis* species migrates to deep waters in winter and return migration has been done towards seagrass beds of shallow coastal areas where the water temperature is higher than 9°C . In our present study, there are no parameter related to water temperature, but the GSI results computed here suggest that the specimens caught in January and with high GSI values are wintering among seagrass depending on the water temperature in the region.

The relationship between the standard length and HSI calculated in *H. hippocampus* and the mean HSI values shift by months are given in Figure 4 and Figure 5, respectively.

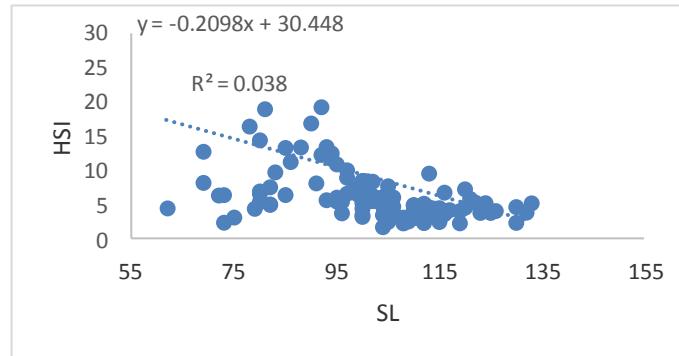


Figure 4. The relationship between Standard length and HSI values.

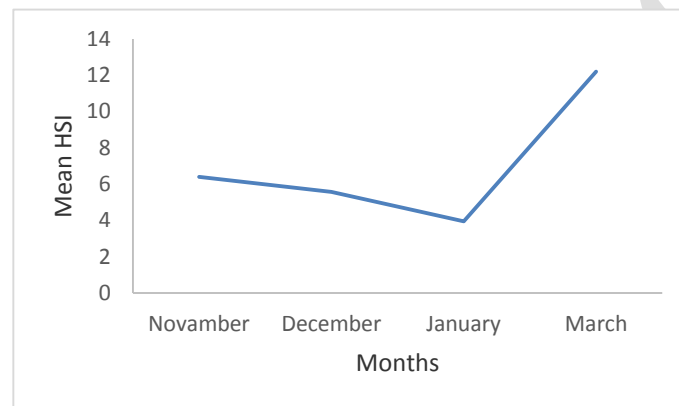


Figure 5. HSI shift by months.

The mean HSI value of the individuals distributed in Tirebolu was calculated as 9.01 ± 15.1 . Therefore, the K values obtained in this study and the HSI values are in parallel during the four months of breeding period of the species (Figure 4). This situation is important in terms of showing that the relationship between liver and body weights is changing seasonally (Mahboob et al., 2002). The change in HSI and K values is an important indicator that the seahorse individuals use the energy they obtain from nutrition mainly for gonad development and growth

As a result of this study, the gonadosomatic and hepatosomatic index results with some biological data for the *H. hippocampus* specimens obtained from the Black Sea coast of Turkey (Tirebolu) were given for the first time. Although they are not considered as a target commercial species in Turkish fishery, seahorses are among the many taxa whose life histories might render them vulnerable to bycatch which may be described as the portion of a commercial fishing catch that consists of marine animals caught unintentionally, or other disruptions such as habitat damage. The two seahorse species inhabit the Turkish seas, *H. hippocampus* and *H. guttulatus* are listed as “Data Deficient” (DD), which reflects substantial gaps in knowledge even for heavily exploited seahorses, such as the pygmy seahorses: *H. bargibanti*, *H. denise*, and *H. pontohi* in Far East Asia. With those data provided here, we are of the opinion that it may partially complete the lack of knowledge on seahorse life history and ecology in Turkey and the best-available biological knowledge may help to take more effective protection measures in the future.

References

- Başusta, A., Özer I., E., Girgin, H., Serdar, O., Başusta, N., 2014. Length-Weight Relationship and Condition Factor of *Hippocampus hippocampus* and *Hippocampus guttulatus* Inhabiting Eastern Black Sea, Pakistan Journal of Zoology 46(2): 447-450.
- Can, M.F., Başusta, N. Cekiç, M., 2002. Weightlength relationships for selected fish species of the small-scale fisheries off the south coast of Iskenderun Bay. Turkish Journal of Veterinary And Animal Sciences 26: 1181-1183.



- Ecoutin, J.M., Albaret, J.J. Trape, S., 2005. Length–weight relationships for fish populations of a relatively undisturbed tropical estuary: the Gambia. *Fish Res.* DOI:10.1016/j.fishres. 2004.10.007, 72: 347– 351.
- Garrick-Maidment N., 2013. Temperature and day length related seasonal movement of seahorses at South Beach in Studland Bay in Dorset. Topsham, UK: The Seahorsetrust.org. 15.
- Gurkan, S. and Taşkavak, E., 2007. Length-Weight relationships for Syngnathid fishes of Aegean Sea, Turkey. *Belgian Journal of Zoology* 137: 219-222.
- Gürkan, Ş., Akalın, S., Taşkavak, E., Özaydın, O., 2007. The investigation of biometric characteristics of seahorse species [*Hippocampus hippocampus* (Linnaeus, 1758) and *Hippocampus guttulatus* Cuvier, 1829] in Izmir Bay. *E.U. Journal of Fisheries & Aquatic Sciences* 24:(1-2): 149–153
- Gürkan, Ş. and Çulha, M., 2008. Regional and Seasonal Distributions of Some Syngnathid Species in the Coastal Waters of Sinop Peninsula (Southern Black Sea-Turkey). *Journal of FisheriesSciences.com.* 2(3): 536-544
- Gürkan, Ş., and Taşkavak E., 2011. Ege Denizi Kıyılarında Dağılım Gösteren Bazı Syngnathid Türlerinin Mevsimsel Kondisyon Faktörleri. *E.U. Journal of Fisheries & Aquatic Sciences Vol 28 (1):* 21-24.
- Koutrakis, E. T. and Tsikliras, A.C., 2003. Length weight relationships of fishes from three northern Aegean estuarine systems (Greece). *Journal of Applied Ichthyology* DOI: 10.1046/ j.1439-0426.2003.00456.x, 19: 258-260.
- Le Cren E D., 1951.The length-weight relationship and seasonal cycle in gonad weight gonad condition in the perch (*Perca fluviatilis*). *Journal of Animal Ecology* 20: 201-19.
- Lin, Q., Lu, J, Gao, Y., Shen, L., Cai, J. Luo, J., 2006. The effect of temperature on gonad, embryonic development and survival rate of juvenile seahorses, *Hippocampus kuda* Bleeker. *Aquaculture* 254: 701–713.
- Mahboob S, Sheri AN., 2002. Relationships among ovary weight, liver weight and body weight of Major, common and some Chinese carps under composite culture system with special reference to pond fertilization. *Asian-Australasian Journal of Animal Sciences* 15(5): 740-744
- Martínez A.M., B.P.C. Vázquez. 2001. Centro Interdisciplinario de Ciencias Marinas, México, Reproductive activity and condition index of *Holacanthus passer* (Teleostei: Pomacanthidae) in the Gulf of California, Mexico, Pg.1-3.
- Otero-Ferrer, F., Molina, L., Socorro, J., Fernández-Palacios, H., Izquierdo, M., 2012. Effect of different live prey on spawning quality of short-snouted seahorse, *Hippocampus hippocampus* (Linnaeus, 1758). *Journal of the World Aquaculture Society* 43, 174-185.
- Park, J.M., Kwak, S.N., 2015. Length –weight relationships and reproductive characteristics of the crowned seahorse (*Hippocampus coronatus*) in eelgrass beds (*Zostera marina*) of Dongdae Bay, Korea *Marine Biology Research* 11(2): 209- 213
- Ricker, W.E., 1975. Computation and interpretation of biological statistics of fish populations. *Bulletin of the Fisheries Research Board of Canada*, Bulletin 191, Ottawa. <http://www.dfo-mpo.gc.ca/Library/1485.pdf>
- Rodrigues K.A., Gustavo J. Macchi, Agueda Massaand María I. Militelli, 2011. Seasonal analysis of condition, biochemical and bioenergetic indices of females of Brazilian flathead, *Percophis brasiliensis*. *Neotropical Ichthyology* 11(1):153-162
- Valle, C., Bayle, J.T. Ramos, A.A., 2003. Weight - length relationships for selected fish species of the western Mediterranean Sea. *Journal of Applied Ichthyology* DOI: 10.1046/ j.1439-0426.2003.00492.x, 19: 261-262.
- Vincent, A. C. J., 1990. Reproductive Ecology of Seahorses. PhD Thesis, Cambridge University, U.K.
- Wong, J.M., Benzie, J.A.H., 2003. The effects of temperature, Artemia enrichment, stocking density and light on the growth of juvenile seahorses, *Hippocampus whitei* (Bleeker, 1855), from Australia. *Aquaculture* 228, 107 – 121
- Woodall, L., 2017. *Hippocampus hippocampus*. *The IUCN Red List of Threatened Species* 2017:e.T10069A67618259. <http://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T10069A67618259.en>. Downloaded on 02 April 2019.
- Zin, T., Than, A.A and Naing, T.T., 2011. Fecundity (F), Gonadosomatic Index (GSI), Hepatosomatic Index (HSI), Condition Factor (K) and Length-weight Relationship (LWR) in *Channa orientalis* Bloch & Schneider, 1801. *Universities Research Journal* 4(2).



Epidemiological index of European eel *Anguilla anguilla* living the Tonga lake (NE, Algeria)

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Abstract

Enigmatic and mysterious animal, the European eel has for a long time fascinated its surroundings; large migratory, amphihalin, thalassotoc, catadromous, semelpare ... etc.; However, since the early 1980s, its continental abundance has declined throughout its range, the causes advanced are very many, seen the complexity of its life cycle. Among the various threats we cite the parasites which deteriorate the general state of the fish thus preventing it from returning to its place of birth to complete its reproductive cycle and therefore the survival of the species.

We therefore decided to undertake a study of the endoparasitic fauna of the European eel captured in Lake Tonga and to analyze its evolution over time and according to the size of the fish. The size of the eels caught varies between 27 and 62.2 cm. The study of the morpho-anatomical characteristics of the parasites revealed: an ascaroid nematode *Hysterothylacium* and a cestode *Bothriocephalus claviceps* (in the gut); a monogenean *Pseudodactylogyrus* (in the gills). The epidemiological index shows that it is the cestode that is the most abundant and that the parasitic rate decrease with increasing length of host. Finally, the most abundant parasite is the monogenean *Pseudodactylogyrus* that infeste more than 70% eels.

Keywords: European eel, parasite, gut, gills, Tonga lake, Algeria.



Diversity and Density of Pleco (*Pterygoplycthis* sp) in Ciliwung River, Jakarta Indonesia

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Abstract

There has been a lot of information about some species of fishes, plants, insects, planktons, river quality, including heavy metal concentrations from organisms, water and sediment, from some research in Ciliwung River since 2008. But, there is still very limited data that related to the diversity and density of pleco in the Ciliwung River. Pleco is a native species from Costarica, Panama and South America and it's known as an invasive species which is potentially to reduce local biodiversity by eliminating local species of fishes in Ciliwung rivers. The aims of this study is to analyzing the diversity and density of pleco from Ciliwung River in the Jakarta area. Purposive sampling was used with a consideration that the three points represent the presence of pleco. The location of sampling was the Ciliwung river in Jakarta which flows along the Cawang-Condut. Sampling has been done using 4x2 m² cast nets with a 2.5-inch mesh size. The sampling activity was carried out in 09.00-15.00 AM. The results showed that the index diversity of pleco in the Ciliwung river in Jakarta was low, which was equal to $H' = 0$ because there is only one species of pleco was found there, *Pterygoplichthys pardalis*. The population density of pleco in the Ciliwung river in Jakarta was 58 individuals/m².

Keywords: *Pterygoplichthys pardalis*, native species, index diversity, population density, Ciliwung river Jakarta

Introduction

Pleco is a suckermouth armored catfish that is found in Ciliwung River in large quantities. It is an introductory species from Costarica, Panama and South America as an object of commercial ornamental fishes in Indonesia (Zworykin & Budaev, 2013). Pleco is also known as invasive species, which can be predators and competitors of local species (Hill & Lodge, 1999), potentially spread parasites and pathogens in their habitats (Torchin, et al., 2003), can cause unexpected hybridization (Mallet, 2007), and potential to reduce local biodiversity by eliminating local species of fishes (Chapin, et al., 2000).

The decline in number of the fish species in Ciliwung River has been happening since 2009. It is noted that there were found 20 fish species in 1910 on the river. One of the main role factors towards the decline of the fish species in Ciliwung River is the existence of pleco that is relatively able to adapt to the river's condition that is polluted and no other predators that hunt them. Pleco in Ciliwung River is categorized as introduced fish that is able to dominate the river, this is supported by its body morphology structure. It has a flat body, all covered with hard scales but its abdomen, it has a wide head and jaw. The main characteristic of this *loricariidae* group is that they have a sucker mouth. The shape of its mouth and



lips enable them to feed, breathe, and be attached to an object through sucking. The sucker mouth in pleco enables them to adhere to an object surround them, even on swift stream rivers. Its mouth and lips are also adapted to any kinds of food such as algae, invertebrate, and detritus (Geerinckx, 2007). Pleco has spiky *adifose fin*, wide back fin, and brown or grey body with black spots on its entire body (Kottelat *et al.*, 1993).

Pleco has a high capability of adaptation in Ciliwung River that have high level of pollutin as it has two respiratory systems. Their main respiratory system is the gill that is used when they are in clean water. Another is a labyrinth that enables them to live in low oxygen and polluted water (Graham, 1997). The existence of pleco can be identified from holes in the form of cluster along the slopes of Ciliwung River. The holes are functioned as a place to lay their eggs (Nico *et al.*, 2012).

The diversity of pleco in Ciliwung River has been researched since 2016 using some methods, such as morphology, morphometric, meristic, and molecular analysis (Elfidasari *et al.* 2016a, Elfidasari *et al.* 2016b, Qoyyimah *et al.* 2016, Rosnaeni *et al.* 2017). From the aforementioned research, there has no data with regards to diversity and density index data of pleco in the areas. Therefore, there is a need to do research to calculate the diversity and density index of pleco in Ciliwung River Jakarta.

Material and Methods

Pleco Sampling at the Ciliwung River Stream Area

Sampling have been done along Cawang-Condnet area of Ciliwung River and based on the planned stations. The samples were taken using three repetitions in different weeks. The sample collection used purposive sampling method, a technique to decide samples purposively based on certain considerations. The plecós was collected using nets around $4 \times 2 \text{ m}^2$ with the size of the eye nets is 2,5 inch. The nets were spread in the morning from 09.00-15.00 WIB which was referred by Nico (2010).

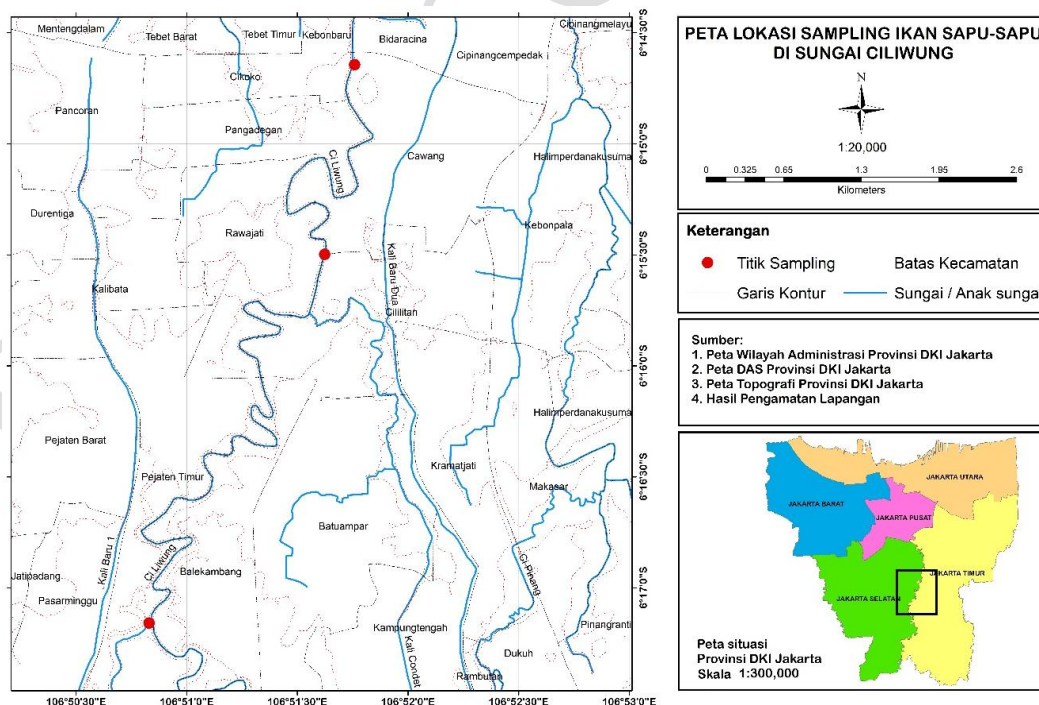


Figure 3. Three observation and sampling station along Cawang-Condnet of Ciliwung River

The consideration from this method was the coordinate which represented the existence of pleco based on the information from pleco fishermen and local citizens. There were three observation stations



from each coordinate, namely S 06.244053°-E 106.862654° at the first station, S 06.25830°-E 106.86040° at the second station and S 06.28599°-E 106.84717° at the third station (Figure 3). The coordinates were determined using purposive sampling method in consideration that samples collection along Cawang-Condut of Ciliwung River is regarded as a highly polluted area. In every coordinate, samples were collected in consideration that the samples caught from the nets were placed in every coordinate.

The Identification of Pleco Species at the River Stream Area of Ciliwung

The identification has been done at the Center of Integrated Laboratory UIN Syarif Hidayatullah Jakarta by identifying morphology characteristics of pleco that have been caught by the nets. The specimen was preserved in an 70% alcohol solution. The specimen labels used its scientific names, its caught places, and its collection dates. The identification of pleco specimen at the River Stream Area of Ciliwung used some methods by looking at the patterns of head, lateral, and abdomen. This research was conducted by looking at the pattern of its abdomen which is the salient morphology characteristic of pleco. This happens because the samples have spots patterns or vermicularis on its ventral (Armbruster & Page, 2006). The pleco species identification refer to the book of fish identification from Kottelat *et al.*, (1993) and other secondary data from scientific journals.

The Diversity of Pleco Types at the River Stream Area of Ciliwung

The relationship between the number of types and individuals can be stated in Diversity Index. To determine the fish diversity, Shannon-Wiener index was employed (Ludwig dan Reynold, 1988):

$$H' = -\sum p_i \ln p_i$$

Notes:

H' = Shannon-Wiener Diversity Index

n = The number (i) of individual species

N = The number of individuals from all species

The scoring criterion based on diversity types is:

$H' < 1$ = Low diversity

$1 < H' < 3$ = Moderate diversity

$H' > 3$ = High diversity

The Density of Pleco at the River Stream Area of Ciliwung

The density of pleco is calculated using the following formula (Barus, 2004):

$$D_i = X_i / N_i$$

Notes:

D_i = Density (individual/m)

X_i = Total number of individual

N_i = Total number of area

Results

The diversity index calculation result towards 1.401 plecosp gained from the three locations at Ciliwung River, resulted in the value of H' equal to 0 (zero). It can be stated that the diversity of pleco in Ciliwung River is low. The Diversity Index (H') is categorized low if, based on the identification result, it is only found one species of pleco in the three locations along the river stream area of Ciliwung River in Jakarta, namely *Pterygoplichthys pardalis*.

Morphologically, pleco's abdomen has big white spots pattern with merged patterns that are attached together to its sucker-mouth beneath (Page & Robins, 2006). Rosnaeni, et al. (2017) research is a



DNA analysis of *barcodes* CO1 in the fragment's length of 650bp supports the identification result of *Pterygoplichthys pardalis*, that even though there are diverse abdomen patterns of the found plecoco, all is from one species that is *P. pardalis*.

Identification result of the abdomen pattern on plecoco from the three locations of Ciliwung River shows matched result with the research conducted by Wu *et al.* (2011). The pleco species in Indonesia has a different abdomen pattern. *P. pardalis* has black spots abdomen pattern (in the shape of commas or dots), *P. disjunctivus* has curved patterns, meanwhile the inter-grade species has a combination pattern between inter-grade or hybrid species. The three different patterns of the abdomen can be characterized as one type of pleco in the family of *Loricariidae* that is *P. Pardalis*.

Two different patterns on its head (geometrical light stripes pattern and spots and blotches patterns) that could be identified by Armbruster and Page (2006) show that the two characteristics are the morphological characteristics of *P. Pardalis* species. The difference in the two lateral patterns (merged patterns forming chevrons (<) and separated patterns and do not create chevrons) also shows the morphological characteristic of *P. Pardalis* species. The result is supported by a statement that the different patterns between the abdomen patterns on pleco are not the main characters to identify the type of pleco (Rosnaeni, *et al.*, 2017).

Density of pleco population in Ciliwung River in the three locations results in different values. At the first station, it has the density value of 58 ind/m², at the second station it has the density value of 80 ind/m² and at the third station it has the density value of 36 ind/m². The average number of pleco density population in Ciliwung River is 58 individu/m². This shows that the density of pleco in this research is higher than the number of population that was found in Halwa's research (2016) that was 22 individuals.

The biggest density value was found at the second station that is around 80 ind/m², meanwhile the lowest is at the third station for only 36 ind/m². The biggest density value at the second station is caused by the number of individual species of *Poecilia reticulata* and *Mystacoleucus marginatus* is lower than the number of individuals at the first and the third stations. It is caused by the interaction between pleco and the species of *Poecilia reticulata* and *Mystacoleucus marginatus*. An interaction occurred in a population can be in the form of competition if among organisms from the same or different type use the same resource. If an organism uses the same resources, then every organism has to compete to feed themselves to survive and to grow.

The abundant number of pleco in Ciliwung River is probably due to an excellent interspecific competition in taking advantages of food resources with other fish in Ciliwung River such as *Poecilia reticulata* and *Mystacoleucus marginatus*. Supported with a statement coming from Josefsson and Andersson (2001), the aggressive characteristic to get food performed by *Pterygoplichthys pardalis* when they were present at certain locations so that they could change another community in a water area may cause the decline of fish and invertebrate populations.

According to De-Merona (2004), the fish population number is also affected by the number of food resources in the water. Pambudi *et al* (2016) states that there are 5.834 individuals of phytoplankton. This shows that the fish population in every station is influenced by the existence of phytoplankton in Ciliwung River. The biggest population number is gained at the second station for 80 ind/m² because the water condition is at its optimum point for the life of phytoplankton. The condition is influenced by the speed of the stream. At the second station, the speed of the stream is found lower than the first and third stations. According to (1988) a water area that is relatively placid is suitable for the habitat of phytoplankton. For the number of stream speed at the second station is 0,4 m/s lower than the first station for 1,5 m/s and the third for 2,1 m/s so that at the second station, it has a relatively placid stream. A research by Pambudi, *et al.* (2016) figures out that most phytoplanktons in Ciliwung River are highly-tolerated phytoplankton such as *Navicula*, *Nitzschia*, *Synedra*, *Cymbella*, and *Fragilaria*.



According to Krebs (1972), the existence of a fish in a water area is heavily influenced by the presence of predators. The pleco's body has several adaptations to predators that have hard bones and are able to regenerate its pectoral, so that pleco is not hunted by other fish living in Ciliwung River and become the competitor by original fish to get some food, additionally to its life cycle (Sinha, et al., 2010). The research results of Rice *et al.* (2007) and Power (1984) state that a predator from *P. pardalis* species is not from other fish type but from reptiles such as snakes and freshwater turtles, birds, and also human (Aguilar & Di-Beernardo, 2004) (Bonino *et al.*, 2009) (Nico, 2010).

The cause of the high density of pleco for 80 ind/m² in Ciliwung River at the second station is because few local people along the riverbank to do activities of fishing or catching fishes compared to the first and third stations. For instance, the act of catching fish commercially to invasive fish of *Pterois volitans* has proven to help inhibit the *Pterois volitans* fish population growth (Barbour *et al.*, 2011).

Cause of the high density of pleco in Ciliwung River at the third station is the low number of predator individuals. It is proven by a research by Rasmendero, et al (2009) that describes no finding of bird prey based on the composition analysis of bird types at Kalibata Station and at other stations in South Jakarta. The low number of pleco predators at the three stations enable pleco at the third station to have high density.

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References

- Barbour A B, Allen S M, Frazer K T, Sherman D K. 2011. Evaluating the Potential Efficacy of Invasive Lionfish (*Pterois volitans*) Removals. <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0019666>
- Bonino M, Lescano N J, Haro G J & Leynaud C G. 2009. Diet of Hydromedusa tectifera (Testudines-Chelidae) in a mountain stream of Córdoba province, Argentina. *Amphibia-Reptilia* 30(4):545-554
- Armbruster, J.W., Page, L.M. (2006):Redescription of *Pterygoplichthys punctatus* and description of a new species of *Pterygoplichthys* (Siluriformes: Loricariidae). *Neotropical Ichthyology*.4(4): 401-409
- Barus, T. A. 2004. Pengantar Limnologi Studi Tentang Ekosistem Air Daratan. Medan: USU Press.
- Chapin F S, Sala O. E, Bruke C I & Roy J. 2000. Ecosystem Consequences of Changing Biodiversity. *BioScience* 48(1).
- Elfidasari D, Qoyyimah D F, Fahmi R M. 2016. Morphometric And Meristic Of Common Pleco (Loricariidae) On Ciliwung River Watershed South Jakarta Region. *International Journal of Advanced Research* 4(12):57-62.
- Geerinckx T, Brunain M, Herrel A, Adriaens D. 2007. A head with a suckermouth: A functional-morphological study of the head of the suckermouth armoured catfish *Ancistrus cf. triradiatus* (Loricariidae, Siluriformes). *Belgian Journal of Zoology* 137(1).
- Hill, A. M & Lodge, D.M. 1999. Replacemat of resident crayfishes by an exotic predation in species replacemat among crayfish. *Ecological Application* 9 678-690.
- Josefsson and Andersson (2001),
- Kottelat, M., A.J. Whitten, S.N. Kartikasari and S. Wirjoatmodjo, 1993. Freshwater fishes of Western Indonesia and Sulawesi. Periplus Editions.
- Krebs. 1972. Krebs, C.J. 1972. *Ecology. The Experimental Analysis of Distribution and Abundance*. Harper and Row, New York. 694.
- Ludwig, J.A. and Reynolds, J.F. (1988) *Statistical Ecology A Primer on Methods and Computing*. Wiley-Interscience Pub., New York.
- Mallet J. 2007. Hybrid speciation. *Nature* 446:279–283 (15 March 2007)



- Nico LG, Butt PL, Johnston GR, Jelks HL, Kail M, Walsh SJ. 2012. Discovery of South American armored catfish (Loricariidae, Pterygoplichthys spp.) in The Santa Fe River drainage, Suwannee River Basin, USA. *BioInvasions Record*. 3 :179-200.
- Page, L.M., Robins, R.H. (2006): Identification of sailfin catfishes (Teleostei:Loricariidae) in south-eastern Asia. *The Raffles Bulletin of Zoology*. 54(2):455-457.
- Qoyyimah, F.D., Elfidasari, E., Fahmi, M.R. (2016): Identifikasi ikan sapu-sapu (Loricariidae) berdasarkan karakter pola abdomen di perairan Ciliwung. *Jurnal Biologi*, 20(1). Rice. 2007.
- Rosnaeni, Elfidasari D, Fahmi R M. 2017. Dna Barcodes Of The Pleco (Loricariidae, Pterygoplichthys) In The Ciliwung River. *International Journal Of Advanced Research* 5(2):33-45
- Torchin M, Lafferty K, Dobson A P & Kuris A. 2003. Introduced species and their missing parasites. *Nature* 421(6923):628-30
- Wu, L.W., Liu, C.C., Lin, S.M. (2011): Identification of exotic Sailfin Catfish species (Pterygoplichthys, Loricariidae) in Taiwan based on morphology and mtDNA sequences. *Zoological Studies*. 50(2):235-246.
- Zworykin & Budaev. 2013. Non-indigenous armoured catfish in Vietnam: Invasion and systematics. *Ichthyological Research* 60(4):327-333.

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Determination of genetic variations of *Carasobarbus luteus* populations living in Euphrates River based on mitochondrial DNA cyt b sequences

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Abstract

Euphrates River is an important natural resource both fish biodiversity and fishing potential. It has been detected the richest family in terms of species number is Cyprinidae. *Carasobarbus luteus* (Heckel, 1843) is known as the Yellow barbell and Mesopotamian himri. It is an endemic species from the family Cyprinidae possessing a wide distribution in Euphrates. It is used as food by local people and this species is also of economic importance due to high demand as food. Because of this a decrease has been observed for populations of this species. It is crucial to recognize genetic variations of populations consisting of this species for long term fishery and conservation strategies. The aim of this study is to reveal fundamental data for sustainability and conservation of the species' stocks by identifying genetic structures of *C. luteus* populations. A total number of 46 fish specimens were collected from 3 localities in the rivers systems of Euphrates and mtDNA cyt b site was analyzed by sequencing. 13 polymorphic sites and 5 haplotypes were identified in these analyses; mean haplotype and nucleotide diversity were determined to be 0.342 and 0.00504, respectively. Information about genetic variation and population structure obtained for *C. luteus* in the this study will contribute for planning effective strategies to conserve this species.

Keywords: Polymorphism, genetic diversity, population genetic, freshwater fish, Yellow barbell



Larvicide activity of almond oil seeds from the *Melia azedarach* tree against *Culex pipiens* L. (Diptera: Culicidae) larvae in north-eastern Algéria.

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Abstract

Mosquitoes are insect vectors that transmit dreaded human diseases (malaria); they cause millions of deaths annually and public health concern. The intensive use of insecticides to control these disease vectors is already a problem for man, the environment and the entire ecosystem. His current difficulties are related to the development of physiological resistance and the alteration of the environment. To address these challenges; the effort has been to formulate biosecurity products. The aim of the present study was to evaluate the efficacy and the biological effects of the vegetable oil of *Melia azedarach* obtained by the extraction of almond seeds, were tested for on newly fourth instars larvae of *Culex pipiens* (Diptera: Culicidae) under laboratory conditions, following World Health Organization's protocols. Concentrations was applied ranging from 1,91 g/L and 7,64 g/L. Mortalities were recorded for treated and control series as a function on vegetable oil exposure time (24, 48 and 72) hours.

The results obtained in this study indicate remarkable larvicidal properties of vegetable oil of *Melia azedarach* against L₄ of *Culex pipiens* with a dose-response relationship inducing significant mortality rates after 24 hours of exposure in the series treated compared to controls. So, toxicity was varied according to the concentration and time of exposure. The values LC₅₀ and LC₉₀ were determined respectively of 3,57 and 7,68 g/L.

The effectiveness of the bio-insecticide is obvious. Depending on their availability in the nature and their effectiveness, biopesticides should be considered as an alternative to conventional synthetic pesticides and their use should be encouraged.

Keywords: Mosquito, *Culex pipiens*, Vegetable oil, *Melia azedarach*, Bioassay, Larvicidal effect.



The Contents of Heavy Metals in *Plecostomus* (Loricariidae) from the Ciliwung River Jakarta, Indonesia

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Abstract

Indonesia has a life-oriented river. As much as 68 percent of the quality of river water in Indonesia is heavily polluted, including the Ciliwung River in DKI Jakarta Indonesia. The pollution can affect river ecosystems, especially river biota such as plecostomus species found in the Ciliwung River. Plecostomus that have dominated Ciliwung River are widely used by traders to be used as processed raw material products. The purpose is to identify the content of heavy metals, especially lead (Pb), mercury (Hg) and cadmium (Cd) in the flesh of plecostomus from the Ciliwung River in Jakarta. The methods employed were collecting plecostomus samples, plecostomus flesh preparation, and metals content analysis with X-Ray Fluorescence (XRF) Spectrometer. The metal results identified with the XRF method on the flesh of plecostomus as much as 57 metals and there are three types of heavy metals of Pb, Hg and Cd. The concentration of heavy metals of Pb, Hg and Cd exceeds the maximum value of SNI threshold. Therefore, plecostomus flesh from Ciliwung River Jakarta is not feasible for consumption.

Keywords: Ciliwung River, *Plecostomus*, fish flesh, heavy metals, Jakarta Indonesia.

Introduction

Rivers in Indonesia are used as a source of life, such as a place to live and to work. Around 68 percent or the majority of the river water quality in 33 provinces in Indonesia is in heavily polluted status including Ciliwung River in DKI Jakarta and its neighborhood (KLHK 2015). The quality of Ciliwung river is heavily polluted in all segments, starting from the upstream (Bogor) to the downstream (DKI Jakarta) and that makes Ciliwung river not feasible to use for any kinds of activities as it can pollute Ciliwung's River Stream Area. The pollution may affect the river ecosystems especially the river biota such as fish species in Ciliwung River.

Plecostomus is one of the species found in Ciliwung River (Hadiaty 2011). This is an introduced fish from Central America and South America which comes from Amazon River (Pound et al. 2010) brought by hobbyists, then entered into public waters in intentionally or unintentionally (Ploeg 2008). Biological and ecological fish brooms include being able to take oxygen from the air (facultative air breather) and detritus feed type (Yossa & Araujo-Lima 1998).

Nowadays, plecostomus from Ciliwung River is mostly used as the raw materials for food, such as dim sum, *empek-empek*, and fish chips (Mahdiah 2002) because plecostomus has economic value. The problem is if plecostomus lives in Ciliwung River that is polluted by metals, and consumed by people as food, it can be poisonous (DINKES 2015). Therefore, there comes the need to conduct a research about metals content in plecostomus flesh. This research is aimed at identifying the contents of heavy metals, especially lead (Pb), mercury (Hg), and cadmium (Cd) within plecostomus flesh from Ciliwung River. This is expected to give additional information about metals content in plecostomus flesh as people's food material.

Material and Methods

The research was conducted from September 2017 until October 2017. The location was at PAIR Laboratory to prepare for the samples and to analyze the results, meanwhile the employment of XRF tool to identify metals in plecostomus flesh was located at PTBGN Laboratory, National Agency of Nuclear Energy (BATAN).

1.1. Materials and Tools

Tools that were used during the sampling were containers and nets. The tools used in laboratory were knife, scissors, rulers with 1 mm precision, containers, mortar & alu, 60 °C oven, analytical balance with 0.0001 g precision, Ziploc plastic bag sized 6x8 cm, desiccator, spatula, crucible, crucible brace, and *X-Ray Fluorescence* (XRF) tool. The materials that were used were 18 plecostomus fish which were categorized into three groups in accordance with its body size, which were small-size plecostomus fish weighed < 115 g, medium-sized plecostomus fish weighed 140-180 g, and bigger-size plecostomus fish weighed > 215-310 g.

1.2. Samples Collection

Samples collection was started with conducting a survey and raw materials sampling at the research location to gain information about the origin of plecostomus and its habitat at Ciliwung River Stream Area (Figure 1). The fish were caught using fish nets and put into containers. After that, morphometric measurement was administered covering the total length, width, and height of the fish. Some samples which had not been researched were preserved inside freezer.

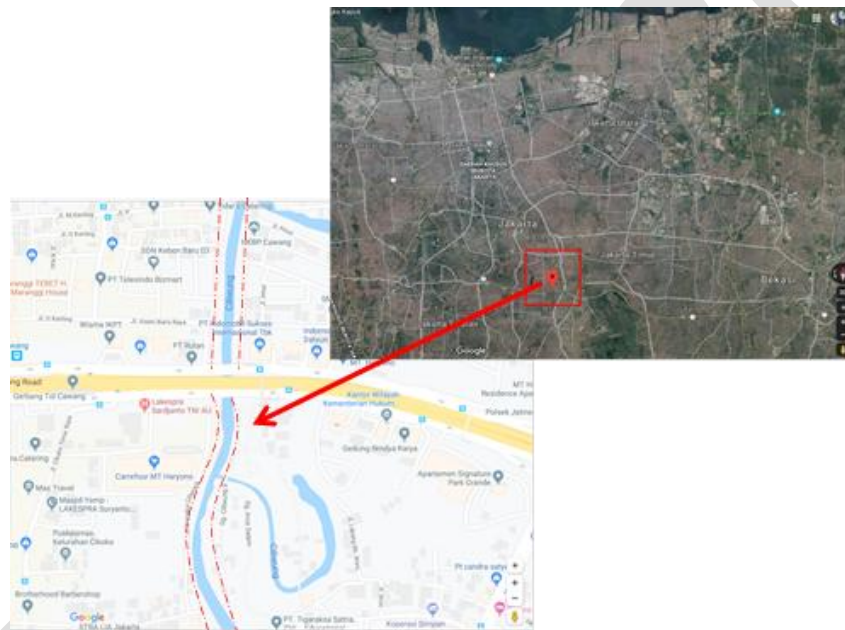


Figure 1 Sampling site Ciliwung River Stream Area Jakarta, Indonesia

1.3. Samples Preparation

The fish were dissected and were separated from its bones and skins using fillet technique. Then, the fish were weighed using analytical balance. The fish were put onto crucible and dried inside the oven for 60°C for five days. The dried flesh were weighed again using digital balance and were crushed and were put into Ziploc plastic bag. Each plastic was given labels according to the fish size category.

1.4. The Analysis of Metals Content in Plecostomus Flesh

The dried flesh samples were filtered \pm 100 mesh and were weighed for 5 grams. The analyzed samples were in the form of *press powder*. After that, the analysis of metals content in plecostomus flesh samples employing *X-Ray Fluorescence* (XRF) *Spectrometer* tool with GeoChemPellet 2 method was administered. The data gained from the analysis results using XRF were in qualitative and quantitative analyses. The results of metals measurement can be seen from the program in graphs, spectrum, and



tables. Then, the results were converted to Microsoft Excel for data processing and would be analyzed using SPSS to determine the correlation. The heavy metals were further analyzed as Pb, Hg and Cd.

Results

The identification result using XRF, it was found three heavy metals; they were Pb (Pb), mercury (Hg) and cadmium (Cd). The unidentified heavy metals were because the XRF method only analyzes metals with high concentration within the samples. Therefore, metals content in relatively low concentration cannot be detected by XRF (Suhariyono & Menry 2005). The presence of metals inside an organism's body occur because there is an accumulation of metals inside the organisms (Puspasari 2006).

Table 1. The result of heavy metals in pleco flesh

Heavy Metals	Pb (mg/kg)	Cd (mg/kg)	Hg (mg/kg)
Small	3.6 ± 0.3	0.6 ± 0.1	1.4 ± 0.3
Medium	2.7 ± 0.3	<0.5 ± -0.2	0.8 ± 0.3
Large	2.2 ± 0.3	<0.5 ± -0.2	0.3 ± 0.3

Discussion

The Pb concentration in three different size categories of plecostomus flesh – smaller-sized fish were for 3.6 ± 0.3 mg/kg, medium-sized fish were for 2.7 ± 0.3 mg/kg, and larger-sized fish were 2.2 ± 0.3 mg/kg (Table 1). The concentration value of Pb that was identified in three different categories of the fish flesh was > from 1 mg/kg as a safe threshold for fishery product to be able to consume and > from 0.3 of the safe threshold of consumption in fishery products (BSN 2009). Thus, it can be found that the concentration value of Pb is higher than the safe threshold value to consume.

Table 2 The comparison of Pb concentration with SNI research results

Category	Heavy Metals		Pb (mg/kg)		
	2009	2013	2017	SNI 2009	
				Flesh	Fishery Products
Small			3.6 ± 0.3		
Medium	0.02	2.88 ± 1.93	2.7 ± 0.3	1	0.3
Large			2.2 ± 0.3		

Based on research conducted by Ratmini (2009), plecostomus that were caught in Ciliwung River have 0,02 mg/kg of Pb, but the value is not higher than the set standard. However, results found in a research conducted by Alfisyahrin (2013), showed that the metal concentration of Pb in plecostomus from Ciliwung River near Bogor, Depok, and Jakarta Railway Stations were for 2.88 ± 1.93 which were higher than the set standard.

The Hg concentration in plecostomus flesh is higher than the safe threshold which is > from 0,03 mg/kg as fishery products and > from 0,5 mg/kg as fishery products, therefore it is not feasible to consume (BSN 2009). The concentration of heavy metal Hg in plecostomus flesh in three different sizes are $1,4 \pm 0,3$ mg/kg in smaller-sized fish, medium-sized fish for $0,8 \pm 0,3$ mg/kg and larger-sized fish for $0,3 \pm 0,3$ mg/kg (Table 2).



Table 3 The comparison of Hg metal concentration with SNI research results

Category	Heavy Metals		Hg(mg/kg)		
	2009	2013	2017	SNI 2009	
				Flesh	Fishery Products
Small			1.4 ± 0.3		
Medium	0.0005	0.001	0.8 ± 0.3	0.03	0.5
Large			0.3 ± 0.3		

The comparison result gained from Ratmini's (2009) and Hardi's (2013) research, showed that Hg concentration in plecostomus flesh in Ciliwung River was < from 0.001 thus it was still lower than the set standard from the government, but if it was consumed constantly for longer period of time, the possibility of being poisoned would occur. Consequently, alter has to be given since Hg metal is bio-accumulative (Puspasari 2006).

The concentration of Cd metal in plecostomus flesh found in three different size categories, showed that in smaller-sized fish has a concentration for 0.6 ± 0.1 mg/kg, medium-sized fish for 0.5 ± -0.2 mg/kg, and bigger-sized fish for 0.5 ± -0.2 mg/kg (Table 3). The metal concentration of Cd found in the three categories of plecostomus flesh was > from 0.3 mg/kg from the safe threshold of consumption in fishery products and > from 0.1 as a safe standard of consumption in fishery products (BSN 2009). The result showed that the concentration of Cd in plecostomus flesh is higher than the safe threshold to consume.

Table 4 The comparison of Cd metal concentration with SNI research results

Category	Heavy Metals		Cd (mg/kg)		
	2009	2013	2017	SNI 2009	
				Flesh	Fishery Products
Small			0.6 ± 0.1		
Medium	0.003	< 0.005	<0.5 ± -0.2	0.3	0.1
Large			<0.5 ± -0.2		

According to the comparison of Cd concentration value in 2017 research finding to Ratmini's (2009) and Dhika's (2013) showed that there was an increment of concentration. From 2009 until 2013, plecostomus flesh from Ciliwung River contained Cd metal concentration for < from 0.005 mg/kg thus it was still lower than the set standard by the government (Table 4). However, in 2017, the Cd concentration was higher than the set standard by the government for > from 0.3 mg/kg as fishery products and > from 0.1 as fishery products. Therefore, plecostomus flesh is not feasible to consume by people (BSN 2009).

The concentration contents of heavy metals of Pb, Hg and Cd from 2009 until 2017 has been increasing inside plecostomus flesh. Increased metal content can be caused by seasonal differences each year (Olojo et al. 2012). Based on the investigation at the sampling area exactly around Ciliwung Riverbank in Jln. Inpeksi Ciliwung Letjen MT. Haryonoo, the stream condition of the water at the sampling location is not too big since the water is black and much of garbage is found alongside the riverbank.

So, the identified metals using XRF method in plecostomus flesh are 57 metals with certain concentration value and there are three types of heavy metals such as Pb, Hg and Cd. The highest heavy metal concentration of Pb, Hg and Cd is in smaller-sized fish for 3.6 ± 0.3 mg/kg of Pb, Hg 1.4 ± 0.3 mg/kg and Cd 0.6 ± 0.1 mg/kg. The heavy metals concentration of Pb, Hg and Cd has always been increasing from 2009, 2013, and 2017 and it has beyond the maximum value of SNI of being feasible to consume status for meat and fishery products, thus plecostomus flesh from River Stream Area of Ciliwung Jakarta is not feasible to consume.

Construction projects, industries, and number of vehicles every year have become the main trigger in the increasing value of heavy metal concentration in Ciliwung River. In addition, the changes in the use of land and more population along the riverbank have implied towards pollutants' addition to Ciliwung River. This finding is supported by research conducted by Taufik (2003) that the sources of pollution in Ciliwung River Jakarta are coming from kinds of activities of the people living close to it and industries. Therefore, the dangerous heavy metal sources such as Pb, Hg and Cd are suspected to come from the



waste of construction projects, industries, residential areas, and transportations along the riverbank which can pollute the river ecosystems especially river biota such as plecostomus in Ciliwung River.

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References

- [BSN]. Badan Standardisasi Nasional. (2009). *SNI 7387:2009 Batasan Maksimum Cemaran Logam Berat Dalam Pangan*. Jakarta: BSN.
- Alfisyahrin, N.F. (2013). *Distribusi Logam Berat Timbal (Pb) dalam Daging Ikan Sapu-sapu (Pterygoplichthys pardalis) di Sungai Ciliwung* [skripsi]. Bogor : Institut Pertanian Bogor.
- [DINKES] Dinas Kesehatan. (2015). Dampak Logam Berat Pada Kesehatan. <http://dinkes.lumajangkab.go.id/dampak-logam-berat-pada-kesehatan/> [10 Maret 2018].
- Dhika, L.R. (2013). Kandungan Logam Berat Kadmium (Cd) dalam Daging Ikan Sapu-sapu (Pterygoplichthys pardalis) di Sungai Ciliwung. [skripsi]. Bogor : Institut Pertanian Bogor.
- Hadiaty R K. 2011. Diversitas dan Hilangnya Jenis-Jenis Ikan di Sungai Ciliwung dan Sungai Cisadane. *Berita Biologi*. 10(4): 491-504.
- Hardi. (2013). Analisis Kandungan Logam Berat Merkuri (Hg) pada Daging Ikan Sapu-sapu (Pterygoplichthys pardalis) di Sungai Ciliwung [skripsi]. Bogor : Institut Pertanian Bogor.
- [KLHK] Kementerian Lingkungan Hidup dan Kehutanan. 2015. *Pengendalian Daerah Aliran Sungai dan Hutan Lindung*. Jakarta : KLHK.
- Mahdiah, E. (2002). Pengaruh Penambahan Bahan Pengikat Terhadap Karakteristik Fisik Otak-Otak Ikan Sapu-Sapu (*Liposarcus pardalis*) [skripsi]. Bogor (ID):Institut Pertanian Bogor.
- Ploeg, A. (2008). Invasive Species in Our Industry?. *OFI Journal*. 58: 21-25
- Pound KL, Nowlin WH, Huffman DG, Bonner TH. 2010. Trophic ecology of a nonnative population of suckermouth catfish (*Hypostomus plecostomus*) in a central Texas spring-fed stream. *Environ Biol Fish*. doi: 10.1007/s10641-010-9741-7.
- Olojo, E.A.A., Olurin, K.B., & Oluberu, S.A. 2012. Seasonal variation in the bioaccumulation of heavy metals in the tissues of *Oreochromis niloticus* and *Chrysichthys nigrodigitatus* in Lagos Lagoon Southwest Nigeria. *Acad. J. Plant Sci*. 5(1): 12-17.
- Puspasari, R. (2006). Logam dalam Ekosistem Perairan. *J.BAWAL*: 1 (2) 43-47.
- Ratmini, N.A. (2009). Kandungan Logam Berat Timbal (Pb), Merkuri (Hg) dan Cadmium (Cd) Pada Daging Ikan Sapu-Sapu (*Hyposarcus pardalis*) di Sungai Ciliwung Stasiun Srengseng, Condet Dan Manggarai. *Jurnal Ilmiah Biologi VIS VITALIS*. 2(1): 1-7. Jakarta : Fakultas Biologi Universitas Nasional.
- Suhariyono, G., & Menry, Y. (2005). Characteristic Analysis of Element in Soil at The Various Location By Using XRF.. *Prosiding PPI – PDIPTN 2005*. 197-206. Yogyakarta : Puslitbang Teknologi Maju – BATAN.
- Taufik, K.L. (2003). Kualitas air Hulu dan Tengah Sungai Ciliwung Kabupaten Bogor Jawa Barat. [skripsi]. Bogor (ID): Institut Pertanian Bogor.
- Yossa, M.I., Araujo-Lima, C.A.R.M. 1998. Detritivo-ry in two Amazonian fish species. *Journal of Fish Biology*, 52 (6): 1141-1153.



Effects of Astaxanthine, Canthaxanthin and Lycopene Containing Diets on the Chemical Quality and Textural Properties of the Black Sea Trout (*Salmo labrax*) Fillets

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Abstract

In this study; effects of astaxanthine, canthaxanthin and lycopene containing diets on the chemical composition and textural properties of the Black Sea trout (*Salmo labrax*) were determined. Trouts have been fed by astaxanthine, canthaxanthin and lycopene in different doses ranged from 100 ppm to 300 ppm for three months. Sampling was done in every month and crude protein, crude fat, crude ash, moisture, amino acid and fatty acid were carried out after the trouts were filleted. Furthermore, texture parameters such as hardness, adhesiveness, flexibility, cohesiveness, gumminess, chewiness, resilience of the fillets were evaluated with the TA.XT texture analyzer equipped with 5 kgf load cell. According to results, all carotenoid supplements had showed statistically a significant effect on the crude protein ratio, total essential amino acids, total mono and poly unsaturated fatty acid as a result of the feeding trials. It has been detected that, while astaxanthine and canthaxanthin had a positive effect on crude fat ratio and meat hardness, lycopene had negative effect on those parameters. Glycine and alanine which are responsible for the hexagonal muscle structure as well as meat hardness in salmonids were found to be higher than the lycopene and control groups ($P \leq 0.05$). In the end of the feeding trials; eicosapentaenoic acid, docosahexaenoic acid, dihomo-gamma linolenic acid were higher in all carotenoid groups than the control groups ($P \leq 0.05$). Besides, the lowest saturated fatty acid content were exhibited in 300 ppm lycopene group in the end of a 3-month feeding trial.

Keywords: *Salmo labrax*, carotenoid, fatty acids, amino acids, hardness.

Acknowledgement

This study is part of the PhD thesis which is entitled as “Determination of Meat Quality of Black Sea Trout (*Salmo labrax* PALLAS, 1814) Fed with Carotenoid Containing Diets” and supported by “A Research on Possibilities of Using Some Phytobiotic Containing Diets in Black Sea Trout (*Salmo trutta labrax* PALLAS, 1814) nutrition” entitled project. Also authors would like to thank Eyüp Çakmak, Dr. Osman Tolga Özel and Esen Alp Erbay for the assistance in feeding trials and chemical analyses.



A Dileptid Ciliate Isolated from Tekirdağ Soils, *Rurikoplites armatus* (Foissner & Schade 2000) Ciliophora: Litostomatea, Rhyncostomatia): Infraciliature and Morphometric Characterization

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Abstract

Dileptids are rapacious ciliates that play an important role in microbial food chains through their predation upon ciliates in soils and other habitats. They are characterized by having a proboscis underneath of which is the oral opening. A comprehensive study of dileptid ciliate species in Tekirdağ province and even in Turkey has not been performed up to the present. *R. armatus*, which was discovered in soil from Helgoland (Oberland), Germany, is possibly a widely distributed species. In this work, this species was studied in two populations from two different stations at working area. Attention was given on the ciliary pattern, the structure of dorsal brush, contractile vacuoles, the shape and size of extrusomes as well as the resting cyst morphology. Soil samples were taken between March-2016 and June-2017. To re-active cystic ciliates from soil samples dried at room temperature, soils cultures were made according to “non-flooded Petri dish” method. The detailed cytological structures of *R. armatus*, isolated from soil (pH 6,37 population 1, 6,82 population 2; unsalted), were investigated using live observation, silver impregnation, and morphometry. In addition, supravital staining with methyl green pyronin was performed for cyst morphology. This species (data based on population 1 and 2) is characterized by: (1) a size of about 166 (133-202) X 24 (17-29) µm-166 (126-253) X 25 (18-29) µm; (2) a narrowly to cylindrically dileptid body with proboscis occupying about 30% - 33% of body length; (3) two dorsal vacuole; (4) three size groups of rod-shaped extrusomes; (5) two-rowed dorsal brush; (6) about 10 kineties (ciliary rows); and mature cysts about 37-35 µm across. *R. armatus* isolated in this study was the first record for ciliate fauna of Turkey. The obtained data were evaluated and compared with original population (Germany) and other descriptions in literature. Indeed, Tekirdağ specimens has remarkable similarities with other populations investigated, but has more size groups of rod-shaped extrusomes. The cyst morphology of *R. armatus* is revealed globally for the first time in this study.

Keywords: dileptid ciliates, *Rurikoplites armatus*, soil, Tekirdağ

Acknowledgement: We would like to express our appreciation to the Tekirdağ Namık Kemal University Scientific Research Project Commission, which supported this study (NKUBAP.01.GA.16.079).



The species of the genus *Calligonum* L. in the Ustyurt

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Abstract

In this study, the synopsis of the genus *Calligonum* L. in Ustyurt is presented. As a result of the obtained herbarium (LE, TASH, AA) collections and floristic findings (2012-2018), *Calligonum* now includes 21 species, of which 1 (*Calligonum litvinovii* Mattei) is new to the flora of Ustyurt. All information of herbarium of LE, TASH, AA, and specimens collected by the authors and have been entered in the database of the flora of Ustyurt. The geographical distribution of *Calligonum* in Ustyurt has been GIS mapped and analyzed.

Keywords: *Calligonum*, herbarium, Middle Asia, new records, Ustyurt

Introduction

The Ustyurt plateau is located between the Caspian and the Aral Sea. It is located at the junction of three states: the Republic of Kazakhstan, Uzbekistan and Turkmenistan.

As a whole, the arid zone of Central Asia is a natural food base, mainly for karakul farms. In connection with this, the study and analysis of the current distribution of plant species, the conservation and sustainable use of biodiversity have become particularly relevant.

The genus of *Calligonum* L. belongs to the family of Polygonaceae, with some 80 species distributed throughout Western Asia, Southern Europe and North Africa (Okasaka and al., 2004). The species belonging to genus of *Calligonum* in Ustyurt have great potential and importance because of providing different products and services, such as forage, traditional medicines, arresting desert encroachment and stabilizing sand dunes. In the Ustyurt according the last enumerating about 6 species are well known (Nabiev, 1971). Based on the new identifications the number of species increased to 13 species (Sherbaev, 1988; Saribaev, 1994). In this revision, a new species for flora of Ustyurt is described and the number of species is increased to 21. Of them six of which endemics to Central Asia.

The study was carried out within the framework of the projects “Systematic of vascular plants of the natural flora of Uzbekistan” conducted at the Botanical Institute of the Academy of Sciences of the Republic of Uzbekistan.

Material and Methods

Specimens of genus *Calligonum* were studied more than 100 herbarium specimens preserved in Uzbekistan (TASH) and abroad herbaria (LE and AA), when collected in all stages of ontogeny from various localities throughout Ustyurt.

Specimens of genus *Calligonum* were studied more than 200 herbarium specimens preserved in Uzbekistan (TASH) and abroad herbaria (LE and AA), when collected in all stages of ontogeny from various localities throughout Ustyurt. For more complete morphological descriptions accepted taxa see several scientific resources (Pavlov, 1936; Nabiev, 1971) on the flora.

The coordinates of plant records were imported into ArcGIS 10.0 and transformed to a point map layer. A WGS84 Geographic coordinate system was used as a reference datum. The digitizing of herbarium specimens was done by scanning with HerbScan TM 224 + Epson Expression 10000 XL.

The nomenclatural part of the checklist includes accepted names of species according to The Plant List database (www.theplantlist.org), synonymy, references to protologues, and type designations. Citation



of authorship of taxa corresponds to the “Authors of plants names” (Brummitt & Powell 1992: 527) and the International Plant Names Index (www.ipni.org).

Results

In the results of our research in the herbarium collections (LE, TASH and AA) and in the expedition (2009-2018) 21 species were registered for the flora of Ustyurt. These results have an importance for investigation of the flora of arid zone of Uzbekistan (Table 1).

Table 1. List of the species registered for the Ustyurt flora.

№	Species	Distribution		
		The flora of Uzbekistan	The flora Kazakhst	The flora Turkmenis
1.	<i>Calligonum acanthopterum</i> I.G. Borshch.		+	
2.	<i>Calligonum aphyllum</i> Gurke	+	+	+
3.	<i>Calligonum aralense</i> I.G. Borshch.	+	+	
4.	<i>Calligonum barsukiense</i> Soskov		+	
5.	<i>Calligonum borszczowii</i> Litv.	+		
6.	<i>Calligonum caput-medusae</i> Schrenk	+	+	
7.	<i>Calligonum eriopodium</i> Bunge		+	
8.	<i>Calligonum junceum</i> (Fisch. et C.A. Mey.) Litv.	+	+	+
9.	<i>Calligonum leuocladum</i> (Schrenk) Bunge	+	+	+
10.	<i>Calligonum litwinovii</i> Mattei (Exped) nov	+		
11.	<i>Calligonum macrocarpum</i> I.G. Borshch.	+		
12.	<i>Calligonum membranaceum</i> Litv. (<i>C. spinulosum</i> Drobow)	+		
13.	<i>Calligonum microcarpum</i> I.G. Borshch.		+	
14.	<i>Calligonum murex</i> Bunge			+
15.	<i>Calligonum patens</i> Litv.			
16.	<i>Calligonum rigidum</i> Litv. (CM)		+	
17.	<i>Calligonum rotula</i> Boszcz. (CM)		+	
18.	<i>Calligonum rubicundum</i> Bunge		+	
19.	<i>Calligonum tetrapterum</i> Jaub. et Spach	+		
20.	<i>Calligonum triste</i> Litv.	+	+	
21.	<i>Calligonum undulatum</i> Litv. (<i>C. tortile</i> Drobow)	+		
	Total	12	13	4

From the species for the flora of Uzbekistan in the genus of *Calligonum* have 6 (*Calligonum aphyllum* Gurke, *Calligonum leuocladum* Bunge, *Calligonum caput-medusae* Schrenk, *Calligonum litwinowi* Drobow, *Calligonum triste* Litv. and *Calligonum junceum* (Fisch. & C.A.Mey.) Litv) of endemic species for the Central Asia.

During floristic study (2012) we found one specimen of *Calligonum litvinovii* Mattei from Karakalpakstan part (Uzbekistan) of the Ustyurt: *Uzbekistan* (TASH): East chink of the Ustyurt. Between Ustyurt and Aral Sea. 30 V 2012, D.M. Tajetdinova, Det.: U. Prатов (Fig 1-2).

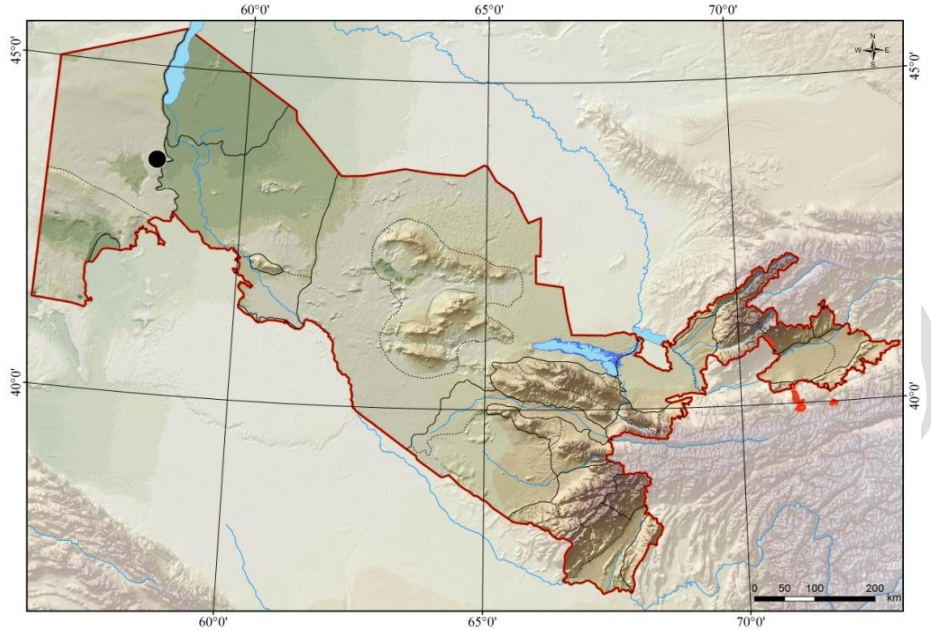


Figure 1. The distributing *Calligonum litvinovii* Mattei. in the Ustyurt.



Figure 2. *Calligonum litvinovii* Mattei.

Based on these collections from Ustyurt, *Calligonum litvinovii* Mattei. is included in the list of flora Uzbekistan.

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References

- Brummitt, R.K., Powell, C.E. (1992). Authors of plant names. *Kew, Royal Botanic Gardens*, 732.
- International Plant Names Index. (2018). Available from: www.ipni.org
- Nabiev, M.M. (1971). *Calligonum* L. In: *Conspectus Florae Asiae Mediae. Tashkent*, 2, 182-201.
- Okasaka, M., Takaishi, Y., Kogure, K., Fukuzawa, K., Shibata, H., Higuti, T., Honda, G., Ito, M., Kodzhimatov, O.K. & Ashurmetov O. (2004). New stilbene derivatives from *Calligonum leucocladum*, *J. Nat. Prod.*, 67, 1044-1046.
- Pavlov, N.V. (1936). *Calligonum* L., *Flora of the USSR. Moskva & Leningrad*, 5, 527-594.
- Saribaev B. (1994). Flora and vegetation of a plateau Ustyurt and prospects of their use. *Avtoreferat of dissertation, Tashkent*, 32.
- Sherbaev B. (1988). Flora and vegetation of Karakalpakstan. *Nukus, Karakalpakstan*, 304.



Penetration of the Pacific Korean rockfish *Sebastes schlegelii* into the Black Sea

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Abstract

Our studies are conducted in the Black Sea coastal zone with the aim of monitoring invasive processes. Several specimens of rockfish were recorded in the Black Sea as a result of the study of ichthyofauna using fishing gear and underwater observations. Fish were found in rocky biotopes off the coast of Crimea and the Caucasus. The first finding took place in 2013, the fish was placed in the Sevastopol Aquarium and was mistakenly identified as a dogtooth grouper *Epinephelus caninus* (Valenciennes, 1843). After the catching and registration of several more specimens, they were identified as a Pacific species Korean rockfish *Sebastes schlegelii* Hilgendorf, 1880. Due to the fact that several large (total length 329,0 – 388,7 mm, standard length 271,5 – 321,0 mm) sexually mature individuals were found in various areas of the coast, we assume that this species naturalized in the Black Sea.

Keywords: Black Sea, alien species, *Sebastes schlegelii*, fish, ichthyofauna, monitoring



The Economic Value Analysis Approach to Conservation and Sustainable Use of Biological Diversity: *Fritillaria sp* as a Case Study

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Abstract

Biodiversity loss is one of the greatest risks of the 21st century. It undermines human health and well-being, societal resilience and progress towards the Sustainable Development Goals. Specifically, biodiversity loss can result in reduced crop yields and fish catches, increased economic losses from flooding and other disasters, and the loss of potential new sources of medicine. Therefore, it is important to determine the economic value of biological diversity on the basis of species and to identify possible economic and ecological losses. In this research, an economic value analysis was performed with the determination of production, the goods and service value functions of *Fritillaria imperialis* in Turkey. In this value analysis were used the economic valuation techniques, socio-cultural and ecological value parameters. The total flow values of the service functions provided by the unit *F. imperialis* is determined as \$72.96/year. The total economic value of *F. imperialis* was calculated as \$14,592,000 / year over 200.000 units which is the annual export amount. It has an annual export revenue of \$ 52,416, and the calculated value is considerably higher than the annual export revenue. The addition of total economic value of the non-measurable positive added value, which is happening in ecological processes, increases significantly the value of *F. imperialis*. The asset value and the inheritance value also affect positively in here. In addition, one of the service functions of *F. imperialis* is the use value in biological control (\$13.6/da/year), the other one is the conservation value (\$37/da/year), the next one is the use value as an ornamental plant (\$8.07/unit/year) and the last one is the use value as a nutrient (\$ 3.6/unit/year) were determined significantly. *Blue tits* have also been shown to be an extremely important pollinator for this species.

Keywords: Economic valuation techniques, *Fritillaria*, *Fritillaria imperialis*, biodiversity, sustainable development, Turkey



Diversity and distribution pattern of waterbirds in wetlands of Algerian steppe region

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Abstract

The main aim of our study is to assess the diversity and abundance waterbirds through wetland ecosystems located in Algerian steppe region. a survey was conducted along four successive study years in the main sites.

This monitoring allowed assessing 52 species, representing 16 families. Anatidae are the most abundant and represented by 11 species. Boughzoul's reservoir is the high richness wetlands, followed by Chott El Hodna and K'sob reservoir. However, Dayet El Kerfa is the preferred wetland for breeding species. Winter migrant, resident, and migrant species are the dominated status with 43 %, 28 % and 17 % respectively. While these statuses varied between sites.

Overall, the analyze phonological status of assessed species display the key role played by these wetlands as wintering grounds, a stopover during migration journeys and breeding sites for several waterbirds species. The presence of vulnerable species (*Marmaronetta angustirostris*), and three near threatened other species (*Aythya nyroca*, *Limosa limosa*, *Numenius arquata*) following the IUCN Red List confirms the importance of the steppe region wetlands for waterbirds conservation.

Keywords: Wetland, Waterbirds, Diversity, Distribution pattern, Steppe region, Algeria.

Introduction

Wetlands have been usually known as primary resources for human activities, as well as irreplaceable habitat for a rich diversity of flora and fauna, particularly waterbird communities (Weller, 1999). Algeria contains a wide variety of wetlands which are important staging posts and wintering grounds for migrating Palearctic birds (Steavenson et al. 1988, Coulthard 2001).

The steppe region wetlands of Algeria known by its habitat diversity (Chott, Reservoir, Daya, Dam...). Many of them are classified as wetland of international importance under the Ramsar Convention and as Important Bird Area (IBA) (Coulthard, 2001). By its strategic location in the center of the country, this complex plays a key role in the ecosystem maintains (Samraoui et al. 2008; Ledant et al. 1981).

The avifauna of Algeria is moderately well known, due former collected data during the past century by many ornithologists (Heim de Balsac & Mayaud 1962, Ledant et al. 1981, Isenmann & Moali, 2000). These early works are based on dispatched observations recorded intermittently in a few wetlands. Baseline information on the distribution and abundance of waterbirds is elementary task of further deeper research and the development of management and conservation strategies (Lancelotti Julio et al. 2009).

In North Africa and particularly in Algeria, there are major gaps in knowledge of the birds' status, distribution, seasonal movements and habitat use, particularly for wetland species Samraoui et al. 2008. These wetlands are used by a large number of wintering and breeding waterbirds (Jacob & Jacob 1980, Bensaci et al. 2014)



Waterbirds diversity and distribution of steppe region wetlands area remain poorly known, where there are few studies were carried out in some sites in this region such as Boughzoul reservoir (Jacob & Jacob 1980), Chott El Hodna (Guergueb et al. 2014), Dayet El Kerfa (Bensaci et al. 2014).

This contribution aimed to assess the diversity, phenology, and distribution of waterbirds species throughout wetlands of steppe region and to determine the opportunities offered by these habitats for the conservation of this biodiversity

Material and Methods

The Steppe region located in northern Algeria, in an area consisting of mountains, valleys, and plateaus between the Mediterranean Sea and the Sahara Desert, where the landscape is dominated by steppe vegetation.

This huge complex has a semi-arid climate, with an annual mean temperature of 25°C and average annual rainfall less than 400 mm (Figure. 1).

The Steppe region contains many wetlands varied between natural and artificial sites, which are developed when the waters converge from the Saharan Atlas Mountains in the South and the Tell Atlas Mountains in the North. Most of these are vast, shallow salt lakes that have been little studied and are poorly known.

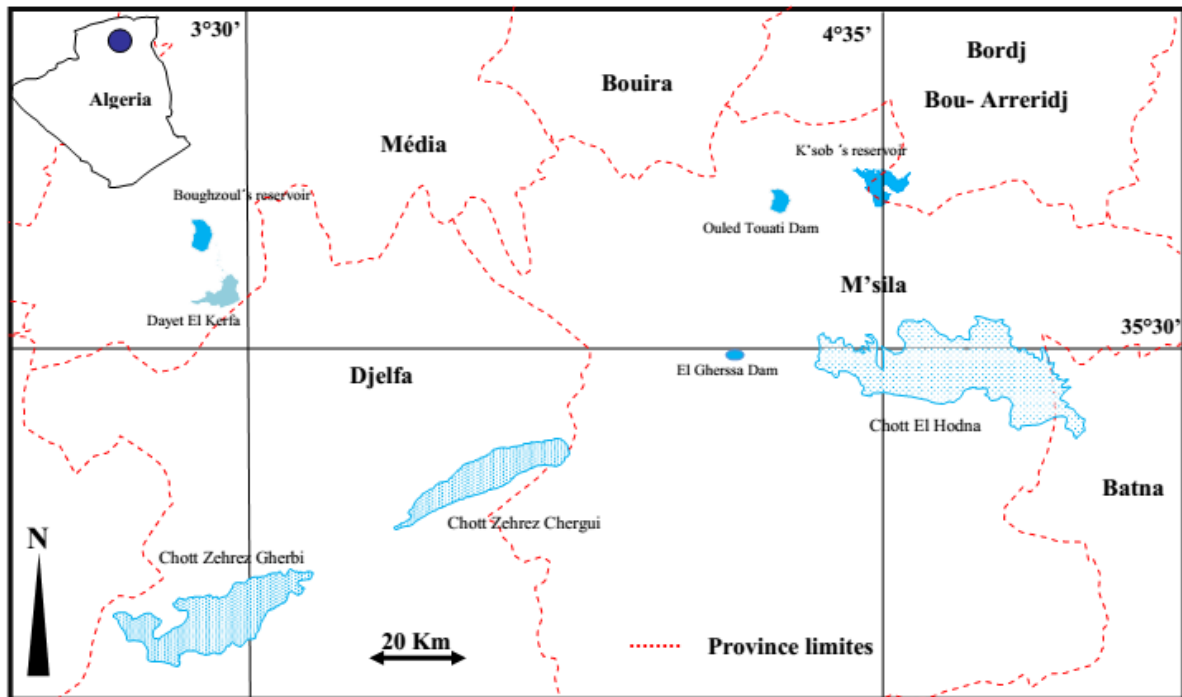


Figure 1. Geographic situation of study area

The waterbirds surveys were undertaken across eight wetlands, two of them were dry for long period (Chott Zehrez Chergui and Zehrez Gherbi) during four study years from 2012 to 2016, through many companies of bird counts during different seasons of the year. The census of the waterbirds was done by direct observation using an Optolyth 20x80 telescope by a team of 3 to 2 observer from near the wetland in different observation points, where most of the surface area and the edge was visible, in the aim to identify and count all birds present (Bibby et al. 1992).

The determination of phenological status based on the period of species occurrence in the site: resident breeder (RB) species present all the year and its nesting is confirmed during the study period; winter migrant (WM) species observed exclusively during the winter season; migrant breeder (MB) migratory species came in summer for breeding; probable breeder (PB) species supposed breeding; and visitor passage (VP) species observed occasionally in the site mainly during migration periods.



Faunal type (FT), was determined according to Voous (1960) classification of the biogeographical origin. Trophic status (TC), were distinguished according to their diet categories (Müller, 1997): granivorous (G), carrion-feeder (Cr), carnivorous (Cv), invertebrate feeder (Inv) and polyphagous (Pp).

Protection status (PRS) was determined nationally according to species citations in Algeria legislation (OJAR, 1995), while, internationally status, following their citations in various international conventions and treaties: the IUCN Red list (Baillie et al., 2004), the African–Eurasian Waterbird Agreement “AEWA” (AEWA, 2008), the Washington Convention “CITES” (CITES, 1994), and conventions of Bonn.

Results

Specific composition of waterbirds population

A total of 52 waterbird species represent 34 genera and 16 bird families, were recorded in the study wetlands of Steppe region throughout. The species richness was varied from site to other where the high value was observed at Boughzoul reservoir with 51 species representing 16 families. However the low richness was observed at Ouled Touati Dam, with only 6 species representing 4 families.

Anatidae family was the best represented with 11 species, followed by Scolopacidae with 9 species, then by Ardeidae with 8 species. Charadriidae, Laridae and Sternidae were represented by 4, 3 and 3 species respectively. However other families were low represented (Table 1) Boughzoul reservoir is the high richness wetland in the complex both in species (52) and families (16), followed by Chott El Hodna and K’sob reservoir. However, Ouled Touati dam is the poorest site with only 06 species and 04 families.

Ecological status of assessed waterbirds

Winter migrant birds are the most assessed species (43 %), followed by resident breeder and migrant species with 28 % and 17 %. Whereas, another status (summer migrant, summer migrant breeder and resident species) are lower represented (Table 02, Figure 04).

The phonological status of inventoried species was varied between sites, the resident breeder was very presented in Dayet El Kerfa and Oulad Touati dam. However, Chott El Hodna, Boughzoul reservoir and K’sob reservoir avifauna is dominated by migrant passage species (Figure 05).

A total of 36 (28 %) birds protected in Algeria, and the most identified species (92.30%: 48 species) were of “Least Concern” according to the IUCN Red List, while three species (*Aythya nyroca*, *Limosa limosa*, *Numenius arquata*) has the “ Near Threatened status, and only one species (*Marmaronetta augurostris*) has the “Vulnerable” status (Table 2).

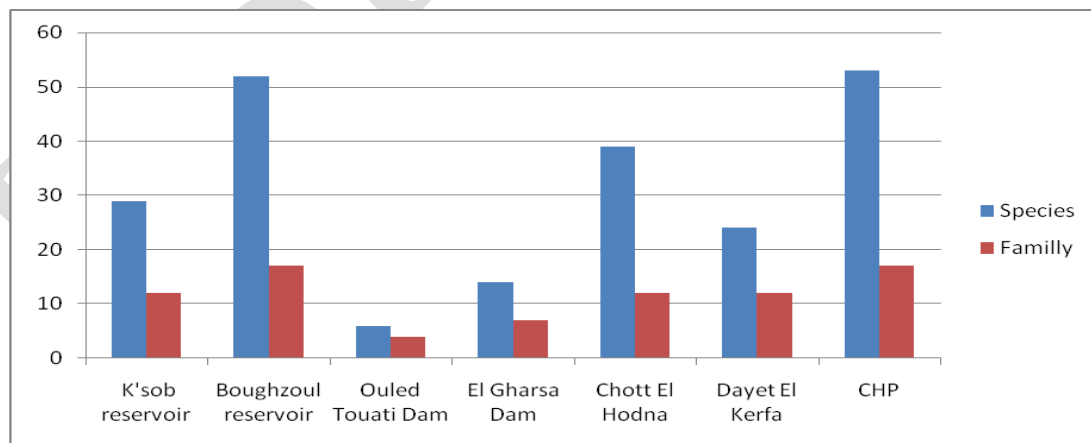


Figure 2: Distribution of families and species in different wetlands

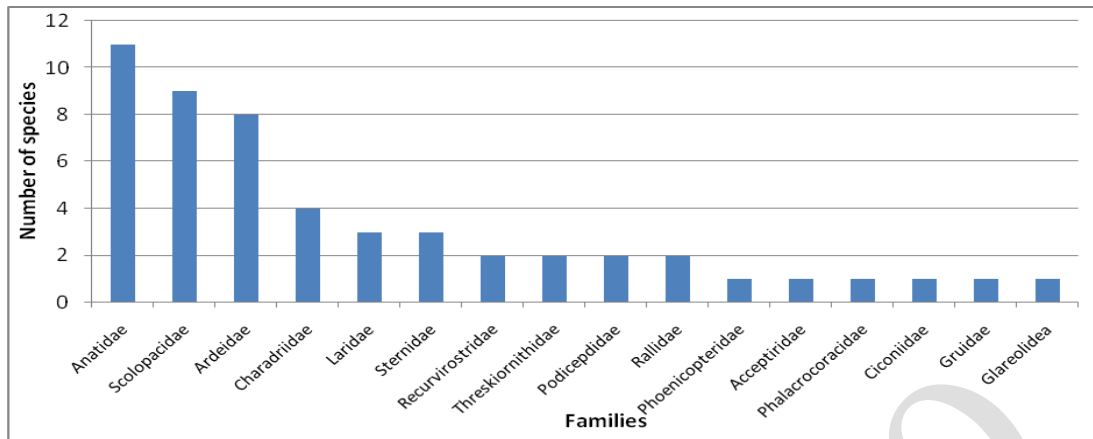


Figure 3: Species richness of different families in the study wetlands

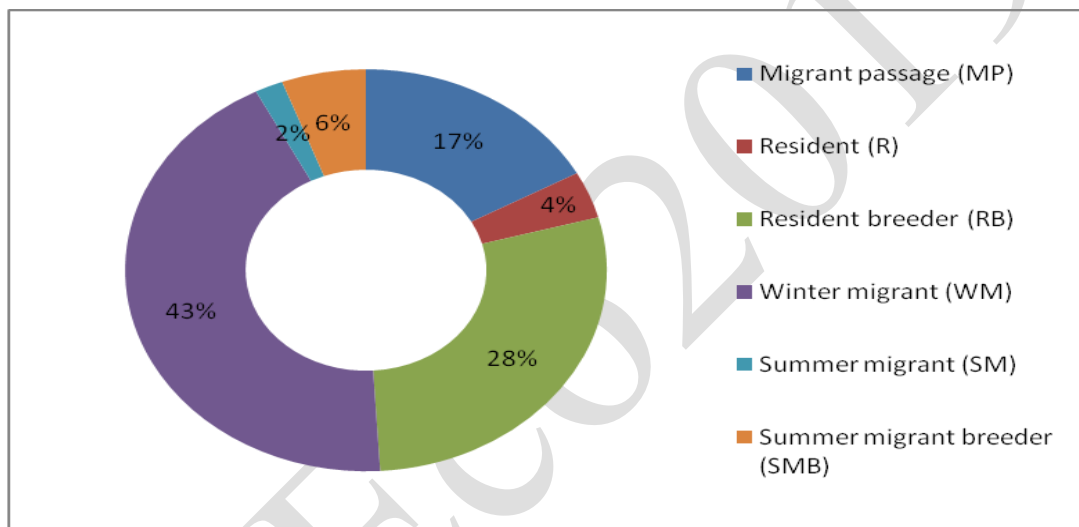


Figure 4. Distribution of waterbirds species following their phonological status in the in the study region

Table 1. Systematic list of bird species recorded in the study region with their ecological and protection status

Species (Scientific name)	Ph	FT	TC	PRS
<i>Anas platyrhynchos</i>	RB	H	Pp	LC,N2,E3,A
<i>Anas clypeata</i>	WM	H	Pp	LC,T3,N2,E3,A
<i>Anas acuta</i>	WM	P	Pp	LC,T3,N2,E3,A
<i>Anas crecca</i>	WM	H	G	LC,T3,N2,E3,A
<i>Anas penelope</i>	WM	P	Pp	LC,T3,N2,L2,E2,A
<i>Anas strepera</i>	WM	H	Pp	LC,N2,E3,A
<i>Marmaronetta augurostris</i>	RB	S	Pp	VU,N1,D,E2,A
<i>Aythya nyroca</i>	WM	TM	Pp	NT,T3,N1,E3,A
<i>Aythya ferina</i>	MP	P	Pp	LC,N2,E3,A
<i>Tadorna furruginea</i>	RB	PX	Pp	LC,N2,D,E2,A
<i>Tadorna tadorna</i>	RB	S	Pp	LC,N2,D,E2,A
<i>Adrea cenerea</i>	WM	P	P	LC,W,A,R3
<i>Bubulcus ibis</i>	RB	IA	Inv	LC,T3,E2,A
<i>Egretta garzetta</i>	WM	OW	Inv	LC,T3,E2,A
<i>Ardea alba</i>	WM	COS	P	LC, D, R2, A
<i>Nycticorax nycticorax</i>	WM	P	Pp	LC,W,A,R2
<i>Ardeola ralloides</i>	WM	P	Pp	LC,W,A,R2



<i>Ardea purpurea</i>	MP	P	Pp	LC,W,A,R2
<i>Tringa nebularia</i>	WM	SB	Inv	LC,N2,E3,A
<i>Tringa erythropus</i>	WM	SB	Inv	LC,N2,R3,W
<i>Calidris minuta</i>	WM	ARC	Inv	LC,N2,E2,A
<i>Gallinago gallinago</i>	WM	H	Inv	LC,N2,E3,A
<i>Calidris alpina</i>	SM	ARC	Inv	LC,N2,E2,A
<i>Tringa totanus</i>	WM	P	Pp	LC,N2,E3,A
<i>Tringa stagnatilis</i>	MP	P	Inv	LC, N2, R3, W
<i>Actitis hypoleucos</i>	MP	P	Pp	LC, N2, R2, W
<i>Limosa limosa</i>	WM	ETH	Inv	NT, N2, R3, W
<i>Numenius arquata</i>	MP	P	Pp	NT,N2,W,R3
<i>Charadrius dubius</i>	WM	P	Inv	LC,N2,E2,A
<i>Charadrius alexandrinus</i>	RB	C	Inv	LC,N2,E2,A
<i>Charadrius hiaticula</i>	MP	ARC	Inv	LC,N2,E2,A
<i>Vanellus vanellus</i>	MP	P	Inv	LC,N2,E3,A
<i>Gallinula chloropus</i>	RB	P	Pp	LC,W,R3
<i>Fulica atra</i>	RB	P	Pp	LC,E3,A
<i>Plegadis falcinellus</i>	WM	AM	Inv	LC,N2,W,A,R2
<i>Platalea leucorodia</i>	WM	OW	Inv	D, LC,C2,N2,W,A,R2
<i>Podiceps cristatus</i>	RB	OW	Inv	LC,W,A,R3
<i>Tachybaptus ruficollis</i>	RB	AM	P	LC, R3, W
<i>Himantopus himantopus</i>	RB	C	Inv	LC,N2,D,E2,A
<i>Recurvirostra avestina</i>	RB	TM	Inv	LC,N2,D,E2,A
<i>Ciconia ciconia</i>	SMB	P	Inv	LC,N2,D,E2,A
<i>Phalacrocorax carbo</i>	WM	OW	Pp	D, LC,W,A,R3
<i>Phoenicopterus roseus</i>	R	M	Pp	LC,T2,N2,L2,D,E2,A
<i>Larus ridibundus</i>	RB	P	Pp	LC,E3,A
<i>Larus genei</i>	RB	S	Pp	LC,N2,E2,A
<i>Larus cachinnans</i>	WM	(-)	Pp	LC,E3,A
<i>Sterna nilotica</i>	RB	C	Pp	LC,E3
<i>Chlidonias hybrida</i>	MP	AM	Inv	LC, D, R2, W
<i>Chlidonias niger</i>	MP	H	Inv	LC,W,R2
<i>Circus aeruginosus</i>	R	P	C	LC, N2, D, R3
<i>Grus grus</i>	WM	P	Pp	LC,T2,N2,D,E2,A
<i>Glareola pratincola</i>	SMB	IA	Inv	LC,N2,E2,A

Discussion

Steppe region wetlands of Algeria by this exceptional biodiversity remain unexplored until now. During the study period through four years, around 52 waterbirds species representing 16 families were recorded in the whole complex. Inventoried species in this wetland complex represent a considerable number of waterbirds, 52 from 99 waterbirds species were identified in Algeria (Samraoui et al. 2011), and represents 12.8 % of all Algerian birds (406 species cited by Isenmann & Moali, 2000).

These species represent different phenologic status: 22 winter migrant species (43%), 15 resident breeder species (28%), 9 migrant passage species (17%), and three (6%) summer migrant breeder species. However, some species have two different statuses, may be due to the existence of two distinct populations that use the site.

The family of Anatidae is the most represented in terms of richness and numbers by ten species. Other families are poorly represented, except those of Scolopacidae and Charadriidae with 09, 08 and 04 species respectively.

For some breeding species, their breeding was confirmed as Ruddy Shelduck *Tadorna ferruginea* in the most of wetlands. This species was previously observed in winter by Jacob & Jacob (1980) at neighbor site (Lake of Boughzoul) with a small number.

Among all recorded species, 36 species are protected under Algerian law pursuant to Decree No. 83-509 of August 20, 1983, and the Order of January 15, 1995 completing the list of non-domestic protected animal species. Marbled Teal *Marmaronetta angustirostris* species of greatest conservation listed as Endangered Species in the category (VU) of Red List by the International Union for Conservation of



Nature (BirdLife International 2004). The latter species is present with a relatively high number in three breeding sites (Chott El Hodna, Dayet El Kerfa and Boughzoul reservoir), could explain the favorable conditions for breeding, particularly the security. This species has been cited only in Chott El-Hodna (Gurgueb et al. 2014) as breeder, in Boughzoul reservoir and Dayet El Kerfa as summer migrant non-breeder.

The distribution pattern of waterbird species via families has differed between sites, these variations explained by the combination of the variability of offered habitats in this wetland complex and ecological requirements of assessed species. While, Anatidae, Podicipedidae, Ardeidae, and Laridae are very represented in depth and freshwater wetlands. Whereas, Rallidae, Recurvirostridae, Charadriidae, and Scolopacidae are most abundant in the salt marsh and large wetlands.

At the end of this study, the steppe region wetlands seem to play a great role in the wintering and breeding of waterfowl and also serve as a stopover site for migrant species during their trans-Saharan migration journeys.

Widely recognized and due to the presence of the near threatened (the site regularly holds a species of global conservation concern: the Marbled Teal *Marmaronetta angustirostris*). The waterbirds assessment in these wetlands indicates the regional importance of this part of the country and also supports their classification as Ramsar sites and Important Bird Area "IBA" because of the importance, richness, and abundance of avian species it shelters and hosts (BirdLife International, 2004). Throughout our surveys, some waterbirds of these wetlands are vulnerable to many threats (human disturbance, pollution, habitats fragmentation), especially those near to cities and had a socio-economic role such as K'sob reservoir and Boughzoul reservoir. However, this internationally important wetland presents a priority for conservation action which needs urgent intervention by local authorities to settle a management plan. These initiatives, if instituted, should provide effective protection to the waterbirds of steppe region wetlands.

Acknowledgements

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References

- AEWA (2008) Report on the conservation status of migratory waterbirds in the agreement area, 4th edn. 15–19 September 2008, Antananarivo, Madagascar.
- Baillie, J.E.M., Hilton-Taylor, C., Stuart, S.N. (2004). IUCN Red List of Threatened Species. *A Global Species Assessment*. IUCN, Gland, Switzerland and Cambridge, UK,
- Bensaci, E., Boutera, N., Cherief, A., Saheb, M., Moali, A., & Houhamdi, M. (2014): Breeding ecology studies of Collared Pratincoles (*Glareola pratincolain*) the Central Hauts Plateaux of Algeria. *Wader Study Group Bull* 121(1): 43-48.
- BirdLife International. 2004. *Threatened Birds of the World 2004*. CD-ROM. Cambridge, UK.
- Bibby, C.J., Burgess, N.D. & Hill, D.A. (1992). Bird census techniques. Academic Press, London.
- CITES (1994) CITES identification guide – birds: guide to the identification of bird species controlled under the Convention on International Trade in Endangered Species of Wild Fauna and Flora. A project of the Canadian Wildlife Service of Environment Canada and Baie-Comeau College
- Coulthard, N. D. 2001. Algeria. In Fishpool, L. D. C. & Evans, M. I. (eds.) *Important Bird Areas in Africa and Associated Islands: Priority Sites for Conservation*. Newbury: Pisces Publications & Cambridge, UK: BirdLife International.
- Guergueb, E., Bensaci, E., Nouidjem, Y., Zoubiri, A., Kerfouf, A., & Houhamdi, M. (2014). Aperçu sur la diversité des oiseaux d'eau du Chott El-Hodna (Algérie). *Bull. Soc. zool. Fr.*, 139(1-4) : 233-244.
- Heim de Balsac, H. & Mayaud, N. (1962). *Les oiseaux du nord ouest de l'Afrique: distribution géographique, écologie, migration, reproduction*. Le Chevalier, Paris.
- Isenmann, P. & Moali, A. (2000). *Oiseaux d'Algérie / Birds of Algeria*. Paris : Société d'Etudes Ornithologiques de France.
- Jacob, J. P. & Jacob, A. (1980). Nouvelles données sur l'avifaune du lac de Boughzoul (Algérie). *Aves*, 16: 59-82.



- Lancelotti Julio L., Luciana M. Pozzi, Federico Márquez, Pablo Yorio, Miguel, Y. & Pascual.A, Waterbird occurrence and abundance in the Strobel Lake Plateau, *Patagonia, Argentina*. *Enviado "El ornero"*. 24(1):13–20.
- Ledant, J. P., Jacob, J. P., Jacob, P., Malher, F., Ochando, B. & Roche, J. (1981). Mise à jour de l'avifaune Algérienne. *Le Gerfaut* 71 ; 295 – 398.
- OJAR (1995). by law of January 17th 1995 complementary of decree N° 83-509 related to non-domestic animal species protected in Algeria. *Official Journal of Algerian Republic*, January 17, 1995.
- Samraoui, B. & Samraoui, F. (2008) An ornithological survey of Algerian wetlands: Important Bird Areas, Ramsar sites and threatened species. *Waterfowl*, 58, 71–98.
- Samraoui, F., Alfarhan, A.H., Al-Rasheid, K.A.S. & Samraoui, B. (2011) An appraisal of the status and distribution of waterbirds of Algeria: indicators of global changes? *Ardeola*, 58, 137–163.
- Steavenson, A.C., Skinner, J., Hollis, G.F. & Smart, M. (1988). El Kala national park and environs, Algeria. An ecological evaluation. *Environmental conservation* 15: 335-348.
- Voous, K.H. (1960) Atlas of European birds. *Nelson*, London (Müller, 1997):
- Weller, M.W. (1999) Wetland birds, habitat resources and conservation implications. *Cambridge University Press*, London



Furan induces cytotoxicity, oxidative stress and apoptosis in Leydig cells

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Abstract

In recent years, heat-induced food contaminants began to be investigated. As a result of the studies, furan has been found significant levels in commonly consumed foods such as baked or fried cereal products, coffee, canned food, jarred foods and baby foods. Researches have shown that furan has carcinogenic effects on experimental animals and humans. Although furan has toxic effects on the reproductive system as well as carcinogenic effects, these data are inadequate to understand the pathogenesis of furan's toxicity. Therefore, the evaluation of the risk and toxicity of the furan on the reproductive system is great importance. Leydig cells are the main cells responsible for the biosynthesis of testosterone in the male reproductive system. In a damage to the reproductive system of a toxic component, the examination of the response in Leydig cells is extremely critical. In this study, different concentrations of furan were applied to TM3 mouse Leydig cell line for 24 hours. With the obtained results, the IC₂₅, IC₅₀, IC₇₅ concentrations of the furan were calculated. Lactate dehydrogenase (LDH), malondialdehyde (MDA), hydrogen peroxide (H₂O₂), hydroxyl radical (OH•) were analyzed by spectrophotometric method, apoptosis/necrosis levels were investigated by fluorescence method and the effects of furan on cytotoxicity, oxidative stress and apoptosis were determined. According to the findings obtained, it was concluded that furan induces apoptosis by stimulating cytotoxicity and oxidative stress in Leydig cells at the applied concentrations.

Keywords: Leydig cells, furan, apoptosis, oxidative stress.



Isolation and 16S rRNA sequence analysis of six environmental haloversatile bacteria from Çamaltı Saltern

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Abstract

Diversity of microbial populations in Çamaltı Saltern inhabiting unique saline environment is useful as it offers important clue of the microorganisms and their adaptation to these habitats. The aim of this study was to identify six haloversatile bacteria isolated from a raw salt sample collected from Çamaltı Saltern using 16S rRNA gene sequences. In the present study, the environmental isolates were belong to species *Arthrobacter ginsengisoli* (two isolates), *Arthrobacter psychrochitiniphilus* (one isolate), *Pseudarthrobacter polychromogenes* (one isolate), *Glutamicibacter arilaitensis* (one isolate) and *Arthrobacter agilis* (one isolate). All isolates showed Gram-positive and haloversatile properties. Haloversatile bacteria may have considerable potential for industrial and agricultural applications due to their important metabolic products and their tolerance towards extreme pH, temperature, salt concentrations.

Keywords: Haloversatile bacteria, Diversity, Çamaltı Saltern, Hypersaline environment, Turkey

Introduction

Çamaltı Saltern is the largest seawater-based saltern in Izmir/Turkey (Koru, 2004; Tıraş, 2007). The salt produced in this saltern is used in leather and food industries to prevent bacterial growth (Koru, 2004; Tıraş, 2007). It is known that salt production from sea has been done since 1863 in this saltern. Seawater is pumped at certain times to Çamaltı Saltern, which is connected to the sea (Koru, 2004; Tıraş, 2007). While the seawater salinity is about 0.35%, the salinity is reached to 26.5% after holding in the pools.

The microbial diversity in Çamaltı Saltern has attracted the attention of scientists. The researchers reported the presence of halophilic microorganisms in Çamaltı Saltern (Yaşa et al., 2008; Mutlu and Guven, 2009; Guven et al., 2010; Mutlu and Guven, 2011; Poli et al., 2012; Erdogmus et al., 2013; Mutlu and Guven, 2015). *Haloferax* and *Halobacterium* species were isolated from Çamaltı Saltern and identified by molecular and conventional methods (Yaşa et al., 2008). Mutlu and Guven (2009) isolated eleven halophilic bacteria from pans of Çamaltı Saltern. According to 16S rRNA sequence analysis, the isolates were characterized as *Halobacillus*, *Pontibacillus* and *Halomonas* (Mutlu and Guven, 2009). Güven and her colleagues (2010) isolated microorganisms from the water samples in Çamaltı Saltern. Researchers have isolated twelve bacterial and archaeal species which can produce DNase, protease, cellulase and lipase enzymes (Güven et al., 2010). They have also reported that salt obtained from Çamaltı Saltern, which is used in the leather and food industries, may be harmful due to the presence of halophilic microorganisms producing enzymes in the salt (Güven et al., 2010). The microbial community in Çamaltı Saltern was investigated by Mutlu and Guven (2011) using FISH and Real Time PCR. It was stated by the researchers that the cells (approximately 10^7 cell/mL) belonged to *Bacteria* and *Archaea* domains found in Çamaltı Saltern samples (Mutlu and Guven, 2011). A new moderately halophilic bacterium *Halomonas smyrnensis* was isolated from soil sample in Çamaltı Saltern and identified by Poli and her colleagues (2012). That isolate was able to produce exopolysaccharide and optimally grow at 10% NaCl (Poli et al., 2012). Aromatic hydrocarbon degrading archaeal genera (*Haloferax* sp., *Haloarcula* sp., *Halobacterium* sp., *Haloarcula* sp.) were isolated from Çamaltı Saltern (Erdogmus et al., 2013). In the study of Mutlu and Güven (2015), the bacteria found in saline water samples collected from Çamaltı Saltern were investigated



by molecular methods. They obtained 42 isolates from the saline water samples and that 17 of these isolates belonged to the *Bacteria* domain (Mutlu and Güven, 2015). Those isolates belonging to the *Bacteria* domain were phylogenetically related to *Halobacillus*, *Virgibacillus*, *Halomonas* genera (Mutlu and Güven, 2015).

The presence of haloversatile bacteria in Çamaltı Saltern was reported by Caglayan (2019). In that study, forty species such as *Bacillus subtilis* subsp. *stercoris*, *Kocuria sediminis*, *Paracoccus marcusii*, *Kocuria polaris*, *Micrococcus aloeverae*, *Bacillus haynesii*, *Microbacterium maritropicum*, *Brevibacterium frigoritolerans*, *Paracoccus hibiscisoli*, *Bacillus velezensis*, *Bacillus pumilus*, *Bacillus safensis*, *Staphylococcus petrasii* subsp. *jettensis*, *Staphylococcus hominis* subsp. *novobiosepticus*, *Staphylococcus lentus*, *Bacillus thioparans*, *Staphylococcus epidermidis*, *Acinetobacter radioresistens*, *Exiguobacterium sibiricum*, *Gordonia alkanivorans*, *Microbacterium aurantiacum*, *Staphylococcus pasteurii*, *Bacillus paraflexus*, *Microbacterium saccharophilum*, *Kocuria rosea*, *Staphylococcus saprophyticus* subsp. *saprophyticus*, *Micrococcus yunnanensis*, *Pseudomonas songnenensis*, *Bacillus nealsonii*, *Staphylococcus equorum* subsp. *equorum*, *Agrococcus lahaulensis*, *Sanguibacter inulinus*, *Virgibacillus salarii*, *Staphylococcus cohnii* subsp. *urealyticus*, *Bacillus altitudinis*, *Exiguobacterium artemiae*, *Bacillus siamensis*, *Exiguobacterium indicum*, *Bacillus oryzaecorticis*, *Staphylococcus warneri* were isolated and identified from twenty salt samples collected from Çamaltı Saltern (Caglayan, 2019).

Haloversatile bacteria are able to grow over a wide range of salt concentrations, but also with growth rate in the absence of salt. These microorganisms are unique in their ability to live without salt and with salt and play an important role in the global biological and biogeochemical cycles of carbon and nitrogen. Hence, this study aimed to identify haloversatile bacterial species isolated from a raw salt sample collected from Çamaltı Saltern.

Material and Methods

In this research, for isolation haloversatile bacteria, a raw salt sample was collected from Çamaltı Saltern in Izmir (Turkey) during June (Figure 1). The sample was brought to the laboratory in sterile bag. Salt solution for isolation haloversatile bacteria was prepared by adding 10 g of salt sample to 90 ml of sterile distilled water containing 0.2 M NaCl. The solution was shaken on a mechanical rotary shaker for 4 h at 25°C (100 rpm). The solution was diluted up to 10⁻⁴ dilutions in sterile distilled water containing 0.2 M NaCl and plated on Oligotrophic Medium (18.2 g R2A, 11.7 g NaCl, 1000 ml distilled water). Three plates per dilution were incubated for 24 h at 32°C (Caglayan, 2019). The bacterial colonies with different morphology and pigmentation were cross-streaked several times to obtain pure cultures. The purity and cell morphology of the colonies were examined after Gram staining. All isolates were characterized by 16S rRNA gene sequence analyses. Chromosomal DNA of pure bacterial isolates were isolated and purified using QIAamp DNA Mini Kit (Qiagen) and QIAquick PCR Purification Kit (Qiagen). Two universal PCR primer pairs [1492R (5'TACGGYTACCTTGTTACGACTT3') and 27F (5'AGAGTTTGTATCMTGGCTCAG3')] were used for amplification process (Caglayan, 2019). The sequences of the PCR amplified 16S ribosomal RNA genes were determined by IONTEK Laboratory in Istanbul/Turkey. Sequencing results were analyzed using ChromasPro Software (ChromasPro 2.1, Technelysium Pty Ltd, Australia) and EzTaxon-e tool (Kim et al., 2012).

Growth of haloversatile bacterial isolates at different salt concentrations (0 M, 0.17 M, 0.2 M, 0.34 M, 0.51 M, 0.85 M, 1.36 M, 1.7 M, 2 M, 2.5 M, 3 M, 3.4 M, 4.2 M, 5.1 M), different pH values (4, 5, 6, 7, 8, 9, 10, 11, 12, 13) and different temperatures (4°C, 10°C, 20°C, 25°C, 28°C, 32°C, 37°C, 40°C, 45°C, 50°C, 55°C, 60°C) were examined on Oligotrophic Medium. Catalase activity was determined by adding H₂O₂ (3%) on the bacterial colonies. The rapid appearance of bubbles indicated positive catalase activity. Oxidase activity was tested by picking bacterial colony with a loop and smearing in the filter paper dropped with oxidase reagent. Color change from pink to dark purple in a few seconds showed positive oxidase activity (Sánchez-Porro et al., 2011).

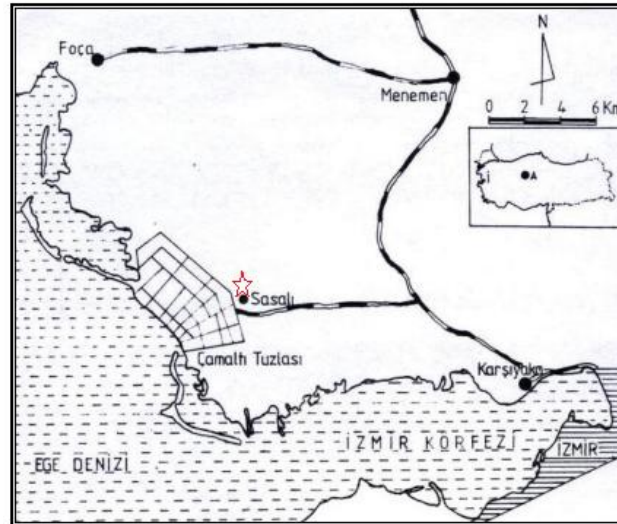


Figure 1. Sampling area (Tıraş, 2007).

Results

The bacterial isolates were assigned to three genera (*Arthrobacter*, *Pseudarthrobacter*, *Glutamicibacter*) based on the 16S rRNA gene sequence similarities. The isolate codes (9ahb, 11fhb, 11ghb, 12chb, 13chb, 17fhb), 16S rRNA sequence similarities (98-100%), closest relative species names (*Arthrobacter ginsengisoli*, *Arthrobacter psychrochitiniphilus*, *Pseudarthrobacter polychromogenes*, *Glutamicibacter arilaitensis*, *Arthrobacter agilis*), sequence length (1155-1328 bp) and GenBank accession numbers (MH753602, MH753614, MH753615, MH753616, MH753622, MH753632) of the isolates were presented in Table 1.

Table 1. The isolate codes, similarity, closest relative species name, sequence length and GenBank accession number of the haloversatile isolates.

Isolate code	Similarity (%)	Closest relative species name	Sequence length (bp)	GenBank accession number
9ahb	99	<i>Arthrobacter ginsengisoli</i>	1296	MH753602
11fhb	99	<i>Arthrobacter psychrochitiniphilus</i>	1328	MH753614
11ghb	98	<i>Pseudarthrobacter polychromogenes</i>	1251	MH753615
12chb	100	<i>Arthrobacter ginsengisoli</i>	1155	MH753616
13chb	98.5	<i>Glutamicibacter arilaitensis</i>	1170	MH753622
17fhb	99.6	<i>Arthrobacter agilis</i>	1235	MH753632

All test isolates were able to grow at 0-3 M NaCl (optimally 0.2 M NaCl). Therefore, these isolates were accepted as haloversatile. Among the isolates, only *Glutamicibacter arilaitensis* was able to grow at 3.4 M NaCl concentration. *Arthrobacter ginsengisoli* and *Arthrobacter agilis* were able to grow at 20-45°C. *Arthrobacter psychrochitiniphilus*, *Pseudarthrobacter polychromogenes*, *Glutamicibacter arilaitensis* were respectively able to grow at 10-45°C, 20-50°C, 20-55°C. While none of the isolates grew at 4°C and 60°C, all isolates optimally grew at 32°C (Table 2). While *Arthrobacter ginsengisoli*, *Arthrobacter psychrochitiniphilus*, *Arthrobacter agilis* were able to grow at pH 6-8, *Pseudarthrobacter polychromogenes* and *Glutamicibacter arilaitensis* were able to grow at pH 6-9. None of the isolates grew at pH 4, 5, 10-13, and 4.2 M-5.1 M NaCl concentrations. All species were Gram-positive and rod-shaped (Table 2).

Table 2. Minimum, optimum and maximum growth ranges, Gram staining, cell shape, catalase and oxidase test results of the isolates



Species	Growth temperatures (°C)			Growth pH values			Growth NaCl (M)			Gram staining	Cell shape	Catalase	Oxidase
	min	opt	max	min	opt	max	min	opt	max				
<i>Arthrobacter ginsengisoli</i>	20	32	45	6	7	8	0	0.2	3	+	rod	+	-
<i>Arthrobacter psychrochitiniphilus</i>	10	32	45	6	7	8	0	0.2	3	+	rod	+	-
<i>Pseudarthrobacter polychromogenes</i>	20	32	50	6	7	9	0	0.2	3	+	rod	+	-
<i>Arthrobacter ginsengisoli</i>	20	32	45	6	7	8	0	0.2	3	+	rod	+	-
<i>Glutamicibacter arilaitensis</i>	20	32	55	6	7	9	0	0.2	3.4	+	rod	+	+
<i>Arthrobacter agilis</i>	20	32	45	6	7	8	0	0.2	3	+	rod	+	+

The haloversatile bacterial species reported in the present study, were also isolated from different places in previous investigations. In a previous study conducted by Siddiqi et al. (2014), *Arthrobacter ginsengisoli* strain DCY81 was isolated from soil collected from ginseng field in Pocheon (Korea). *Arthrobacter psychrochitiniphilus* strain GP3, psychrotrophic bacterium, was isolated from Adélie penguin guano in Antarctica (Wang et al., 2009). This strain was able to produce chitinase, lipase, amylase, cellulase and lactase enzymes. In addition, this strain was able to grow at the range of 0-25°C temperatures in the study of Wang et al. (2009). However, *Arthrobacter psychrochitiniphilus* strain 11f was able to grow between 10°C and 45°C in the present study (Table 2). *Pseudarthrobacter polychromogenes* was isolated by Schippers-Lammertse et al. (1963) as *Arthrobacter polychromogenes*, and this species was emended as *Pseudarthrobacter polychromogenes* by Busse (2016). *Glutamicibacter arilaitensis* strain ALA4 was reported as carboxymethyl cellulase (CMCase) producer strain by Aarti et al. (2018). The researchers investigated the application of CMCase produced by *Glutamicibacter arilaitensis* strain ALA4 in lignocellulosic waste biomass saccharification (Aarti et al., 2018). It was reported that low concentration of the volatile organic compound (dimethylhexadecylamine) produced by *Arthrobacter agilis* strain UMCV2 could inhibit the growths of *Botrytis cinerea* and *Phytophthora cinnamomi* (Velázquez-Becerra et al., 2013). These fungal *Botrytis cinerea* and oomycete *Phytophthora cinnamomi* species are known as plant pathogens adversely effecting agriculture worldwide (Velázquez-Becerra et al., 2013). *Arthrobacter* species is important due to their ability to reduce hexavalent chromium and to reduce agricultural pesticides (Megharaj et al., 2003). This genus also reported as plant growth promoting bacteria (Manzanera et al., 2015) and important enzyme producing bacteria (Kallimanis et al., 2011).

As a conclusion, haloversatile microorganisms are unique in their ability to live without salt and with salt and play an important role in the cycles of carbon and nitrogen. The metabolites produced by the haloversatile bacteria, which can be adapted to different salt concentrations, may have a potential in agricultural and industrial use.

Acknowledgements

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References

- Aarti, C., Khusro, A., & Agastian, P. (2018). Carboxymethyl cellulase production optimization from *Glutamicibacter arilaitensis* strain ALA4 and its application in lignocellulosic waste biomass saccharification. *Preparative Biochemistry and Biotechnology*, 48(9), 853-866.
- Busse, H.J. (2016). Review of the taxonomy of the genus *Arthrobacter*, emendation of the genus *Arthrobacter sensu lato*, proposal to reclassify selected species of the genus *Arthrobacter* in the novel genera *Glutamicibacter* gen. nov., *Paeniglutamicibacter* gen. nov., *Pseudoglutamicibacter* gen. nov., *Paenarthrobacter* gen. nov. and *Pseudarthrobacter* gen. nov., and emended description of *Arthrobacter roseus*. *International Journal of Systematic and Evolutionary Microbiology*, 66, 9-37.
- Caglayan, P. (2019). Enzymatic Reactions and Phylogenetic Analysis of Haloversatile Bacteria Isolated from Çamaltı Saltern Salt Samples used in Leather Industry. *The Journal of the American Leather Chemists Association*, December 2019, in press.



- Erdogmus, S.F., Mutlu, M.B., Korcan, S.E., Guven, K., & Konuk, M. (2013). Aromatic Hydrocarbon Degradation by Halophilic Archaea Isolated from Camalti Saltern, Turkey. *Water Air and Soil Pollution*, 224, 1449.
- Güven, K., Demirci, A., Mutlu, M. B., & Korcan, S. E. (2010). Phenotypic characterization of halophilic bacteria isolated from Çamaltı Saltern in Turkey. *Electronic Journal of Biotechnology*, 1, 1-21.
- Kim, O.S., Cho, Y.J., Lee, K., Yoon, S.H., Kim, M., Na, H., Park, S.C., Jeon, Y.S., Lee, J.H., Yi, H., Won, S., & Chun, J. (2012). Introducing EzTaxon: a Prokaryotic 16S rRNA Gene Sequence Database with Phylotypes that Represent Uncultured Species. *International Journal of Systematic and Evolutionary Microbiology*, 62, 716-721.
- Kiran, S., Swarnkar, M.K., Pal, M., Thakur, R., Tewari, R., Singh, A.K., & Gulati, A. (2015). Complete genome sequencing of protease-producing novel *Arthrobacter* sp. strain IHBB 11108 using PacBio single-molecule real-time sequencing technology. *Genome Announcements*, 3(2), e00346-15.
- Koru, E. (2004). The potential of Artemia population in Çamaltı Saltworks (Sasalı-İzmir) at aquaculture. *Ege Journal of Fisheries and Aquatic Sciences*, 21, 187-189.
- Manzanera, M., Narváez-Reinaldo, J.J., García-Fontana, C., Vilchez, J.I., & González-López, J. (2015). Genome sequence of *Arthrobacter koreensis* 5J12A, a plant growth-promoting and desiccation-tolerant strain. *Genome Announcements*, 3(3), e00648-15.
- Megharaj, M., Avudainayagam, S., & Naidu, R. (2003). Toxicity of hexavalent chromium and its reduction by bacteria isolated from soil contaminated with tannery waste. *Current Microbiology*, 47(1), 51-54.
- Mutlu, M. B., & Güven, K. (2009). Isolation and Characterization of Halophilic Bacteria from Çamaltı Saltern Turkey. *New Biotechnology*, volume 25S, page S81.
- Mutlu, M.B., & Güven, K. (2011). Detection of prokaryotic microbial communities of Çamaltı Saltern-Turkey by Fluorescein *In Situ* Hybridization (FISH) and Real Time PCR. *Turkish Journal of Biology*, 35, 687-695.
- Mutlu, M. B., & Güven, K. (2015). Bacterial diversity in Çamaltı Saltern, Turkey. *Polish Journal of Microbiology*, 64, 37-45.
- Poli, A., Nicolaus, B., Denizci, A.A., Yavuzturk, B., & Kazan, D., (2012). *Halomonas smyrnensis* sp. nov., a moderately halophilic, exopolysaccharide-producing bacterium from Camalti Saltern Area, Turkey. *International Journal of Systematic and Evolutionary Microbiology*, 63, 10-18.
- Sánchez-Porro, C., Yilmaz, P., De La Haba, R.R., Birbir, M., & Ventosa, A. (2011). *Thalassobacillus pellis* sp. nov., a moderately halophilic, Gram-positive bacterium isolated from salted hides. *International Journal of Systematic and Evolutionary Microbiology*, 5, 1206-1210.
- Siddiqi, M.Z., Kim, Y.J., Hoang, V.A., Siddiqi, M.H., Huq, M.A., & Yang, D.C. (2014). *Arthrobacter ginsengisoli* sp. nov., isolated from soil of a ginseng field. *Archives of Microbiology*, 196(12), 863-870.
- Schippers-Lammertse, A.F., Muijsers, A.O. & Klatser-Oedekerck, K.B. (1963). *Arthrobacter polychromogenes* nov.spec., its pigments, and a bacteriophage of this species. *Antonie van Leeuwenhoek*, 29(1), 1-15.
- Tıraş, M. (2007). Çamaltı Saltworks. *Eastern Geographical Review*, 18, 291-300.
- Velázquez-Becerra, C., Macías-Rodríguez, L.I., López-Bucio, J., Flores-Cortez, I., Santoyo, G., Hernández-Soberano, C., & Valencia-Cantero, E. (2013). The rhizobacterium *Arthrobacter agilis* produces dimethylhexadecylamine, a compound that inhibits growth of phytopathogenic fungi in vitro. *Protoplasma*, 250(6), 1251-1262.
- Yaşa, I., Kahraman, O., Tekin, E., & Kocyigit, A. (2008). Isolation and molecular identification of extreme halophilic archaea from Çamaltı Saltern. *Ege Journal of Fisheries and Aquatic Sciences*, 25, 117-121.
- Wang, F., Gai, Y., Chen, M., & Xiao, X. (2009). *Arthrobacter psychrochitiniphilus* sp. nov., a psychrotrophic bacterium isolated from Antarctica. *International Journal of Systematic and Evolutionary Microbiology*, 59(11), 2759-2762.



A new application of the Micronucleus Test on Zooplankton: from lab to field

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Abstract

It is now recommended to use more sensitive parameters than mortality, growth or reproduction to highlight the toxicity of a product, effluent or environmental matrix. Genotoxic disorders are the expression of alterations, sometimes irreversible, at the molecular level and constitute early alarms with regard to the subsequent impairments that they can lead to during key stages of the life cycle.

In this study, we applied a genotoxicity test, commonly used in medicine on human erythrocytes, which can detect chromosomal breaks and aneugenic agents: the micronucleus test (MN) to aquatic microcrustaceans. The MN test protocol was adapted and applied to the cladoceran *Daphnia magna* to evaluate its feasibility. The sensitivity of this test on *D. magna* was evaluated by exposing organisms to different concentrations of metals (Cu, Zn, Cd), deltamethrin and crude extracts of the toxic algae *Caulerpa taxifolia* for 4h, 48h and 7 days. The results are expressed in number of MN over 1000 cells observed. The results showed, for all the contaminants considered, a dose-time-dependent induction of MN with a maximum value of 11.5 %.

The MN test was then applied on freshwater cladocerans collected from different environments (dams, ponds, wadi) in Tunisia. MN occurrence in animals varied from one site to another and MN frequencies varied between 0.67 and 22%, suggesting the presence of genotoxic substances in certain sites.

The MN test applied to cladocerans proved to be easily feasible, sensitive and could be used to biomonitor the *in situ* genotoxicity in aquatic environments.

Keywords: Genotoxicity, Micronucleus Test, *Daphnia magna*, Zooplankton, Biomonitoring, Freshwater environments, Tunisia



Relationship of Otolith Size to Standard Length of the Prussian Carp *Carassius gibelio* (Bloch, 1782) in Tigris River, Şırnak, Turkey

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Abstract

The relationships between standard length (SL) and otolith length (OL), width (OWi) and weight (OWe) were examined for Prussian carp *Carassius gibelio* (Bloch, 1782) from Güçlükonak Location of Tigris River. In total, 169 specimens collected from every month using nets from January to December 2015. There were no significant differences between left and right otolith ($p>0.05$). Samples consisted of fish varying in standard length from 8 to 19 cm, otolith length from 1.096 to 2.312 mm and otolith weight from 0.003 to 0.0203 g. While the relationships between fish length and otolith length had the highest coefficient of determination ($R^2=0.821$) and the relationships between fish length and otolith weight had the lowest coefficient of determination ($R^2=0.647$). This research provide a reliable tool in feeding studies and prey identification.

Keywords: Otolith, Prussian carp, *Carassius gibelio*, TigrisRiver, Şırnak



Relationship of Otolith Size to Standard Length of the *Capoeta trutta* (Heckel, 1843) in Tigris River, Şırnak, Turkey

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Abstract

The relationships between standard length (SL) and otolith length (OL), width (OWi) and weight (OWe) were examined for *Capoeta trutta* (Heckel, 1843) from Güçlükonak Location of Tigris River. In total, 367 specimens collected from every month using nets from January to December 2015. There were no significant differences between left and right otolith ($p>0.05$). Samples consisted of fish varying in standard length from 9.3 to 29.0 cm, otolith length from 1.88 to 5.02 mm and otolith weight from 0.0011 to 0.0118 g. While the relationships between fish length and otolith height had the highest coefficient of determination ($R^2=0.826$) and the relationships between fish length and otolith weight had the lowest coefficient of determination ($R^2= 0.747$). This research provide a reliable tool in feeding studies and prey identification.

Keywords: Otolith, *Capoeta trutta*, Tigris River, Şırnak

Introduction

Capoeta trutta belongs to the Cyprinidae family has a wide distribution both in the Euphrates and Tigris basins and in the lakes in Mesopotamia (Ozdemir and Kabukcu, 1983; Polat, 1987; Unlu, 1991). They are of economic importance as they are preferred by people as food sources.

Otoliths differ from species to species in size and shape. Therefore, it is used systematically and age determination (Geldiay and Balık, 2007). The relationship between otolith length and fish length can be used to estimate fish size from fossil and gastric contents and to verify fish length by determining age from otolith (Echeverria, 1987). In fish, bony structures and fish length are related. Otoliths, length, weight, depending on the various measurements such as the relationship between the length of the fish to determine the growth rate is quite common recently (Samsun and Samsun 2006).

There are studies on the metric and meristic features, population structure, age determination, growth and reproductive characteristics of *C. trutta* (Ozdemir and Kabukcu, 1983; Polat, 1987; Unlu, 1991; Şevik, 1993; Gül et al., 1996; Yapalak et al. 1997; Kalkan, 2008; Oymak et al., 2008; Eroğlu and Şen 2017). Studies on the relationship between fish length and otolith length of *C. trutta* (Doğan and Şen, 2017; Düşükcan, 2018) were given by some researchers.

In this study, it was aimed to calculate the relationship between *C. trutta*'s length and weight and fish length; otolith height, fish height otolith height, fish length otolith weight, fish age otolith length, fish age otolith height and fish age otolith weight were evaluated by fish vote.

Materials and Methods

The fish samples were collected monthly using nets between January and December 2015 in Tigris River, Şırnak. The fish were measured for standard length (SL) to the nearest 1 mm and weighed to the nearest 0.01 g for. Sagittal otoliths were removed, cleaned and preserved dry in labeled boxes. Otolith length and otolith width were measured to the nearest 1 µm using (Olympus SZ61TR+Olympus LC20). Otolith weights were measured to the nearest 0.0001 g. The right and left otoliths were dealt with separately. Broken and damaged otoliths were excluded from the calculations.



Differences between the lengths of the right and left otoliths for each species were tested using paired t-test. The relationships between otolith length and fish length were calculated using least squares regression equations to predict the standard length and weight of the original fish from otolith length. The otolith dimensions-standard length relationships were examined by using the following equation: ($y=a+b*x$), where y is otolith length, x is fish standard length, a is intercept value, b is coefficient value (Basusta et al., 2013).

Results

Otolith size and fish standard length regressions were performed using data from 367 specimens of *C. trutta*. There were no significant differences between right and left otoliths ($p>0.05$). For each specimens, minimum and maximum lengths and mean values of fish standard length, fish total weight, otolith length, otolith height and otolith weight are summarized (Table 1).

Table 1. Parameter of *C. trutta* and otoliths

Parameter	Female Range (Mean±SE)	Male Range (Mean±SE)	All Range (Mean±SE)
Fish standard length (cm)	9.3-29.0 (17.78±0.23)	10.0-25.5 (17.29±0.27)	9.3-29.0 (17.58±0.17)
Fish total weight (g)	13.54-360.83 (95.93±4.06)	15.3-235.84 (87.88±4.24)	13.54-360.83 (92.57±2.96)
Otolith length (mm)	1.88-5.02 (3.17±0.033)	2.00-4.46 (3.11±0.039)	1.88-5.02 (3.15±0.026)
Otolith height (mm)	1.58-4.02 (2.47±0.024)	1.55-3.71 (2.45±0.030)	1.55-4.02 (2.46±0.019)
Otolith weight (g)	0.0011-0.0118 (0.0041±0.0001)	0.0015-0.0089 (0.0040±0.0001)	0.0011-0.0118 (0.0040±0.0008)

The relationship between fish standard length and otolith length was as $y=0.1338x+0.7966$ (Fig 1), between fish standard length and otolith height was as $y=0.0987x+0.7275$ (Fig 2), fish standard length and otolith weight was as $y=0.0004x-0.0029$ (Fig 3).

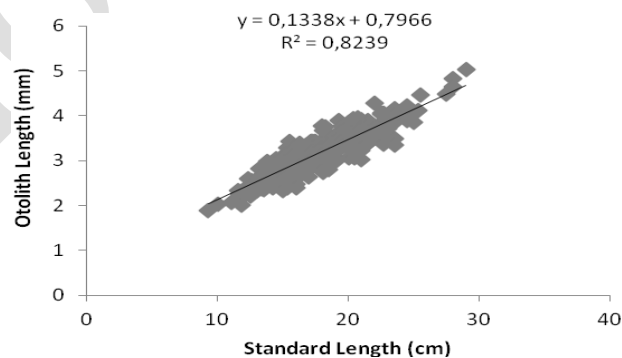


Figure 1. Standard length-otolith length relationship of all specimens *C. trutta*

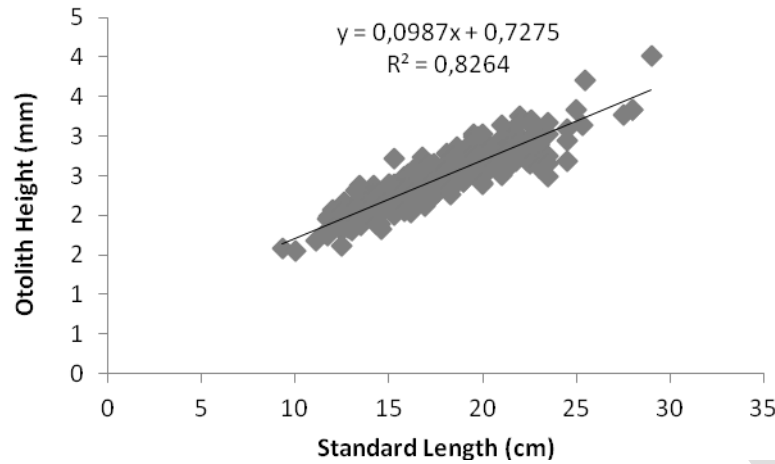


Figure 2. Standard length-otolith height relationship of all specimens *C. trutta*

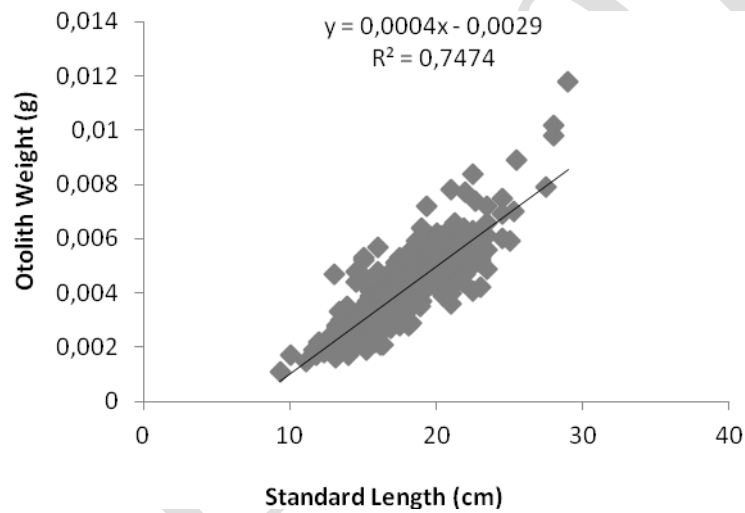


Figure 3. Standard length-otolith weight relationship of all specimens *C. trutta*

The relationship between fish standard length (SL) and otolith length (OL), fish standard length (SL) and otolith height (OH), fish standard length (SL) and otolith weight (OW), fish total weight (W) and otolith weight (OW) are summarized (Table 2).

Table 2. Relations between otolith measurement and fish size of *C. trutta*

	Relation	a		b		R ²
		mean	SE	mean	SE	
Female	SL-OL	0.745	0.079	0.137	0.004	0.822
	SL-OH	0.732	0.054	0.098	0.003	0.837
	SL-OW	-0.0033	0.0003	0.0004	0.0002	0.763
	W-OW	0.0018	0.00096	0.00002	0.0000008	0.786
Male	SL-OL	0.864	0.086	0.130	0.0049	0.826
	SL-OH	0.711	0.069	0.1005	0.0039	0.816
	SL-OW	-0.0025	0.00033	0.0004	0.00018	0.731
	W-OW	0.0019	0.00012	0.00024	0.000012	0.736
All	SL-OL	0.797	0.0585	0.134	0.0033	0.824
	SL-OH	0.728	0.0428	0.099	0.0024	0.826
	SL-OW	-0.0029	0.00022	0.0004	0.00012	0.747



W-OW	0.0019	0.00008	0.00002	0.000007	0.765
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There was a positive and very strongly relation ship between fish length and otolith size, and fish weight and otolith weight. The coefficients of determination (R^2) of the males, females and all specimens ranged from 0.731 to 0.826, 0.763 to 0.837, 0.747 to 0.826, respectively (Table 2).

The relationship between fish age and otolith length was as $y=0.2661x+2.3777$ ($R^2=0.568$) (Fig 4), between fish age and otolith height was as $y=0.1998x+1.8834$ ($R^2=0.591$) (Fig 5), fish age and otolith weight was as $y=0.0009x+0.0015$ ($R^2=0.624$) (Fig6). A significant linear regression was showed between fish age and otolith size ($R^2>0.56$).

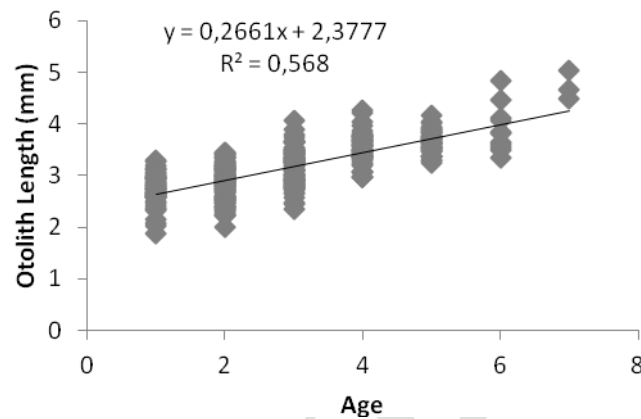


Figure 4. Age-otolith length relationship of all specimens *C. trutta*

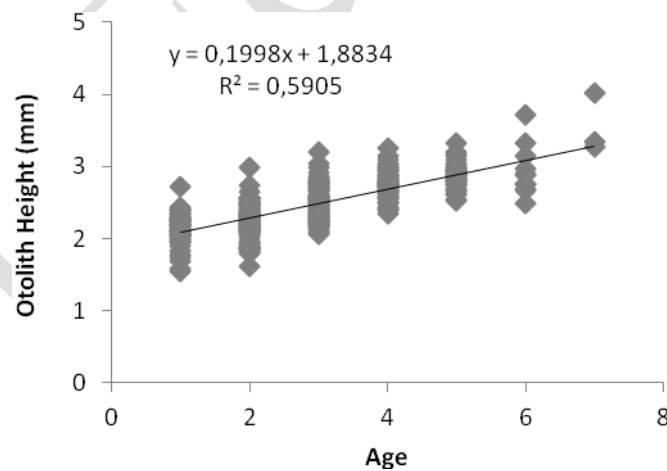


Figure 5. Age-otolith height relationship of all specimens *C. trutta*

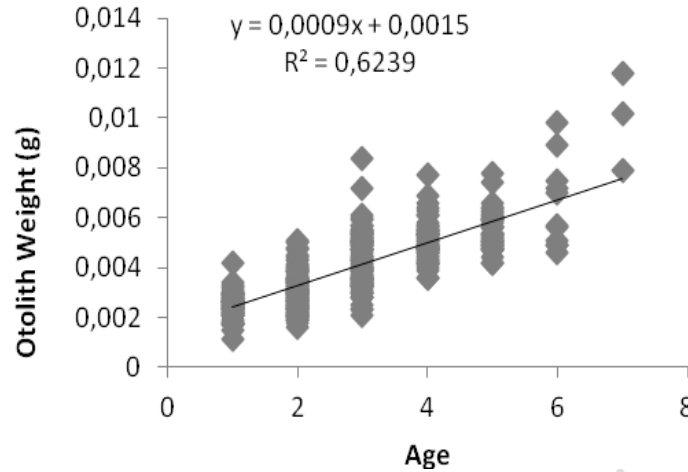


Figure 6. Age-otolith weight relationship of all specimens *C. trutta*

Age is between 1 and 6 years for males, 1 and 7 years for females. The relationship between fish age (A) and otolith length (OL), fish age (A) and otolith height (OH), fish age (A) and otolith weight (OW) are summarized (Table 3).

Table 3. Relations between otolith measurement and fish age of *C. trutta*

	Relation	a		b		R ²
		mean	SE	mean	SE	
Female	A-OL	2.3772	0.0522	0.2699	0.0161	0.5696
	A-OH	1.8776	0.0349	0.2008	0.0108	0.6008
	A-OW	0.0014	0.00015	0.0009	0.00045	0.6156
Male	A-OL	2.3809	0.0589	0.2547	0.0189	0.5634
	A-OH	1.8904	0.0468	0.1988	0.0151	0.5451
	A-OW	0.0017	0.00018	0.0008	0.00057	0.5860
All	A-OL	2.3777	0.0388	0.2661	0.0121	0.5687
	A-OH	1.8834	0.0280	0.1998	0.0088	0.5905
	A-OW	0.0015	0.00011	0.0009	0.00035	0.6239

The coefficients of determination (R²) of the males, females and all specimens ranged from 0.5451 to 0.5860, 0.5696 to 0.6156, 0.5687 to 0.6239, respectively (Table 3). There was a positive correlation between fish age and otolith size (length, height and weight).

Discussion

This Is The First Information On Relationships Between Fish Age And Otolith Size (Length, Height And Weight) For *C. Trutta*. Previous Studies Focused On The Relationship Between Fish Length And Otolith Size (Length, Height And Weight) For *C. Trutta* (Doğan And Şen (2017); Düşükcan (2018)).

Doğan And Şen (2017) Stated That The Coefficients Of Determination (R²) Of The Males, Females And All Specimens Ranged From 0.33 To 0.46, 0.46 To 0.54, And 0.38 To 0.49, Respectively. Düşükcan (2018) Mentioned That The Coefficients Of Determination Ranged From 0.815 To 0.884 For Males, From 0.825 To 0.910 For Females And From 0.824 To 0.889 For All Specimens.

In Conclusion, There Was Very Strongly Correlation Between Fish Length And Otolith Size, And Fish Weight And Otolith Weight (R²>0.73). Düşükcan (2018) Reported Similar Results About The Coefficients Of Determination Of *C. Trutta*. These Information Will Certainly Be Of Interest In Food Habits Of Piscivores And Size Of Fish In Archaeological Samples.



References

- Başusta, A., Özer, E.İ., Girgin, H. 2013. Akdeniz'deki *Lepidotrigla Dieuzeidei* (Blanc & Hureau, 1973) Populasyonunda Otolit Biyometrisi-Balık Uzunluğu Arasındaki İlişki. Yunus Araştırma Bülteni, 3: 3-9.
- Doğan, Y., Şen D., (2017). Keban Baraj Gölü'nde Yaşayan *Capoeta Trutta* (Heckel, 1843)'Da Otolit Biyometrisi-Balık Boyu İlişkisi. Fırat Üniv. Fen Bilimleri Dergisi, 29(2), 33-38.
- Düşükcan, M., (2018). Özlüce Baraj Gölü'ndeki *Capoeta Trutta* (Heckel, 1843) Populasyonunda Balık Boyu-Otolit Biyometrisi İlişkisi. Türk Tarım – Gıda Bilim Ve Teknoloji Dergisi, 6(6), 764-769.
- Echeverria, T.W. (1987). Relationship Of Otolith Length To Total Length İn Rockfishes From Northern And Central California. Fishery Bulletin, 85(2): 383-387.
- Eroğlu, M. And Şen, D. (2017). Reproduction Cycle And Monthly Alteration Of Serum Testosterone, Estradiol And Cholesterol İn *Capoeta Trutta* (Heckel, 1843). Journal Of Scientific And Engineering Research, 4(4): 99-105.
- Geldiay, R., Balık, S. (2007). Türkiye Tatlısu Balıkları (Ders Kitabı). V. Baskı. Ege Üniversitesi Basımevi, Bornova-İzmir. 644 S.
- Gül A., Yılmaz M. & Solak K., (1996). Fırat Nehri Tohma Suyunda Yasayan *Capoeta Trutta* (Heckel, 1843)'Nın Büyüme Özellikleri. Tr. J. Of Zoology. 20: 177-185.
- Kalkan E., (2008). Growth And Reproduction Properties Of *Capoeta Trutta* (Heckel, 1843) İn Karakaya Dam Lake. Turk. J. Zool. 32:1-10.
- Oymak, S., Musa D. & Ünlü E., (2008). Reproductive Biology And Histological Changes İn The Gonads Of Barb, *Capoeta Trutta* (Heckel, 1843) İn Atatürk Dam Lake, Turkey. Aquatic Sciences And Engineering, 23(2), 1-11.
- Ozdemir, N. & Kabukcu A., (1983). Studies On *Capoeta Trutta* (Heckel, 1843) From Keban Dam Lake (Elazığ) Length, Weight, And Reproductive Period. F.U. Vet. Fak. Der. 35: 15-22.
- Polat, N., 1987: Age Determination Of *Capoeta Trutta* (Heckel, 1843) İn Keban Dam Lake. Turk J. Of Zool. 11: 155-160.
- Samsun, N., Samsun, S. (2006). Kalkan (*Scophthalmus Maeoticus* Pallas, 1811) Balığının Otolit Yapısı, Yaş Ve Balık Uzunluğu-Otolit Uzunluğu İlişkilerinin Belirlenmesi. Fırat Üniversitesi Fen Ve Mühendislik Bilimleri Dergisi, 18(2): 181- 187.
- Şevik, R. (1993). Aşağı Fırat Sularında Yaşayan *Capoeta Trutta* (Heckel, 1843)'Nın Büyüme Durumu Ve Üreme Özellikleri Üzerine Araştırmalar. Doğu Anadolu Bölgesi I. Su Ürünleri Sempozyumu , (23-25 Haziran 1993), Erzurum, 172-200.
- Unlu E. 1991: The Biological Characteristics Of *Capoeta Trutta* (Heckel1843) From Tigris River. Tr. J. Of Zool. 15: 12-38.
- Yapalak S., Solak K & Oymak S.A., (1997). Atatürk Baraj Gölü'nde Yasayan *Capoeta Trutta* (Heckel, 1843)'Nın Üreme Özellikleri Üzerine Bir Araştırma. IX Ulusal Su Ürünleri Sempozyumu, Isparta.



Population Dynamism of Black Scorpion [*Androctonus crassicauda* (Olivier, 1807)] (Scorpiones: Buthidae) in Şanlıurfa Province

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Abstract

In this study, Sanliurfa province, where *Androctonus crassicauda* scorpion species is widespread, has been chosen as the research area. Field studies were conducted in all districts of Şanlıurfa and 289 samples were collected. The study was conducted between June 2016 and May 2017. In the study area, Harran district with a maximum of 54 individuals and secondly with 30 individuals were collected in Eyyübiye district. The least collection was done in Karaköprü with 10 individuals and Haliliye districts with 12 individuals. Due to its ruin and stony structure, *Androctonus crassicauda* was observed more intensely in the district of Harran. It was generally observed from April to October. The peak period is June, July and August. Correlation test results for a series of non-normal distribution considering seasonal expectations are listed as two options: Kendall's tau_b correlation coefficient and Spearman's rho correlation coefficient. For the first (Kendall's tau_b) coefficient, there is a positive correlation between the month and the population with a significance level of 0.16% (16%). For the second (Spearman's rho) coefficient, 0.231 (23%) positive correlation was observed between the month and the population according to the significance level of 1%. Correlation test results for a series that are not normally distributed, considering the regional expectation, are listed in two options. For the first coefficient, there is a negative correlation between the region and the population with a significance level of 0,099 (9%). For the second second coefficient, it was found that there was a negative correlation between the region and the population according to the significance level of 0.1128% (12%). In this study, seasonal variation and variation between regions were determined.

Keywords: Scorpion, *Androctonus crassicauda*, bioecology, Population dynamics, Sanliurfa



Plant Biodiversity of the Vark Watershed of Lorestan province, Iran

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Abstract

The Vark watershed area is one of the most beautiful place of Lorestan province where located in the south-easten of Khorramabad city, with Geogeric situation between 33°, 21' north latitude and 48°, 51' east longitude. The of this study were introducing of life forms, chorology, scientific name and local name. According to the results, 135 plant taxa from 43 families and 111genera were identified and studied. The dominant plant families in this study area includes the Lamiaceae (19 taxa), Asteraceae (18 taxa), Fabaceae (12 taxa), Liliaceae and Brassicaceae (9 taxa), Rosaceae (8 taxa), Poaceae (6 taxa) and Apiaceae and Caryophyllaceae each with 5 species. The plants of region have been collected and prepared for studying. Several floras were used for identification the specimens and they are preserved in Lorestan University herbarium (HLUKH). This investigation showed that in the Vark watershed region, the dominant life forms include 31.85 % (47 taxa) therophytes, 23.79 % geophytes (32 taxa), 20 % hemicryptophytes (27 taxa), 18.51 cryptophytes (25 taxa) and11.85 % of phanerophytes (16 taxa), Analyses shows that most of species of region belongs to the Iran-o-Turanian region which containins 64 taxa (47.40%), 28 taxa (20/74 %) Euro-Siberian-Irano-Turanian-Mediterranean species and 26 taxa (19.25%) Irano-Turanian-Mediterranean species of region's flora.

Keywords: Darkhatoon – Absorkh, Floristic, Iran, life froms, Vark, vegetative



Floristic diversity and composition of the Roomeshkan county, Lorestan province, Iran

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Abstract

The Romeshkan County Located in the south-west of Kuhdasht, Lorestan province, between 30°, 47' north latitude and 33°, 17' east longitude. This study aimed to introduce the flora, geographical distribution, life forms, and areas of vegetation, habitat and local names of plant species in the areas of Romeshkan. In total, 132 plant species from 51 families and 132 genera were recorded.

The largest families were Asteraceae (18 taxa), Fabaceae (17 taxa), Lamiaceae (7 taxa), poaceae (7 taxa), Rosaceae (7 taxa), Apiaceae (6 taxa), Brassicaceae and Liliaceae (4 taxa) and Caryophyllaceae, Malvaceae, Papararaceae and Boraginaceae with 3 taxa.

The life forms were followed by the therophytes (32.57 %), hemicryptophytes (23.48 %) and phanerophytes (17.42 %), geophytes (14.39 %), chamaephytes (9.48 %), cryptophyte (1.51 %) and helophytes (1.51 %). From the chorological point of view, the largest proportion of the flora belongs to the Irano- Turani elements (59.09 %). Chrotypes existent in Roomeshkan county were composed of 59.09 % Irano-Turanian species, 3/87 % Euro-Siberian-Irano-Turanian species, 10.6 % Euro-Siberian-Irano-Turanian-Mediterranean species, 12.87 % Irano-Turanian-Mediterranean species, 5.3 % cosmopolitan species and 0.75 % Irano-Turanian-Saharo-Sindian species.

Keywords: Floristic, Iran, life forms, plants, Roomeshkan



Attention please! *Pinna nobilis* in great danger

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Abstract

The largest bivalve, fan mussel *Pinna nobilis* (Linnaeus, 1758), is endemic species to the Mediterranean Sea. Their size varies between 20-40 cm and it reaches up to 120 cm. It lives up to 27 years and at depths between 0.5 m and 60 m. This species is filter feeding organisms. Therefore, it supplies to the increase of water quality. The population of *P. nobilis* has decreased significantly due to fishing activities, environmental pollution, habitat damage (reclamation ground activities, creating beaches, harbour construction, debris dumping, and ground excavation), tourism and a Haplosporidium parasite in the digestive tract etc. Since 1992, *P. nobilis* has been strictly protected by Council of Europe Directive 92/43/EEC and listed as an endangered species. Especially in recent years, fan mussel population has dropped significantly as much as 2 to 3 folds in many countries such as France, Greece, Spain, Italy, and Croatia. In some regions, there has been a regression from 15 individuals per 100 m² to 1 individual per 100 m². Unfortunately, in the western Mediterranean area 100% of deaths was observed. Results of decrease of this species, macrobenthic organisms attached to the shell are negatively affected. What can we do? It can establish new protected areas, especially disease-free. It can be produced by applying various culture methods from the larval stage. In addition, the spats of *P. nobilis* are collected from nature by net collectors and then they can be planted and grown in areas under protection. In this way, the damaged *P. nobilis* population can be improved and enriched. In areas where habitat is disrupted, it is possible to transport *P. nobilis* individuals to appropriate areas. Considering all the factors, legal sanctions should be continued and new protection areas should be established.

Keywords: Endangered species, *Pinna nobilis*, Aquaculture, transplantation



Investigation of the effects of *Giardia lamblia* and *Cryptosporidium parvum* on environmental pollution by real-time PCR in horse farms in Southeastern Anatolia

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Abstract

Giardia lamblia and *Cryptosporidium parvum*. It is now accepted as the primary enteric pathogen in animals and humans. Diarrhea is the second leading cause of death in children in developing countries such as Turkey. *Cryptosporidium parvum* and *Giardia lamblia* are the leading causes of diarrhea in children. Water contaminated with extracts, such as animal or human feces, may be a suitable source for the transmission of these microorganisms. Therefore, we aimed to determine the status of pollution of *Cryptosporidium parvum* and *Giardia lamblia* parasites in water samples taken from local wells and streams horse farms in Southeastern Anatolia by real-time PCR.

In 2019, *G. lamblia* was found in 3 (7.1%) of 42 samples and *C. parvum* was found in 2 (4.7%) of the water samples in the Sanliurfa Suruc region near the horse farms included in our study. While *C. parvum* and *G. lamblia* were not detected in 36 samples, *C. parvum* and *G. lamblia* were detected in 1 sample. In conclusion, in our country, we determined that *G. lamblia* and *C. parvum* are contaminated by the molecular method.

Keywords: *Giardia lamblia*, *Cryptosporidium parvum*, Real-time PCR, Horse

Introduction

Cryptosporidium parvum and *Giardia lamblia* are now accepted as one of the primary enteric pathogens in animals and humans. Diarrhea is the second leading cause of death in children in developing countries such as Turkey. *Cryptosporidium parvum* and *Giardia lamblia* are the leading causes of diarrhea in children. Although they have effective treatments, symptoms similar to those of other diarrhea-causing agents or asymptomatic conditions may lead to delayed or unsuccessful treatment of infections with these agents in developing countries. Water contaminated with extracts, such as animal or human feces, may be a suitable source for the transmission of these microorganisms.

Important environmental organizations are working hard to reduce the concentration of this protozoa in the water used. In 2018, it is also a concern to identify these protozoa in our own studies, especially in patients coming from hospitals in the Southeastern Anatolia region (Demirci et al. 2018). Equine is an important source of income in our region. So there are too many horse farms. Especially considering the popularity of horseback riding, the increasing number of farms led to the need to examine whether the presence of *C. parvum* and *G. lamblia* is a source of contamination to the environment.

Therefore, we aimed to determine the status of pollution of *Cryptosporidium parvum* and *Giardia lamblia* parasites in water samples taken from local wells and streams in Southeastern Anatolia by real-time PCR.



Material and Methods

For this study, 42 water samples collected from local water wells around horse farms in Şanlıurfa and surrounding provinces in January 2019 period were included in our study. After DNA isolation from water, *G. lamblia* and *C. parvum* were used with specific primers and probes by real-time PCR method in LightCycler 480 system and the results were evaluated.

Table 1: Specific primers and probes for the detection of *G. lamblia* and *C. parvum*

Organisms	Gene	Oligonucleotid Sequence	Amplicon Size (bp)	Ref.
<i>Giardia lamblia</i>	β-giardin gene F	CATAACGACGCCATCGCGGCTCTCAGGAA	218	Ahmed et al, 2012
	β-giardin gene R	TTTGTGAGCGCTTCTGTCTGGCAGCGCTAA		
	β-giardin Probe	FAM-AGCTCAACGAGAAGGTCGCAGAGGGCTT-TAMRA		
<i>Cryptosporidium parvum</i>	COWP gene F	CAAATTGATACCGTTTGTCTTCTG	150	
	COWP gene R	GGCATGTCGATTCTAATTCAGCT		
	COWP gene Prot	FAM-TGCCATACATTGTTGTCTGACAAATTGAAT-TAMRA		

Results and Discussion

Cryptosporidium parvum and *Giardia lamblia* are zoonotic enteric protozoa that cause significant health problems in developing countries where sanitary cleaning, hygiene and water resources are insufficient. These parasites are one of the most important microbial pollution indicators of surface water sources. Drinking and irrigation water is a very important enteric pathogen for humans in recent years has been proven by many studies.

Sato de Souza and colleagues in their study in 2018 reported that even in very low numbers of *Cryptosporidium* can cause clinical infections in humans. In fact, they detected 1.0×10^3 and 1.0×10^4 doses in spring waters. In a study by Daniels and colleagues in rural areas of India in 2015. 85 people, 111 animal feces, 207 water wells and 94 pond water were examined as our study. They detected these parasites from wells (10%) and ponds (37%). These rates are much higher than the results we found. In our study, *G. lamblia* (7.1%) and *C. parvum* (4.7%) were detected by real-time PCR in local wells.

In 2019, *G. lamblia* was found in 3 (7.1%) of 42 samples and *C. parvum* was found in 2 (4.7%) of the water samples in the Şanlıurfa Suruç region near the horse farms included in our study. While *C. parvum* and *G. lamblia* were not detected in 37 samples, *G. lamblia* and *C. parvum* were detected in 1 sample.

Tablo 2: Distribution of *G. lamblia* and *C. parvum* assets

	<i>G. lamblia</i>	<i>C. parvum</i>
Local wells n:42	3 (7,1%)	2 (4,7%)

In conclusion, in our country, we determined that *G. lamblia* and *C. parvum* were contaminated by the molecular method. In addition, this study showed us that the parasites should be examined in the faeces of the horse farms with further studies and that they should be educated on how to direct the horse manure. Considering that water can be a source for these infections, which are important problems for our country, we believe that it should be kept in mind in molecular methods that can provide fast and reliable results for this purpose.



References

- Ahmed W, Hodgers L, Sidhu JP, Toze S. (2012). Fecal indicators and zoonotic pathogens in household drinking water taps fed from rain water tanks in Southeast Queensland, Australia. *Appl Environ Microbiol.*;78(1):219-26.
- Daniels, M. E., Shrivastava, A., Smith, W. A., Sahu, P., Odagiri, M., Misra, P. R., ... & Jenkins, M. W. (2015). Cryptosporidium and Giardia in humans, domestic animals, and village water sources in rural India. *The American journal of tropical medicine and hygiene*, 93(3), 596-600.
- de Souza, M. S., O'Brien, C., Santin, M., & Jenkins, M. (2019). A highly sensitive method for detecting Cryptosporidium parvum oocysts recovered from source and finished water using RT-PCR directed to Cryptosporidium RNA. *Journal of microbiological methods*, 156, 77-80.
- Demirci, M., Yiğın, A., Demir, C., & Acel, D. P. (2018). Determination of Giardia intestinalis Genotypes in Stool Specimens by Real-Time PCR Method. *Türk Mikrobiyol Cem Derg*;48(3):187-191
- Hennessey KM, Rogiers IC, Shih HW, et al. (2018). Screening of the Pathogen Box for inhibitors with dual efficacy against Giardia lamblia and Cryptosporidium parvum. *PLoS Negl Trop Dis.*;12(8):e0006673. Published 2018 Aug 6. doi:10.1371/journal.pntd.0006673.
- Johnson, E., Atwill, E. R., Filkins, M. E., & Kalush, J. (1997). The prevalence of shedding of Cryptosporidium and Giardia spp. based on a single fecal sample collection from each of 91 horses used for backcountry recreation. *Journal of Veterinary Diagnostic Investigation*, 9(1), 56-60.
- Mmbaga BT, Houghton ER. (2017). Cryptosporidium and Giardia Infections in Children: A Review. *Pediatr Clin North Am.* Aug;64(4):837-850. doi: 10.1016/j.pcl.2017.03.014.



The Nutritional Value of Smooth Scallop

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Abstract

The per capita consumption of seafood is rapidly increasing with the fast growth of world population. Most dietary guidance recommends eating many types of seafood. In general, it's a healthy addition to your diet. Shellfish have been eaten all over the world for centuries. This study was carried out between July 2017 and June 2019, on the scallop *Flexopecten glaber* species found in the Çardak Lagoon (Lapseki-Çanakkale) in the North Aegean Sea of the Dardanelles. The meat yield and condition index of the scallop were determined as 19.38 to 29.94 and from 5.49% to 10.74 %, respectively. These values were found to be nutritional and economically adequate. In this study, a total of 27 amino acids were measured, 8 Essential Amino Acids and 19 Nonessential Amino Acids. Essential Amino Acids was found in high amounts. *Flexopecten glaber* bivalve meat is a potential source for food value due to high quality protein, as well as balanced essential amino acids. The highest values in terms of EAA content were in winter and spring period, while the highest values in NEAA were in summer and autumn period ($p < 0.05$). Bivalves are rich with fatty acids profile. In this study, the ratio of polyunsaturated fatty acids (PUFA) in total fatty acids in the card has been found to be higher than that of monounsaturated (MUFA) fatty acids in the total fatty acids. The heart benefits from a reduction in the risk of heart attack due to those all-important Omega-3 fatty acids. Omega-3s are vital, and have all sorts of health benefits that should not be overlooked. Shellfish are loaded with nutrients that may promote heart health, including omega-3 fatty acids. Several studies have linked eating omega-3 fatty acids from fish and shellfish to a lower risk of heart disease. Scallops have a high mineral content. All these great nutrients add up to big benefits for your body, including lower risk of heart disease, a boost in brain development, and higher levels of good cholesterol. Scallops are rich in Fe, Zn and Mn in micro elements. This mineral have important roles in your body. They also contain high amounts of certain macronutrients, including Na, K and S. Due to their impressive nutrient content, scallop may be good for your waistline, brain, heart, and immune system. The data on the biochemical composition of *F. glaber* was obtained shows in this study that it was a high quality marine product and it was the most suitable period of the year for the consumption in the spring and winter season.

Keywords: *Flexopecten glaber*, Scallop, Amino Acid, Mineral, Fatty Acid, Healthy Food Source



Is the Gediz River Basin Suitable for Breeding and Populating of the Red Eared Slider, *Trachemys scripta elegans*? Special emphasis to some Observations on the Overwintering Hatchlings of Terrapins at Western Turkey.

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Abstract

The Gediz River is home to indigenous species of terrapins, European pond turtle (*Emys orbicularis*) and the Balkan Terrapin (*Mauremys rivulata*) as well as the Red Eared Slider, *Trachemys scripta elegans*, which is an American originated fresh water turtle. *T. s. elegans* is included among top 100 world's worst invasive alien species. According to previous observations, the Mediterranean coast of Turkey has the potential to provide the requirements of this alien species. The described impacts of the red-eared sliders on native turtles are competition for food and basking sites. In general, mating of native species takes place from the beginning of January to June as soon as after hibernation depending on latitude and temperature. Hatchlings of both indigenous species usually emerge from their subterranean nest in late summer or autumn and move to a nearby marsh, lake, or stream to spend their first winter. Retardation in emergence is quite common among terrapins, and the neonates may stay in the nest after hatching for short and variable periods or even overwinter in the nest. We, here, present the records of hatchlings of *E. orbicularis* found active in late March and August, respectively. On the other hand, our observations on the Red Eared Slider are the first data that show that this species can breed in the natural environments of western Anatolia, just as in the Mediterranean.

Keywords: Balkan Terrapin, European pond turtle, *Emys orbicularis*, *Trachemys scripta elegans*, Overwintering, Gediz River, Turkey.

Introduction

The European pond turtle, *Emys orbicularis*, which is distributed from Northwest Africa in the west to the former Aral Sea in the east and from the Moscow Region in the north to the Turkey-Syria border in south, is one of the most widespread water turtle species in the world and also one of the two representatives of the family Emydidae in the Palearctic region (Fritz, 2001, 2003).

In terms of the Bonn agreement Annex II (1979), the European Habitat and Species Directive (1992) and finally raising to the category of vulnerable species for the Mediterranean basin in the IUCN report, the European pond turtle is an endangered and protected species in many European countries (Cox & Temple 2009).

Despite the reproductive biology of the species has been studied by many authors (e.g. Zuffi & Odetti, 1998; Zuffi et al., 1999, 2004, 2007), almost all of those studies have focused on the European populations (see review, Fritz, 2001; 2003), and the studies on Anatolian populations is scarce in number (Ayaz, 2003; Ayaz et Al., 2007).



On the other hand, with more than 52 million individuals exported from the United States to foreign markets between 1989 and 1997, *Trachemys scripta elegans*, the red-eared slider, is the most popular turtle in the pet trade. More than 23 million exported in five years during the years of 1998 and 2002. Due to the vivid coloured shell of hatchlings, the species was introduced in the animal pet trade in the 1950s and rapidly became the most commonly sold turtle all over the world (Franke & Telecky, 2001; Ernst & Lovich, 2009). Despite on 22 December 1997, the EU banned the import of the subspecies *T. scripta elegans* via the *Protection of Species of Wild Fauna and Flora by Regulating Trade* (Bringsøe 2006). This species was free to import to Turkey until 2010 and they were all sold out at pet shops as “Singapore Turtle”. In fact, *T. scripta elegans* is a freshwater turtle that occurs in the Mississippi Valley of USA (Ernst & Lovich, 2009). Introduced populations of *T.s. elegans* have been reported from Mexico: feral populations exist throughout the country; parts of the United States (Arizona, California, Hawaiian Islands, north-eastern States); Guadeloupe (France): Occurs on Grande Terre and Basse Terre (Iverson 1992, Malhotra and Thorpe 1999); Portugal: widespread, especially in the south; Spain: widespread at low elevations; France: widespread, except in the north; Italy (scattered throughout the country); Slovenia (near Italian border region); Greece (Crete); Austria (Vienna region); Germany; south-western Switzerland; Netherlands; Turkey; Israel; South Africa; Taiwan; Thailand; Cambodia; Indonesia; and Australia. It is a medium sized species; adult males and females can attain, respectively, 20 and 28 cm of carapace length (Ernst & Lovich, 2009). This is one of the reasons that sooner or later almost all turtle “owners” release their animals somewhere from city parks to natural environments (Ferronato et al., 2009). Although the fate of these imported babies is obviously unknown, many are known to be dead and some of them had released into the indigenous habitats. Despite the vast worldwide occurrence of *T. s. elegans*, little is known of their impact on native ecosystems in Turkey.

Overwintering behaviour of hatchlings is known among many freshwater turtles (Ultsch, 2006). However, there is little information about *E. orbicularis* on how this behaviour occurs in many countries (Parde et al., 2000; Mitus & Zemanek, 2003; Thienpont et al., 2004; Novotny et al., 2004) and whether overwintering occurs in embryonic stage still remain a mystery. The data we presented is the third record for overwintering *E. orbicularis* hatchlings in Turkey. The given ones for *T. scripta* reflect that besides they have overwintering behaviour in a similar manner, this species could also breed in the natural environment of Turkey.

Materials and Methods

The terrains where Gediz River runs through Manisa plain and surrounding streams are used as the study area (Figure 1). This area covers approximately 6-7 km east of the Manisa-Muradiye bridge over the Gediz River and the surrounding creeks and drainage channels (38° 41'25.66" N and 27° 22'45.74" E). There was water consistently in the canals and creeks of Gediz River during the winter months, while the stream beds were completely dry in summer (especially in July and August).

Amphibians (*Pelophylax bedriagae*, *Lissotriton vulgaris* and *Triturus karelinii*) and turtles (*Emys orbicularis*) were found during our field studies. On March 26, 2010 and August 29, 2011, two new-borns were caught among reed field at the edges of the drainage channels. The air and water temperatures were 19 ° C and 15 ° C, respectively for the first specimen, while they were 31°C and 20°C for the second specimen.

Lengths were measured with 0.01 mm precision calliper and weighted with 1 g precision balance. The colour and pattern characteristics of the captured specimens were recorded and taken photograph, and then the offspring were released to the area where they were caught. Body measurements of the first specimen were not be able to taken (Figure 2); The measurements taken for the second specimen, larger one, were (Figure 3); Straight line Carapace Length (SCL = 42,71), Curved Carapace Length (CCL=45,1mm), Carapace Width (CW = 36,93), Plastron Length (PL = 37,15), Plastron Width (PW = 20,13), Shell Height (SH = 17,52), Tail Length (TL = 32,41) and Weight (W = 15 g). The measurements taken for *T. s. elegans* are given in table (Figure 4).

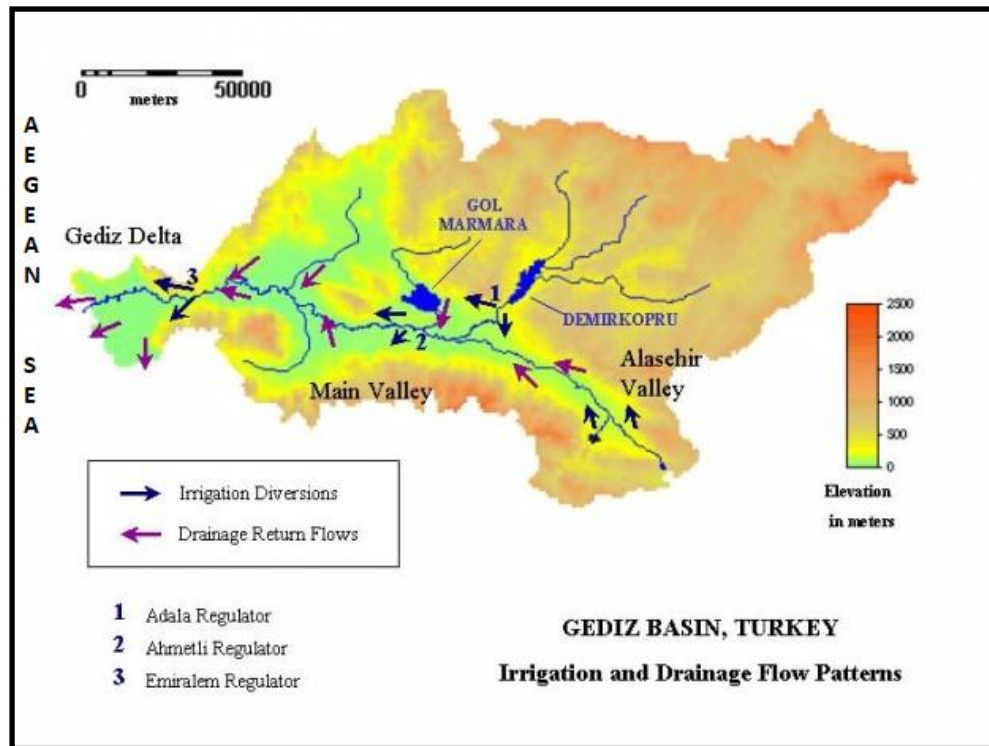


Figure 1. Gediz Basin where *Emys orbicularis* and *Trachemys scripta elegans* new-borns were captured.

Results and discussion

Depending on latitude, among the *Emys orbicularis* specimens, mating occurs from January to June, immediately after hibernation (Ernst & Barbour, 1989). Nesting starts in late May in the south and early July in the north (Zuffi et al., 1999; Ayaz et al., 2007). The egg number varies by regions (Zuffi et al., 1999 and 2007). In the Southern European *Emys orbicularis* populations, females lay their first eggs at the beginning of mid-May, whereas in Central and Eastern European populations, the females turtles usually lay eggs in the first half of June (Fritz, 2001 and 2003). The eggs number in each egg-laying can be between 3 and 16, but usually this number is 9-10 (Ernst & Barbour, 1989).

Depending on latitude and seasonal conditions, after the incubation period of 90 to 117 days, the offspring hatch from August to the end of October (Lebbon & Chelazzi, 1991; Andreas & Paul, 1998; Schneeweiss et al., 1998; Servan, 1998). The offspring with 20-25 mm carapace length are about 5 g weight and have a well-developed spine, long tail and large head (Ernst & Barbour, 1989; Fritz, 2001, 2003). Overwintering in nesting chamber or on anywhere outside of nesting chamber, some new-borns emerge in the next spring (Bannikov, 1951; Zemanek & Mitrus, 1997; Mitrus & Zemanek, 1998 and 2003; Servan, 1998; Kotenko, 2000; Novotny et al. 2004; Thienpont et al., 2004).

Table 1. The measurements taken for *Trachemys scripta elegans*.

THE MEASUREMENTS TAKEN	SPECIMEN 1	SPECIMEN 2
STRAIGHT LINE CARAPACE LENGTH	32,17	32,97
STRAIGHT LINE CARAPACE WIDTH	32,18	32,90
PLASTRON LENGTH	28,87	28,35
PLASTRON WIDTH	21,37	21,32

The measurements of one of the two overwintered *Emys* specimens were taken and these measurements are given in Table 1. The captured specimens' body weight is 15 g, the median vertebrae and a pair of lateral spine lines are evident. There are no axillary and inguinal plaques. Plastron formula is



as follows: Anal> Abdominal> Pectoral> Gular> Femoral> Humeral. In both specimens, the femoral suture is the shortest, while the anal suture is the longest one. The extremities are covered with small and medium sized keratin scales. No abnormalities were observed on the keratin plates of carapace and plastron.

Nuchal plaques were seen to be parallel in both specimens of *Emys*. The perpendicular plates of the carapace are covered with granules and have no signs of growth (Figure. 2). The first captured specimen that shows the secondary developmental characteristics such as small body size and relatively large head size has the characteristics of the newly hatched, new-born in the early developmental stage. In both offspring, the carapace is brownish olive in colour and the edges of the marginal plaques have a slightly light yellow colour. Plastrons are distinctly dark. This dark portion covers two-thirds of the plastrons and only the lateral edges are light in colour (Figure 3). The ground colour is dark with light yellow spots.

Reproduction of *E. orbicularis* for the European population has been studied in detail in the last 20 years (e.g., Lebboron & Chelazzi, 1998; Zuffi et al., 1999 and 2007). However, there is no a detailed study on reproduction apart from few observational studies of the European pond turtles in Turkey. At the beginning of May 2001, Ayaz (2003) found a nest, which was destroyed by predators about 16 meters away from the water, in Lakes Region. As a result of his study, Ayaz (2003) reported that turtles lay eggs between the beginning of June and the first week of July.

In addition, Ayaz (2003) gave the measurements taken from new-born specimens in the beginning of July for Lakes Region. When these findings are taken into consideration, it can be concluded that incubation begins in the beginning of July and continues until the end of summer among *E. orbicularis* populations in Turkey. Ayaz & Çiçek (2011), in his study at Sülüklü Lake, supports this opinion by observing mating in April and May. Ayaz & Çiçek (2011) gave the average straight line carapace length 26.48 mm and 4.18 g average weight for offspring. In the study of three different subspecies of *E. orbicularis*, Fritz et al. (2006) gave the carapace length value as 23.4 to 30.8 mm and weight values as 3.7 g to 6.7 g. Similarly, in the study of the species' Northern distribution, Drobenkov (2000) has given the average carapace length 28.0 mm (25.9-29.0) and the average weight of 6.1 (5.65-6.45) g for new-borns.



Figure 2. Dorsal and ventral view of relatively small first *Emys orbicularis* specimen, of which morphological measurements were not able to taken.



Figure 3. Second *Emys orbicularis* specimen.

Ayaz et al. (2007) reported for the first time a 22.3 mm of straight line carapace length for a captured new-born from Uluabat Lake in Turkey. The results obtained in our study are within the limits of the values given in the studies mentioned above and these individuals can be considered as new-born since no growth rings were seen. In many European populations of *E. orbicularis*, it has been reported that there are more than one egg laying in a year and that the offspring hatched at the end of summer spend their first winters in their nests (Rossler, 2000a,b; Fritz, 2001, 2003). We believe that the first new-born we caught had come out at the beginning of spring by surviving the winter in the nest due to adverse weather conditions.

The Aegean Region climate shows characteristics of partly continental and partly the Mediterranean climate. In areas where the continental climate is dominant, environmental conditions may change very quickly, as is case observed at the Gediz River basin in Manisa. In some years, adverse weather may probably encourage offspring to overwintering behaviour. However, it is extremely difficult to indicate whether the offspring spend the winter in the nest (Kotenko & Fedorchenko, 1993; Mitus & Zemanek, 2003) or whether they spend the winter on the land after hatching (Bannikov, 1951). Clarifying this dilemma is highly crucial for a better understanding of the reproductive behaviour of the species.

Invasive species are a matter of concern because they can impact native species through competitive exclusion, niche displacement, hybridization, introgression, predation and even extinction (Mooney & Cleland, 2001). The ecological effects of introductions of *T. s. elegans* have been poorly documented (Platt & Fontenot 1992). Their omnivorous diet habits and high ability to adapt to various habitats, gives them great potential for impacting indigenous habitats and fauna.

This species has been nominated as among 100 of the "World's Worst" invaders. Çiçek and Ayaz (2015) reported for the first time reproduction in a naturalized population of the red-eared slider (*T. s. elegans*) from Southern Anatolia (Anamur, Mersin). We may accept the locality given by the researchers as semi-natural or semi-captive area (Mamure Castle, Anamur, province of Mersin, Lat: 36.081789, 32.894666, sea level on the Mediterranean coast of southern Turkey). Because of the many introduced freshwater turtles in this locality as well as numerous native terrapins have been frequently fed by pet lovers or animal lovers. Undoubtedly, two offspring with no traces of growth we found in the Gediz have been fully matched with the characteristics of the *Trachemys*' newborns given in literature. Thus, the given data here is the first recorded overwintering case for the red-eared slider in Turkey, as well as the Gediz basin is the suitable habitat where this invasive species breed very successfully.

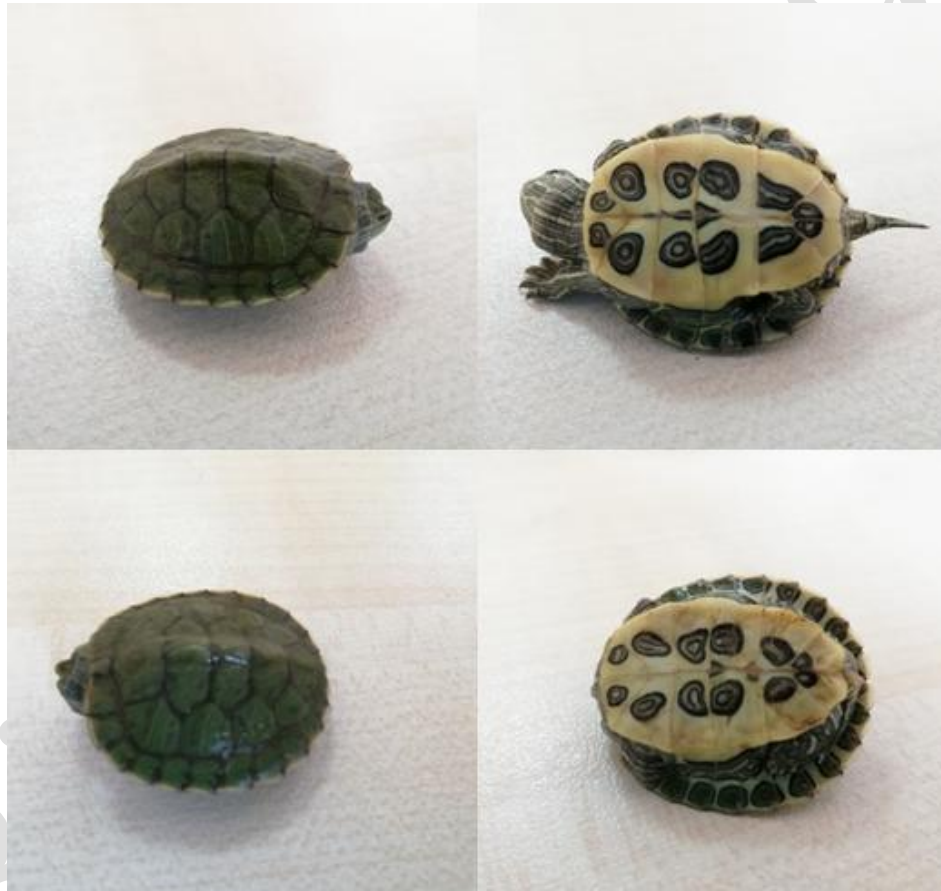


Figure 4. Dorsal and ventral view of *Trachemys scripta elegans* specimens captured in Gediz basin on April 23, 2019.

References

- Andreas, B., R. Paul., 1998. Clutch size and structure of breeding chambers of *Emys o. orbicularis* in Brandenburg. - *Mertensiella*, 10: 29-32.
- Ayaz, D., 2003. Goller Bolgesi ve Doğu Akdeniz Bolgesi *Emys orbicularis* (Testudinata: Emydidae) ve *Mauremys rivulata* (Testudinata: Bataguridae) turlerinin sistematik durumu, morfolojisi, dağılışı, ureme ve beslenme biyolojisi üzerine araştırmalar. Ph.D. thesis, Ege University Graduate School of Natural and Applied Sciences, 239 pp. (In Turkish with English summary).



- Ayaz, D., Çiçek, K. (2011). Data on the population structure of the European Pond Turtle, *Emys orbicularis* (LINNAEUS, 1758) in Lake Sülüklü (western Anatolia, Turkey). *Herpetozoa*, 24(1/2): 33-41.
- Ayaz, D., C.V. Tok, K. Cicek., 2007. Overwintered hatchling of *Emys orbicularis* (Linnaeus, 1758) observed in Turkey. - *Herpetozoa*, 19(3/4): 189- 192.
- Bannikov, A.G., 1951. Materialy kpoznaniyu biologii kavkazkikh cherepakh. – *Uchebnye Zapiski Moskovskogo Gorodskogo Pedagogicheskogo Instituta imeni V. P. Potemkina*, 18: 129-167. (In Russian)
- Bringsøe, H. 2006. Invasive Alien Species Fact Sheet–*Trachemys scripta* http://www.nobanis.org/files/factsheets/Trachemys_scripta.pdf
- Cox, N.A., H.J. Temple., 2009. *European red list of reptiles*. Luxembourg: Office for Official Publications of the European Communities, 32pp.
- Çiçek, K. & D, Ayaz (2015). Does the red-eared slider (*Trachemys scripta elegans*) breed in Turkey? *Hyla* VOL. 2015., No.1: 4-10.
- Drobenkov, S.M., 2000. Reproductive ecology of the pond turtle (*Emys orbicularis* L.) in the Northeastern part of the species range. - *Russian Journal of Ecology*, 31(1): 49-54.
- Ernst, C.H., R.W. Barbour., 1989. *Turtles of the World*. Washington, DC. Smithsonian Institution Press. 314 p.
- Ernst, C.H. & Lovich, J.E. (2009). *Turtles of the United States and Canada*. Johns Hopkins University Press, Baltimore, 840 pp.
- Franke, J. & Telecky, T.M. (2001). *Reptiles as Pets: an Examination of the Trade in Live Reptiles in the United States*. The Humane Society Of The United States, Washington, 146 pp.
- Fritz, U., 2001. *Emys orbicularis* (Linnaeus, 1758) – Europäische Sumpfschildkrote. In: FRITZ, U. (Ed.): *Handbuch der Reptilien und Amphibien Europas, Band 3/IIIA: Schildkroten I*, Aula, Wiebelsheim, pp. 343-515.
- Fritz, U., 2003. *Die Europäische Sumpfschildkrote*. Bielefeld, Laurenti, 224 pp.
- Fritz, U., S. D'angelo, M.G. Pennisi, M. Lo Valvo., 2006. Variation of Sicilian pond turtles, *Emys trinacris* – What makes a species cryptic? - *Amphibia- Reptilia* 27: 513-529.
- Iverson J. B (1992). *A revised checklist with distribution maps of the turtles of the world*. Privately Printed. Richmond.
- Ferronato, B.O., Marques, T.S., Guardia, I., Longo, A.L.B., Piña, C.I., Bertoluci, J., Verdade, L.M. (2009): The turtle *Trachemys scripta elegans* (Testudines, Emydidae) as an invasive species in a polluted stream of southeastern Brazil. *Herpetological Bulletin* (109): 29-34
- Kotenko, T.I. 2000. The European pond turtle (*Emys orbicularis*) in the steppe zone of the Ukraine. - *Stapfia* 69: 87- 106.
- Kotenko T.I., A.A. Fedorchenko., 1993. Reproductive cycle of *Emys orbicularis* in the Danube Delta. - In: Llorente, G.A., A. Montori, X. Santos, M.A. Carretero (Eds.): *7th Ordinary General Meeting Societas Europaea Herpetologica*. Universitat de Barcelona, Barcelona, pp. 86.
- Lebboroni, M., G. Chelazzi., 1991. Activity patterns of *Emys orbicularis* L. (Chelonia Emydidae) in central Italy. - *Ethology Ecology and Evolution*, 3: 257- 268.
- Mitrus, S., M. Zemanek., 1998. Reproduction of *Emys orbicularis* (L.) in Central Poland. - *Mertensiella*, 10: 187-191.
- Mitrus, S., M. Zemanek., 2003. European pond tortoise, *Emys orbicularis*, neonates overwintering in the nest. - *Herpetological Journal*, 13: 195-198.
- Malhotra, A. and R.S. Thorpe., 1999. *Reptiles & Amphibians of the Eastern Caribbean*. Macmillan Educ. Ltd., London.
- Mooney, H.A. & Cleland, E.E. (2001). The evolutionary impact of invasive species. *Proceedings of the National Academy of Sciences USA*, 98, 5446– 5451.
- Novotny, M., S. Danko, P. Havaš., 2004. Activity cycle and reproductive characteristics of the European pond turtle (*Emys orbicularis*) in the Tajba National Nature Reserve, Slovakia. - *Biologia*, 59(14): 113-121.



- Parde, J.-M., S. Hurstel, A.-C. Lefevre., 2000. Etude eco-ethologique de la Cistude d'Europe dans le Bas- Armagnac (Gers, France), en vue de sa conservation. - In: BUSKIRK, J., J. SERVAN (Eds): *Proceedings of the 2nd International Symposium on Emys orbicularis*. Chelonii 2, pp. 73–82.
- Platt, S.G. and Fontenot, L.W. 1992. The red-eared slider, *Trachemys scripta* (Wied) in South Korea. *Bulletin Chicago Herpetological Society* 27:113–114
- Rossler, M., 2000a. Die Fortpflanzung der Europäischen Sumpfschildkröte *Emys orbicularis* (L.) im Nationalpark Donau-Auen (Niederösterreich). - *Stapfia* 69: 145-156.
- Rossler, M., 2000b. The ecology and reproduction of an *Emys orbicularis* population in Austria. - *Stapfia* 69: 69- 72.
- Schneeweiss, N., B. Andreas, N. Jendretzke., 1998. Reproductive ecology data of the European pond turtle (*Emys o. orbicularis*) in Brandenburg, Northeast Germany.- *Mertensiella*, 10: 227-234.
- Servan, J., 1998. Ecological study of *Emys orbicularis* in Brenne (Central France). - *Mertensiella*, 10: 245-252.
- Thienpont, S. A. Cadi, R. Quesada, And M. Cheylan. 2004. Overwintering habits of the European pond turtle (*Emys orbicularis*) in the Isere department (France). — *Biologia* 59: 143–147.
- Ultsch, G.R., 2006. The ecology of overwintering among turtles: where turtles *overwinter* and its consequence. - *Biological Reviews*, 81(3): 339–367.
- Zemanek, M., S. Mitrus., 1997. Biologia i ochrona zolwia błotnego *Emys orbicularis* w wojewodztwie radomskim. - *Chrońmy Przyrodę Ojczystą*, 53: 67-83.
- Zuffi, M.A.L., F. Odetti., 1998. Double egg deposition in the European pond turtle, *Emys orbicularis*, from central Italy. *Italian Journal of Zoology*, 65: 187– 189.
- Zuffi, M.A.L., A. Celani, E. Foschi, S. Tripepi., 2007. Reproductive strategies and body shape in the European pond turtle (*Emys orbicularis*) from contrasting habitats in Italy. – *Journal of Zoology*, 271: 218-224.
- Zuffi, M.A.L., M.F. Di Benedetto, M.E. Foschi., 2004. The reproductive strategies in neighbouring populations of the European pond turtle, *Emys orbicularis*, in central Italy. *Italian Journal of Zoology* 2 (Suppl.): 101–104.
- Zuffi, M.A.L., F. Odetti, P. Meozzi., 1999. Body-size and clutch-size in the European pond turtle, *Emys orbicularis*, from central Italy. *Journal of Zoology*, 247: 1–8.



Spatio-temporal variation in distribution and abundance of marine Cladocerans in relation to environmental factors in Güllük Bay (Aegean Sea, SW Turkey)

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Abstract

In this study, monthly abundance and distribution of the cladoceran species were determined from August 2015 to July 2016 in near the Boğaziçi Lagoon entry in Güllük Bay, which has one of the most important harbours in Turkey and is under the influence of the open shore of the Aegean Sea. Samples were seasonally taken with 200 micron WP2 plankton net horizontally from three stations. In order to see effects of environmental factors on abundance and distribution of cladocerans, temperature, salinity, dissolved oxygen, nitrite, nitrate, phosphate and chlorophyll-a parameters were measured monthly on the surface of the stations. Four cladocera species, *Penilia avirostris*, *Evadne tergestina*, *Evadne spinifera* and *Podon polyphemoides* were found in all sampling occasions during the study. They showed high abundances in August and October as dominant zooplankton group. In particular, abundance of *P. avirostris*, which was determined as dominant cladoceran in all stations except August. *E. tergestina* was second dominant species. In September, only *E. tergestina* and *P. polyphemoides* were found in low abundances. Maximum abundance of *P. polyphemoides* was observed in March with 390 individual/m³. Abundance of cladocerans did not significantly differ amongst seasons. Two physicochemical variable, temperature and dissolved oxygen were the principal drivers of change in cladocera composition of Güllük bay.

Keywords: Cladocera, marine, Güllük Bay, Boğaziçi Lagoon, abundance, Turkey.



Investigation of Statistical Experimental Design Results of UV Absorbance Values of Aluminium Nanoparticles of Different Sizes

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Abstract

Nanoparticles (NPs) are the most important materials in the rapidly developing field of nanotechnology. NPs are tiny materials having size ranges from 1 to 100 nm. They can be classified into different classes based on their properties, shapes or sizes. NPs are important scientific materials with many applications, especially in the fields of biotechnology and toxicology. In this context, it is important to make the most commonly used metal-based environmental or ecological risk assessments. In this study, the results of statistical experimental design of ultraviolet-visible (UV-Vis) absorbance values of Aluminium NPs (18 nm and 60-80 nm) of different sizes were investigated. According to the results of the study, it was concluded that maximum effect was observed between 24-30 hours and 25 ppm adsorbance concentration was more effective. Adsorption value decreased in all NPs under periods of 24 hours and above 36 hours. Similarly, the effect was reduced when the adsorbance dose was low and too high. When all these data are considered, it is concluded that the effect changes according to NP type and size and the change is meaningful.

Keywords: Aluminium, Nanoparticle, UV-Vis Absorbance Values, Statistical Experimental Design

Introduction

Nanotechnology (NT) is a new scientific horizon that has been revolutionizing human life and our perception of chemistry of materials whose sizes vary from 1-100 nm (Huber, 2005). Nowadays, the NT is one of the fastest growing industry and the nanoparticles (NPs) account for a great deal of advancement in many industry fields (Colvin, 2003). The NPs or Nanomaterials are continuously developing with their unique physical and chemical properties (Vance et al. 2015). The literature on the toxicity of NPs to aquatic organisms is also rapidly developing (Garner et al., 2015), because of big potentials to be released into aquatic and terrestrial environments (Nowack et al., 2012; Batley et al., 2013). But it is a challenge to keep pace with demands for ecological risk assessments of new products (Baysal et al., 2019). At the same time, one of the important properties of the metal oxide NPs is the sorption of other metals from the media (Altıntığ et al., 2017; Baysal and Saygın, 2018).

Characteristic properties of materials vary depending on their structure and physicochemical processes used in their formulation and manufacture. Materials in nano-scale could demonstrate entirely different properties than their bulk forms. Therefore, physical and chemical properties, such as particle size, shape, surface area, surface reactivity and solubility of NPs should be carefully identified when bio-assays to determine toxicity of NPs smaller than 100 nm are to be conducted.



Ultraviolet-visible (UV-Vis) spectroscopy is one of that identification/ characterization analyses, usually used for measuring molecules or inorganic ions and complexes in the solutions. While the UV scan is corresponding normally to the wavelength range of 200 - 400 nm, the visible light scan corresponds to the range 400 - 800 nm. Al-NPs (18 nm and 60-80 nm) optical properties sensitive to size, shape, density, aggregation and refractive index close to the surface, which is why it is important to identify, characterize and examine NPs by UV-Vis spectroscopy.

Material and Methods

Nanoparticles

Al-NPs (18 nm and 60-80 nm) were obtained from commercial companies selling SkySpring products in our country. All chemicals of analytical reagent class are used without any purification or distillation.

Statistical Determination of UV-Vis Absorbance Values

UV – visible spectra of NPs were determined at 300-800 nm wavelengths in absorption mode using UV – Vis spectrophotometer (Optima, SP-3000 Nano). In order to determine the effect of NPs in the sizes of Al-NPs (18 nm and 60-80 nm), UV-Vis absorbance values were determined by Design Expert v.10., were evaluated statistically.

Results

Statistical Experimental Design Results Demonstrating UV-Vis Absorbance Values of Nanoparticles

To the data obtained from the experimental design according to Table 1 and 2, it was made the regression process with the least squares method. According to the polynomial equation obtained as a result of this three-variable and three-level design, the following equations (1,2) provided us the response surface graphs.

$$y_i = \beta_0 + \sum \beta_i X_i + \sum \beta_{ii} X_{ii}^2 + \sum \beta_{ij} X_i X_j \dots \dots \dots (1)$$

$$y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_{11} X_1^2 + \beta_{22} X_2^2 + \beta_{33} X_3^2 + \beta_{12} X_1 X_2 + \beta_{13} X_1 X_3 + \beta_{23} X_2 X_3 \dots \dots \dots (2)$$

Table 1. Level and range of independent variables used in measuring of the absorbance

Variables	Variable Codes	Levels		
		-1	0	+1
Nanoparticle dose (mg L ⁻¹)	X1	1	10	50
Activation time (Hour)	X2	24	36	48

Table 2. Experimental design based on BBD (Box Behnken Design) model with two independent variables

No	X1: Dose	X2: Time	Al NPs (18 nm)	Al NPs (60-80 nm)
1	10.00	48.00	0.157	0.146
2	10.00	24.00	0.365	0.321
3	10.00	48.00	0.16	0.147
4	50.00	48.00	0.33	0.188
5	1.00	48.00	0	0
6	10.00	48.00	0.153	0.145
7	10.00	72.00	0.067	0.053
8	50.00	72.00	0.151	0.054
9	10.00	48.00	0.156	0.146
10	1.00	24.00	0.032	0.032
11	50.00	24.00	0.514	0.266
12	10.00	48.00	0.161	0.146
13	1.00	72.00	0	0



In order to find the difference of absorbance values on the basis of second order polynomial equation; statistical analysis of NP concentration (ppm) and activation time was performed and ANOVA analysis within 95% confidence value ($P < 0.05$) of the model was examined. The model was compared with the experimental findings. The statistical analysis of the mean effects of NPs on the media was uploaded to the system as tables in a multi-media system (due to the image size). In the statistical evaluation, the suitability of the selected model is shown as tables for each NP. Accordingly, the quadratic model was used for all of these experiments and the Anova Test results of the obtained data are shown in the tables.

Table 3. Statistical data for Al-NPs (18nm)

ANOVA						
Source	Sum of Squares	df	Mean Square	F Value	p-value	
Mean vs Total	0.39	1	0.39			
Linear vs Mean	0.21	2	0.10	15.84	0.0008	
2FI vs Linear	0.018	1	0.018	3.55	0.0921	
Quadratic vs 2FI	0.032	2	0.016	8.00	0.0156	Suggested
Cubic vs Quadra	0.013	2	6.482E-003	26.95	0.0021	Aliased
Residual	1.202E-003	5	2.405E-004			
Total	0.66	13	0.051			

Source	Std. Dev.	R-Squared	Adjusted R-Squared	Predicted R-Squared	PRESS	
Linear	0.081	0.7600	0.7120	0.4876	0.14	
2FI	0.072	0.8280	0.7706	0.5399	0.12	
Quadratic	0.045	0.9476	0.9102	0.5857	0.11	Suggested
Cubic	0.016	0.9956	0.9893	-1.1666	0.59	Aliased

Model Summary Statistics: Focus on the model maximizing the "Adjusted R-Squared" and the "Predicted R-Squared".

Source	Sum of Squares	df	Mean Square	F Value	p-value	
Model	0.26	5	0.051	25.33	0.0002	significant
A-Part dose	0.15	1	0.15	76.38	< 0.0001	
B-Time	0.094	1	0.094	46.54	0.0002	
AB	0.018	1	0.018	9.08	0.0196	
A ²	0.032	1	0.032	15.98	0.0052	
B ²	3.340E-003	1	3.340E-003	1.65	0.2398	
Residual	0.014	7	2.024E-003			
Lack of Fit	0.014	3	4.708E-003	457.10	< 0.0001	significant
Pure Error	4.120E-005	4	1.030E-005			
Cor Total	0.27	12				

Correlation coefficient (R^2) value of the Quadratic model, which is considered appropriate, respectively; Multiple R = 97.35%, $R^2 = 94.76\%$ and adjusted $R^2 = 91.02\%$. The determination of

(R²) value as 99.49% shows that there is a high compatibility between the observed values and the predicted values and the applied model is within the confidence interval. 97.35% of multiple R values indicate that regression is statistically significant and only 3.65% of total variables cannot be explained by this model. In order to determine the statistical value of the model, “Significance F” value in ANOVA test was examined. Significance of F value less than 0.05 (0.0002) and obtaining the model F value as 25.33 indicates that the model is statistically valuable in 95% confidence interval (Table 3).

In mathematical modeling

$$y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_{12} X_1 X_2 + \beta_{11} X_1^2 + \beta_{22} X_2^2 \dots \dots \quad (3)$$

$$\text{Abs.} = 0.34 + 0.16 X_1 - 0.13 X_2 - 0.64 X_1 X_2 - 0.20 X_1^2 - 0.035 X_2^2 \quad (4)$$

As a result of the evaluation, it was concluded that the adsorbance dose of Al (18nm) selected parameters affects the absorbance value in increasing direction and the duration decreasing the absorbance value. When the absolute values of the coefficients are examined, the order of effect is in the form of dose and duration.

Graphs of statistical data for Al (18nm) (graph.1) are shown below.

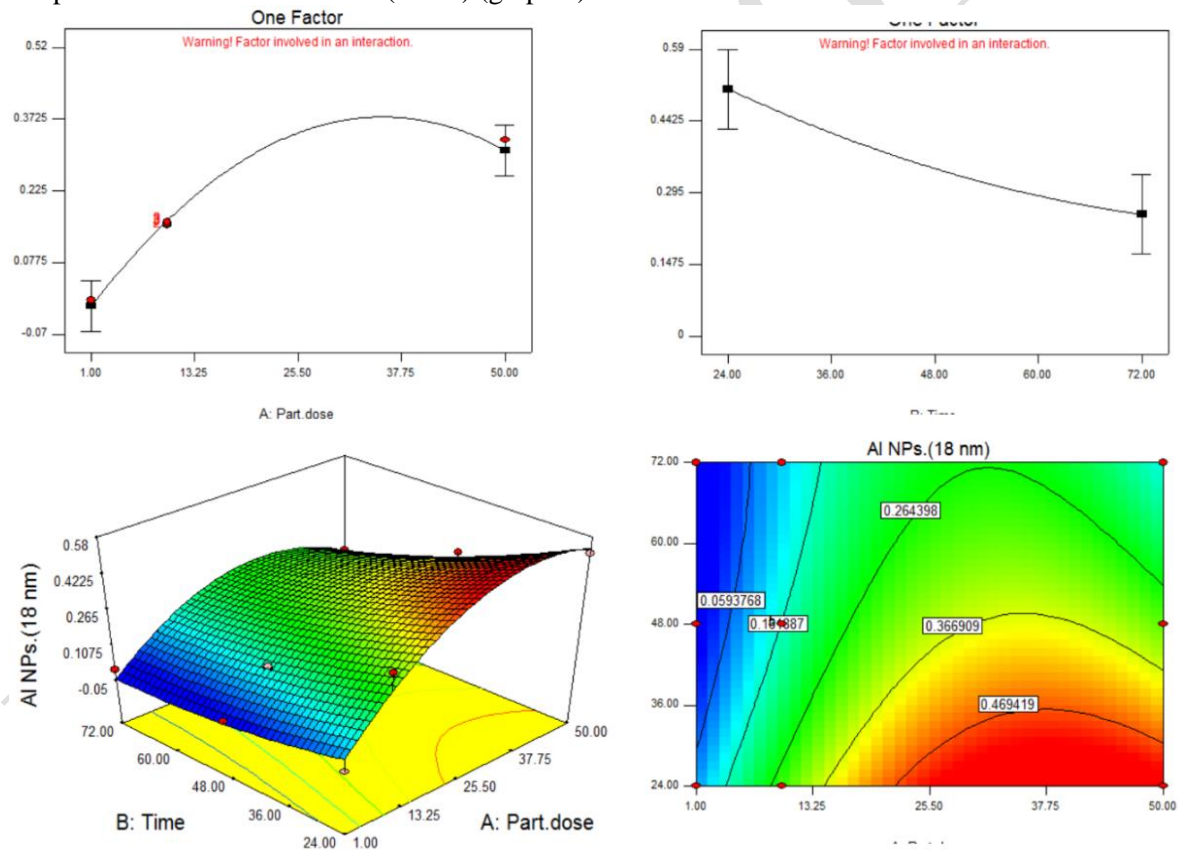


Figure 1. Graphs of statistical data for Al-NP (18 nm)

Tablo 4. Statistical data for Al-NPs (60-80 nm)



y ^A Transform							Fit Summary		f(x) Model		ANOVA		Diagnostics		Model Graphs	
Response	2	AI NPs.(60-80 nm)				Transform:		None								
*** WARNING: The Cubic Model is Aliased! ***																
Sequential Model Sum of Squares [Type I]																
	Source	Sum of Squares	df	Mean Square	F Value	p-value	Prob > F									
	Mean vs Total	0.21	1	0.21												
	Linear vs Mean	0.059	2	0.030	5.37	0.0261			Suggested							
	2FI vs Linear	3.093E-003	1	3.093E-003	0.53	0.4836										
	Quadratic vs 2FI	0.038	2	0.019	9.28	0.0107			Suggested							
	Cubic vs Quadra	0.014	2	6.828E-003	54.42	0.0004			Aliased							
	Residual	6.273E-004	5	1.255E-004												
	Total	0.32	13	0.025												
Model Summary Statistics																
	Source	Std. Dev.	R-Squared	Adjusted R-Squared	Predicted R-Squared	PRESS										
	Linear	0.074	0.5177	0.4213	0.1018	0.10			Suggested							
	2FI	0.076	0.5447	0.3930	-0.4396	0.16										
	Quadratic	0.045	0.8753	0.7863	-0.0774	0.12			Suggested							
	Cubic	0.011	0.9945	0.9869	-1.7547	0.32			Aliased							
Response	2	AI NPs.(60-80 nm)														
ANOVA for Response Surface Quadratic Model																
Analysis of variance table [Partial sum of squares - Type III]																
	Source	Sum of Squares	df	Mean Square	F Value	p-value	Prob > F									
	Model	0.10	5	0.020	9.83	0.0046			significant							
	A-Part.dose	0.038	1	0.038	18.51	0.0036										
	B-Time	0.047	1	0.047	22.92	0.0020										
	AB	3.093E-003	1	3.093E-003	1.52	0.2580										
	A ²	0.036	1	0.036	17.83	0.0039										
	B ²	9.260E-004	1	9.260E-004	0.45	0.5221										
	Residual	0.014	7	2.040E-003												
	Lack of Fit	0.014	3	4.760E-003	9520.58	< 0.0001			significant							
	Pure Error	2.000E-006	4	5.000E-007												

Correlation coefficient (R^2) value for quadratic model, which is considered suitable for AI (60-80 nm) nanoparticle; Multiple R = 97.35%, R^2 = 87.53%, and adjusted R^2 = 78.63%. The determination of (R^2) value as 93.55% shows that there is a high compatibility between the

observed values and the predicted values and that the applied model is within the confidence interval. A multiple R value of 93.55% indicates that regression is statistically significant and only 6.45% of the total variables cannot be explained by this model. In order to determine the statistical value of the model, “Significance F” value in ANOVA test was examined. Significance F value less than 0.05 (0.0265) and model F value of 5.37 is obtained, 95% confidence interval of the model is statistically significant (Table 4).

In mathematical modeling;

$$y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_{12} X_1 X_2 + \beta_{11} X_1^2 + \beta_{22} X_2^2 \dots \dots \quad (3)$$

$$\text{Abs.} = 0.29 + 0.079 X_1 - 0.091 X_2 - 0.026 X_{12} - 0.21 X_1^2 + 0.018 X_2^2 \quad (4)$$

As a result of the evaluation, it was concluded that the adsorbance dose of Al (60-80 nm) selected parameters affect the absorbance value in increasing direction and the duration decreasing the absorbance value. When the absolute values of the coefficients are considered, the order of action is in the form of time and dose. Graphs of statistical data for Al (60-80 nm) (graph.2) are shown below.

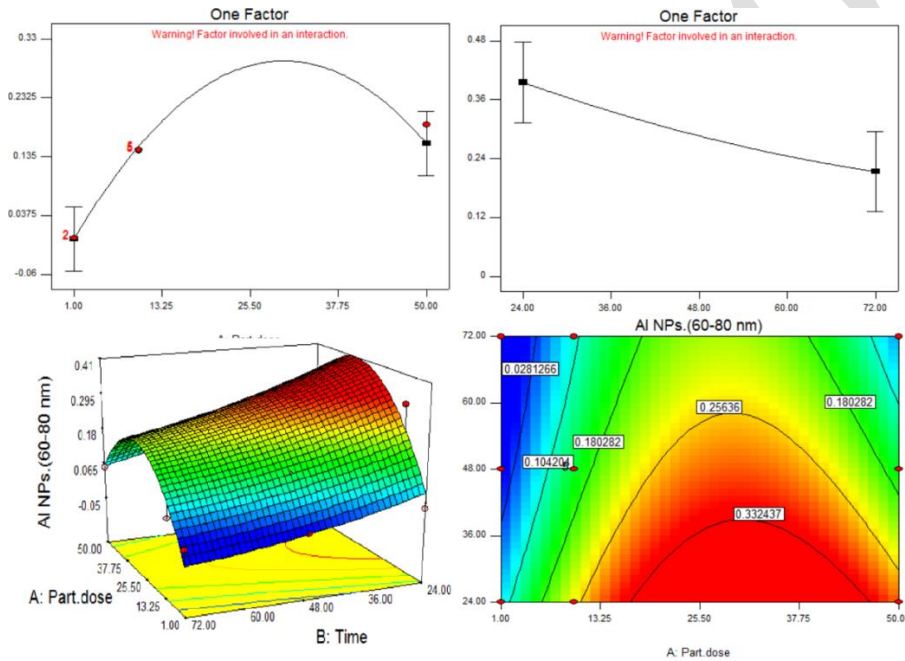


Figure 2. Statistical table for Al-NPs (60-80 nm)

As a conclusion, considering all statistical data; It was concluded that maximum effect was observed between 24-30 hours and 25 ppm adsorbance concentration was more effective. Adsorption value decreased in all NPs under periods of 24 hours and above 36 hours. Similarly, the effect was reduced when the adsorbance dose was low and too high. When all these data are considered, it is concluded that the effect changes according to NP type and size and the change is meaningful.

Intensive and possible misuse of nanoscale materials is one of the greatest threats to the environment and all living things. In this study, important results were obtained on the establishment of control mechanisms for uses of NP.

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References

- Altıntug, E., Altundag, H., Tuzen, M., Sari, A. (2017). Effective removal of methylene blue from aqueous solutions using magnetic loaded activated carbon as novel adsorbent. *Chem. Eng. Res. Des.*, 122, 151–163. <https://doi.org/10.1016/j.cherd.2017.03.035>.
- Batley, G.E., Kirby, J.K., McLaughlin, M.J. (2013). Fate and risks of nanomaterials in aquatic and terrestrial environments. *Acc. Chem. Res.*, 46, 854–862.
- Baysal, A., Saygin, H. (2018). Effect of zinc oxide nanoparticles on the trace element contents of soils. *Chem. Ecol.* 34(8), 713–726. <https://doi.org/10.1080/02757540.2018.1491556>.
- Baysal, A., Saygin, H., Ustabasi, G.S. (2019). Influence of Al₂O₃ Nanoparticles on the Soil Elements. *Bulletin of Environmental Contamination and Toxicology*, 102, 98–104, <https://doi.org/10.1007/s00128-018-2481-7>.
- Colvin, V.L. (2003). The potential environmental impact of engineered nanoparticles. *Nat. Biotechnol.* 21, 1166–1170.
- Garner, K.L., Suh, S., Lenihan, H.S., Keller, A.A. (2015). Species sensitivity distributions for engineered nanoparticles. *Environ. Sci. Technol.* 49, 5753–5759.
- Huber, D.L. (2005). Synthesis, Properties, and Applications of Iron Nanoparticles. *Small*, 1, 482–501.
- Nowack, B., Ranville, J., Diamond, S., Gallego-Urrea, J., Metcalfe, C.D., Rose, J., Horne, N., Koelmans, A.A., Klaine, S.J. (2012). Potential scenarios for nanomaterial release and subsequent alteration in the environment. *Environ. Toxicol. Chem.*, 31, 50–59.
- Vance, M.E., Kuiken, T., Vejerano, E.P., McGinnis, S.P., Hochella, M.F.Jr., Rejeski, D., Hull, M.S. (2015). Nanotechnology in the real world: Redeveloping the nanomaterial consumer products inventory. *Beilstein J. Nanotechnol.*, 6, 1769–1780.



The study of quantitative and qualitative changes of essential oil from *Smyrniun cordifolium* Boiss. in Lorestan Province

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Abstract

Smyrniun cordifolium belongs to Umbelliferae family which growing in the west and southwest of Iran and has nutritive and medicine use in the regions. Identification of chemical compositions of essential oil of *S. cordifolium* grown in different regions of Lorestan province and study effects of environmental factors on it. This plant was collected from five different regions of Lorestan province and was investigated for quantitative and qualitative changes of its essential oil. The oils were injected to GC for identification of constituents. Yields of essential oil were 0.07% to 0.55% in these different regions. The most amount of essential oil was related to Poldokhtar and the least amount to Aligodarz. In the essential oil of different regions two oxygenated sesquiterpen Curzerene and Curzerenone had the most amount. Among common and remarkable components we can mention to Germacrene-D, Isopimarol and Phyllocladanol. In Kouhdasht and Khoramabad, Curzerene was the main component with 39.4 and 34.2 percentages respectively, and in Poldokhtar, Nourabad and Aligodarz it was Curzerenone with 49.4, 33.8 and 35.6 percentages. Also, in different regions Germacrene-D is abundant in the oil. The identified components of essential oil of different regions showed the differences and similarities from quantitative and qualitative point of view. GC/MS analysis revealed that the sesquiterpen compounds were the main components in different regions. α -pinene and β -pinene were just observed in Nourabad and Aligodarz.

Keywords: Essential oil, Lorestan, *Smyrniun Cordifolium*, Curzerene, Curzerenone



Sipunculans associated with *Posidonia oceanica* (L.) Delile 1813 in Izmir Bay (Aegean Sea, Eastern Mediterranean)

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Abstract

This study deals with the sipunculan species collected on *Posidonia oceanica* samples in Izmir Bay. The faunistic analysis of 4 stations taken from 0 to 10 m depths yielded 8 sipunculan species and 249 individuals. *Phascolosoma* (*P.*) *stephensoni* is new to the *P. oceanica* fauna of Izmir Bay. The present material included one alien sipunculan species (*Aspidosiphon* (*A.*) *mexicanus*). *Aspidosiphon* (*Aspidosiphon*) *muelleri* (48.6%) is the most dominant species in the area. Three bioeroder species; *Aspidosiphon* (*Aspidosiphon*) *muelleri*, *Aspidosiphon* (*Aspidosiphon*) *misakiensis* and *Phascolosoma* (*Phascolosoma*) *stephensoni* present in *Posidonia oceanica* sheaths. Brief descriptions of all species and their distributional characteristics are given.

Keywords: *Posidonia oceanica*, Sipuncula, alien, bioeroder, Izmir Bay

Introduction

Seagrass meadows are considered among the most important marine ecosystems, for biodiversity, ecological and economic reasons (Constanza et al., 1997; Duarte and Chiscano 1999; Boudouresque et al., 2006). *Posidonia oceanica*, a seagrass species endemic to the Mediterranean Sea, extends from the surface to about 50 m depth (Pasqualini et al., 1998). It constitutes nursery grounds for the juveniles of a lot of commercially important fishes and vertebrates; provides food via the high primary production of the plants and epiphyte algae, produces oxygen via photosynthesis; controls sedimentary flows, stabilizes coastal area and protects the beaches from coastal erosion (Stoner, 1980; Orth et al., 1984; Mazzella et al., 1992; Boström et al., 2006; Bedini et al., 2011).

This meadow is known to host diversified sipuncula assemblages in the Mediterranean Sea. Prior to this study, a total of 7 sipunculan species have been reported from this meadow in Izmir Bay up to date (Açıık 2008; 2009).

The purpose of this study is to present the sipunculan species inhabiting the *P. oceanica* meadows distributed along the coasts of Izmir Bay, and to give some notes on their morphological and distributional features.

Material and Methods

Posidonia oceanica samples were collected by scuba diving from 0 to 10 m depths at 4 stations in Izmir Bay. At each station, three replicates were taken using by a quadrat of 400 cm². On field, samples were sieved through 0.5 mm mesh and the retained material was placed in separate jars containing 4% seawater-formaldehyde solution. In the laboratory, *P. oceanica* samples were rinsed in fresh water, sorted according to taxonomic groups using a stereomicroscope, and preserved in 70% ethanol. Afterwards, sipunculan species were identified and counted using both stereo- and compound microscopes. Some biometrical measurements (i.e. lengths of trunk and introvert, lengths of papillae and hooks, etc.) of the smallest and largest individuals of each species were measured using an ocular micrometer. Photographs were taken with a digital camera (Olympus, OM-D E-M5) attached to a stereomicroscope.

The number of species and individuals of sipunculans for each station and their relative abundance (RA) were calculated. The Soyer's (1970) Frequency Index (F) was used for classifying



species according to their occurrences in samples. According to this index, species with $F \geq 50\%$ are considered 'Constant', those with F between 25 and 49% are 'Common', while F values $< 25\%$ are considered as 'Rare'.

Results

The faunistic analysis of *Posidonia oceanica* samples from 0 to 10 m depths at 5 samples in Izmir Bay yielded 8 sipunculan species and 249 individuals belonging to three families. Of the species determined in the present study, *Phascolosoma (P.) stephensoni*, is new to the *P. oceanica* fauna of Izmir Bay. The present material included one alien sipunculan species (*Aspidosiphon (A.) mexicanus*). *Aspidosiphon (Aspidosiphon) muelleri* (121 specimens, 48.6% of the total populations) was the most dominant species in the area, followed by *A. (A.) misakiensis* (82 specimens, 32.9%), *P. (P.) stephensoni* (20 specimens, 8%) and *Onchnesoma steenstrupii steenstrupii* (15 specimens, 6%), *Aspidosiphon (A.) mexicanus* (6 specimens, 2.4%) and other species (5 specimens, 2.1%), respectively. According to the Soyer's (1970) frequency index (F), only *A. (A.) muelleri* and *A. (A.) misakiensis* can be classified as constant in the area.

Among stations, the highest numbers of species were found at Karaburun (5 species) and the lowest at Karantina Island. The present study included three bioeroder species; *Aspidosiphon (Aspidosiphon) muelleri*, *Aspidosiphon (Aspidosiphon) misakiensis* and *Phascolosoma (Phascolosoma) stephensoni* in *Posidonia oceanica* sheaths.

The biometrical, morphological and distributional aspects of the species are given below.

***Golfingia (Golfingia) vulgaris vulgaris* (de Blainville, 1827)**

Remarks: Skin is smooth and translucent. Cylindrical trunk is 1.5-3 mm long, 0.5-1.5 mm wide. The presence of scattered hooks (20-100 μm) and both ends of trunk with dark brown or black papillae (20-60 μm) are diagnostic characters for the species. This species was previously recorded on *P. oceanica* beds in the Aegean and Levantine coasts of Turkey (Açık 2007, 2009, 2010a, b and 2011).

Distribution: Northwest and Eastern Pacific Ocean, Northeast Atlantic Ocean, Indian Ocean, Mediterranean Sea and Red Sea (Saiz Salinas, 1993, Cutler, 1994, Açık, 2011).

***Thysanocardia procera* (Moebius, 1875)**

Remarks: Skin is smooth with fine ridges. Trunk is 1.2-2 mm long and 0.7-0.9 mm wide. The tentacle crown is simple, commonly with only eight short festoons, each with 5-10 tentacles. Tentacles surrounding the bilobed nuchal organ. The two retractor muscles are fused for much of their length and originate in the posterior third of the trunk. Contractile vessel has villi. This species was previously found on *P. oceanica* beds in Izmir Bay (Açık, 2009).

Distribution: North Atlantic Ocean and Mediterranean Sea (Saiz Salinas & Villafranca Urchegui, 1990; Açık, 2011).

***Phascolion (Phascolion) strombus strombus* (Montagu, 1804)**

Remarks: Body is semi-transparent and lightly yellowish. Trunk 1.5 mm long, 0.8 mm wide. This species is mainly distinguished from the other *Phascolion* species of the Mediterranean Sea by having the ventral retractor muscles much thinner than dorsal pairs and claw like, pointed hooks (20-35 μm long). It has distinct proteinized border on holdfast papillae. This species was previously found on *P. oceanica* beds in Izmir Bay (Açık, 2008).

Distribution: North Atlantic Ocean, Arctic Ocean, Pacific Ocean, Mediterranean Sea, Red Sea (Cutler et al., 2004; Açık, 2011) and Southwest Indian Ocean (Cutler & Cutler, 1996).



***Onchnesoma steenstrupii steenstrupii* Koren & Danielssen, 1875**

Remarks: Pear-shaped trunks (1-2 mm long), with thin introverts partially retracted (6-9 times the trunk length when everted). The surface of the trunk has small papillae and keel-like structures. Only one retractor attached at posterior part of body. This species was previously recorded on *P. oceanica* beds in the Aegean and Levantine coasts of Turkey (Açık 2007, 2008, 2009, 2010b, 2011).

Distribution: Atlantic, Western and Eastern Pacific and southwest Indian Oceans, Mediterranean Sea (Cutler 1994, Açık 2011) and Red Sea (Pancucci-Papadopoulou et al. 1999).

***Phascolosoma (Phascolosoma) stephensoni* (Stephen, 1942)**

Remarks: Body wall is opaque and light brownish. Trunk is 2-8 mm long, 0.6-1.5 mm wide. The presence of cone-like preanal (30-150 µm long) and posterior papillae (25-160 µm long), and hooks with distinct streak, triangular space and crescent (15-40 µm long) distinguish this species from other *Phascolosoma* species in the Mediterranean Sea. This species was previously recorded on *P. oceanica* beds in the Aegean and Levantine coasts of Turkey (Açık 2010a, 2010b, 2011).

Distribution: Western and northwestern Indian Ocean, eastern Atlantic Ocean, western Pacific Ocean, and Mediterranean Sea (Cutler, 1994; Açık, 2011).

***Aspidosiphon (Akrikos) mexicanus* (Murina, 1967)**

Remarks: Body wall is thin and light yellow. Trunk is 1.4-12 mm long, 0.6-3 mm wide. This species is mainly characterized by ill-defined anal shield and the presence of scattered hooks (15-30 µm long). This species was previously recorded on *P. oceanica* beds in Levantine coasts of Turkey (Açık, 2011).

Distribution: Western Atlantic Ocean, Indian Ocean and Mediterranean Sea (Pancucci-Papadopoulou et al., 1999; Açık, 2011).

***Aspidosiphon (Aspidosiphon) misakiensis* Ikeda, 1904**

Remarks: Body wall is semitransparent. Trunk is 1.5-7 mm long, 0.5-3 mm wide. It has ungrooved anal shield. Light brown bidentate hooks are present in distal rings followed by scattered unidentate hooks that are unidentate. The retractor originate close to the caudal shield. This species was previously recorded on *P. oceanica* beds in the Aegean and Levantine coasts of Turkey (Açık 2008, 2010a, 2010b, 2011).

Distribution: Pacific Ocean, eastern and western Atlantic Ocean, and Mediterranean Sea (Cutler, 1994; Açık, 2011).

***Aspidosiphon (Aspidosiphon) muelleri* Diesing, 1851**

Remarks: Body wall is thin and semitransparent. Trunk is 2-11 mm long, 0.8-2.5 mm wide. The continuous longitudinal musculature and the longitudinal grooves of the anal shield (10-12) are diagnostic characters of this species. The two retractor muscles originate from the caudal shield. This species was previously recorded on *P. oceanica* beds in the Aegean coasts of Turkey (Açık 2007, 2008, 2009).

Distribution: Northeastern Atlantic Ocean, eastern Pacific Ocean, Mediterranean Sea, Red Sea (Cutler, 1994; Açık, 2011), and Indian Ocean (Saiz Salinas, 1993a).



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References

- Açık, S. (2007). Soft bottom sipunculans in Ildir and Gerence Bays (Aegean Sea). *Rapp. Comm. int. Mer. Medit.*, 38, 409.
- Açık, S. (2008). Sipunculans along the Aegean coast of Turkey. *Zootaxa*, 1852: 21-36.
- Açık, S. (2009). Soft bottom sipunculans in Izmir Bay (Aegean Sea, eastern Mediterranean). *Zootaxa*, 2136, 40-48.
- Açık, S. (2010a). Sipunculan Fauna in the Fethiye-Göcek Specially Protected Area (Eastern Mediterranean). *Mediterranean Marine Science*, 11, 105-116.
- Açık, S. (2010b). Kuşadası Körfezi'nde (Ege Denizi) dağılım gösteren Sipuncula türleri. *Ege Üniversitesi Su Ürünleri Dergisi*, 27 (2), 91-96.
- Açık, S. (2011). Sipuncula from the southern coast of Turkey (eastern Mediterranean), with a new report for the Mediterranean Sea. *Cahiers de Biologie Marine*, 52, 313-329.
- Bedini, R., Pertusati, M., Batistini, F., & Piazzini, L. (2011). Spatial and temporal variation of motile macro-invertebrate assemblages associated with *Posidonia oceanica* meadows. *Acta Adriatica*, 52 (2), 201-214.
- Boström, C., Jackson, E.L., & Simenstad, C.A. (2006). Seagrass landscapes and their effects on associated fauna: A review. *Estuarine Coastal and Shelf Science*, 68, 383-403.
- Boudouresque, C.F., Bernard, G., & Bonhomme, P. (2006). Préservation et conservation des herbiers à *Posidonia oceanica*. Accord RaMoGe Publ. Marseille, France. 202 pp.
- Costanza, R., d'Arge, R., de Groot, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., Oneill, R.V., Paruelo, J., Raskin, R.G., Sutton, P., & van den Belt, M. (1997). The value of the world's ecosystem services and natural capital. *Nature*, 387 (6630), 253-260.
- Cutler, E.B. (1994). The Sipuncula. Their Systematics, Biology and Evolution. Comstock Publishing Associates: Ithaca. 433 pp.
- Cutler, E.B. & Cutler N.J. (1996). Sipuncula from the Indian Ocean and New Caledonia. Bulletin du Muséum National d'Histoire Naturelle, Paris 4^e série, 18, 341-365.
- Cutler, E.B., Schulze, A., & Dean, H.K. (2004). The Sipuncula of sublittoral New Zealand, with a key to all New Zealand species. *Zootaxa*, 525, 1-19.
- Duarte, C.M. & Chiscano, C.L. (1999). Seagrass biomass and production: a reassessment. *Aquatic Botany*, 65, 159-174.
- Mazzella, L., Buia, M.C., Gambi, M.C., Lorenti, M., Russo, G.F., Scipione, M.B., & Zupo, V. (1992). Plant-animal trophic relationships in the *Posidonia oceanica* ecosystem of Mediterranean Sea: a review. In: Plant-animal interactions in the marine benthos. Systematic association special volume. (Ed., D.M. John, S.J. Hawkins & J.H. Price). Clarendon press: Oxford. pp. 165-187.
- Orth, R.J., Heck, J.R., & Van Montfrans, J. (1984). Faunal communities in seagrass bed: a review of the influence of plant structure and prey characteristics on predator-prey relationships. *Estuaries*, 7, 339-350.
- Pancucci-Papadopoulou, M.A., Murina, G.V.V., & Zenetos, A. (1999). The phylum Sipuncula in the Mediterranean Sea. *Monographs on Marine Science*, 2, 1-109.
- Pasqualini, V., Pergent-Martini, C., Clabaut, P., & Pergent, G. (1998). Mapping of *Posidonia oceanica* using aerial photographs and side scan sonar: Application off the island of Corsica (France). *Estuarine, Coastal and Shelf Science*, 47(3), 359-367.
- Saiz Salinas, J.I. (1993). Sipuncula from Réunion Island (Indian Ocean). *Journal of Natural History*, 27: 535-555.
- Saiz Salinas, J.I. & Villafranca Urchegui, L. (1990). Sipuncula from the Alboran Sea and Ibero-Moroccan Bay. *Journal of Natural History*, 24, 1143-1177.



- Soyer, J. (1970). Bionomie benthique du plateau continental de la cote catalana Française. III: Les peuplements de Copepodes Harpacticoides (Crustacea). *Vie Milieu*, 21, 377-511.
- Stoner, A.W. (1980). The role of seagrass biomass in the organization of benthic macrofaunal assemblages. *The Bulletin of Marine Science*, 30, 537-551.

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The importance of Sipuncula species in marine ecosystems

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Abstract

In marine ecosystems, sipunculans play important roles in bioerosion on calcareous habitats, as components of the diet of many fishes and invertebrates, as bioturbators and active burrowers in sediments, and as transformers of particulate food (algae, protista, meiofauna, detritus, fecal pellets) from the water column, sediment-water interface or sediments. Human consumption of sipunculans is not widespread, but there are reports of people in the Indo-West Pacific eating sipunculan specimens.

Keywords: Sipuncula, marine ecosystem, bioerosion, food source, consumption.

Introduction

Sipuncula is a group of unsegmented, coelomate, bilaterally symmetrical and worm-like invertebrates, widely distributed in the world's oceans, from intertidal to abyssal depths (Cutler, 1994). The phylum has almost 150 species world-wide and 36 species in the Mediterranean Sea (Cutler, 1994; Ferrero-Vicente et al., 2016b).

The body of sipunculan consists of two parts; a trunk and more slender retractable introvert. The shape of trunk varies from a slender cylinder, to spindle and flask shaped, to almost spherical. The mouth is located at the anterior of the introvert and is usually wholly and partly surrounded by a group of tentacles or by a tentacular fold. They have a variety of epidermal structures such as papillae, hooks and shields. A long alimentary canal lies within a large coelom. The anus is usually situated at the anterior end of the trunk.

In this study, the importance of sipuncula species in marine ecosystems is given.

Results

Sipunculans are of great importance in marine ecosystems:

Bioeroder features

Bioerosion is the degradation of substrates as a consequence of the drilling and abrasive actions of various marine organisms caused on the calcareous substrates (Neumann, 1966). A wide variety of borers such as microalgae, fungi, sponges, molluscs, polychaetes and sipunculans took part in this phenomenon (Hutchings, 1986), which often results in a honeycombed structure. Bioeroder species may cause losses of the habitats due to the boring rocks and coral reefs (Peyrot-Clausade et al., 1992; Schönberg, 2002b). Sipunculans play an important role in bioerosion of calcareous habitats and rocks (Cutler, 1968; Peyrot-Clausade et al., 1992). The bioerosion process of sipuncula species apparently combines the secretion of acidic fluids in the mucus to loosen the crystals with mechanical abrasion to remove the dislodged units (Williams and Margolis, 1974; Rice and MacIntyre, 1972). Sipuncula species has long, extensible introverts and short, digitiform tentacles feed by extending the introvert from the mouth of the burrow, grazing the surface of the surrounding environment (Rice, 1976).

Some species of *Aspidosiphon*, *Lithacrosiphon* and *Phascolosoma* are bio-eroders and cause habitat changes, especially in calcareous habitats such as coral reefs (Peyrot-Clausade et al. 1992). In the northern Gulf of California the bioerosion community, which includes sipunculans, erodes calcareous rocks at a rate of about 0.3 m/1000 years (Stearly and Ekdale, 1989).



Obtaining Energy

Sipunculans represent all forms of feeding habits from filter feeding to predator (Cutler, 1994). *Themiste* species are ciliary-mucus filter feeders, and have elaborated, branched tentacular crowns (Pilger, 1982). Sipunculans can make tunnels through the sand, and collect sand, detritus, diatoms and smaller invertebrates that fall into tunnels with their tentacular crown.

The introvert of *Golfingia*, *Onchnesoma*, some *Nephasoma* and *Antillesoma* species extends out of the burrow and explores the surrounding sediments, collecting additional material from the surface layer including some sand, shell fragments, bits of coral (Cutler, 1994).

The study on feeding behaviors of *Golfingia* (*G.*) *elongata*, *Golfingia* (*G.*) *vulgaris* and *Phascolosoma* (*P.*) *granulatum* from Swedish fjords and off southern France indicated that they fed especially on crustaceans (mainly copepods) and nematodes (Walter, 1973).

Some species of *Phascolion*, *Aspidosiphon*, *Nephasoma* and *Apionsoma* often have reduced tentacular crowns. They use the mucus secreted by the rich array of glands of the introvert and pick up particulate matter from the surface of the sediment (Cutler, 1994).

Coral and rock-dwelling species belonging to genera *Phascolosoma*, *Lithacrosiphon*, *Cloeosiphon* and *Aspidosiphon* scrape and collect algae, small invertebrates and detritus from the surrounding sediment with their curved hooks of the introvert.

Sources of Energy

Sipunculans may have a significant role as a food source for higher trophic levels (Kedra and Wlodarska-Kowalczyk, 2008). They are consumed by fish species belonging to genera Gerridae, Labridae, Sparidae, Mullidae, Pomadasyidae and *Mustelus* (Kohn, 1975). They are also eaten by gastropods (Mitridae), anemones (*Sagartia* sp.), decapod crustaceans (*Carcinus maenas*), starfish and cephalopods (Kohn, 1975; Taylor, 1989).

Human consumption of sipunculans is not widespread but there are reports of people in the Indo-West Pacific eating sipunculans belonging to genera *Sipunculus*, *Siphonosoma* and *Phascolosoma* (Murina *et al.* 1999).

Symbiotic Relationships

In the Indo-west Pacific region, juvenile specimens of *Aspidosiphon* (*A.*) *muelleri* move into empty gastropod shells for shelter. Planula larvae of solitary corals in the genera *Heteropsammia* and *Heterocyathus* settle on the outside of the occupied shells. Then, the coral overgrows and absorbs the shell's material into its own tissue, but the sipuncula continues to exit within the coral. The sipuncula species benefits from this relationship by having a portable shelter. The coral benefits by being kept upright (Cutler, 1994).

Body surfaces of sipunculans provide a suitable area to which smaller metazoans can attach. The hydroid (*Perigonimus repens*, *Podocoryne carnea*, *Perigonimus* sp.), bryozoon (*Triticella pedicellata*) and entoproct species (*Loxosomella murmanica*, *L atkinsae*, *Loxosomella* sp.) was previously reported on trunks of *Phascolion* (*P.*) *strombus* and *Golfingia* (*G.*) *muricaudata* (Hylleberg, 1970; Cutler, 1994; Açıık, 2011).

In addition, some bivalv species attach to the body of the sipuncula species by their byssus. The bivalv species, *Tellimya phascolionis* (Dautzenberg & Fischer, 1925) was found on the trunk of *Phascolion* (*P.*) *strombus* (Troncoso *et al.*, 2000).

References

- Açıık, S. (2011). Sipuncula from the southern coast of Turkey (eastern Mediterranean), with a new report for the Mediterranean Sea. *Cahiers de Biologie Marine*, 52, 313-329.
- Cutler, E.B. (1968). A review of coral-inhabiting Sipuncula. *Extrait des Cahiers ORSTOM. Oceanographie*, 3, 51-63.
- Cutler, E.B. (1994). *The Sipuncula: their systematics, biology and evolution*. Ithaca, NY: Comstock Publishing Associates.
- Dautzenberg, P.H. & Fischer, P. H. (1925): Les mollusques marins du Finistere et en particulier de la region de Roscoff. *Travaux de la station biologique de Roscoff*, 3, 1-180.



- Hutchings, P.A. (1986). Biological destruction of coral reefs. A review, *Coral Reefs*, 4, 239-252.
- Hylleberg, J. (1975). On the ecology of the sipunculan *Phascolion strombi* (Montagu). In: *Proceedings of the international symposium on the biology of the Sipuncula and Echiura* (M.E. Rice & M. Todorovic eds), pp. 241-250. Naučno Delo Press, Belgrade.
- Ferrero-Vicente, L.M., Saiz-Salinas, J.I., Açık, S. & Sanchez-Lizaso, J.L. (2016). Guide to the Mediterranean sipunculans. Publicacions Universitat D'Alacant.
- Kedra, M. & Włodarska-Kowalczyk, M. (2008). Distribution and diversity of sipunculan fauna in high Arctic fjords (west Svalbard). *Polar Biology*, 31, 1181-1190.
- Kohn A.J. (1975). Predation on sipunculans. In: *Proceedings of the International Symposium on the Biology of the Sipuncula and Echiura* (M.E. Rice & T. Todorovis eds), pp. 313-334. Naučno Delo Press: Belgrade.
- Murina, GVV. (1984) Ecology of Sipuncula, *Marine Ecology Progress Series*, 17 (1), 1-7.
- Murina G.V.V., Pancucci-Papadopoulou, M.A. & Zenetos A. (1999). The phylum Sipuncula in the eastern Mediterranean: composition, ecology, zoogeography. *Journal of the Marine Biological Association of the United Kingdom*, 79, 821-830.
- Neumann, A.C. (1966). Observations on coastal erosion in Bermuda and measurements of the boring rate of the sponge. *Limnology and Oceanography*, 11, 92-108.
- Peyrot-Clausade, M., Hutchings, P. & Richard, G. (1992). Temporal variations of macroborers in massive *Porites lobata* on Moorea, French Polynesia, *Coral Reefs*, 11(3): 161-166.
- Pilger, J.F. (1982). Infrastructure of the Tentacles of *Themiste lageniformis* (Sipuncula). *Zoomorphology*, 100, 143-156.
- Rice, M.E. & Macintyre, I.G. (1972). A preliminary study of sipunculan burrows in rock thin-sections, *Caribbean Journal of Science*, 12, 41-44.
- Rice, M.E. (1976). Sipunculans associated with coral communities, *Micronesica*, 12, 119-132.
- Romero-Wetzel, M.B. (1987). Sipunculans as inhabitants of very deep, narrow burrows in deep-sea sediments. *Marine Biology*, 96, 87-91.
- Schönberg, C.H.L (2002). Sponges of the “*Cliona viridis* complex”- a key for species identification. *Proc. 9th Int. Coral Reef Symp.*, Bali, pp: 295-299.
- Stearley, R.F. & Ekdale, A.A. (1989). Modern marine bioerosion by macroinvertebrates, Northern Gulf of California. *Palaios*, 4, 453-467.
- Taylor, J.D. (1989). The diet of coral-reef Mitridae (Gastropoda) from Guam; with a review of other species of the family. *Journal of Natural History*, 23, 261-278.
- Troncoso, N., Moreira, J. & Troncoso, J. S. (2000). *Tellimya phascolionis* (Dautzenberg & Fischer, 1925) (Bivalvia, Montacutidae) and other fauna associated with the sipunculid *Phascolion strombi* (Montagu, 1804) in the Ría de Aldán (Galicia, NW Península Ibérica). *Argonauta*, XIV (1), 59-66.
- Walter MD (1973) FreBverhalten und Darminhallsuntersuchungen hei Sipunculiden. *Helgolaender Wiss Meersunters*, 25, 486-494
- Williams, J.A. & Margolis, S.V. (1974). Sipunculid burrows in coral reef: evidence for chemical and mechanical excavation. *Pacific Science*, 28, 357-359.



Determination of some species of invertebrate on mussel culture units in Balıkhlova, İzmir Bay

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Abstract

This study was conducted to determine biodiversity such as Mollusca, Arthropod and Echinodermata species on mussel culture unit in Balıkhlova, İzmir Bay, Turkey. Samples were collected from four materials which are main float, main rope, pipe float and rope collector in the culture area. The most abundant species diversity in the samples was belong to Bivalve Classis. In addition to this, amphipods were found all materials and in contrast sea urchin, *Paracentrotus lividus*, was determined only rope collector.

Keywords: Mussel culture units, biodiversity, İzmir Bay, Turkey

Introduction

Mussel culture floating systems provide habitats for some sessile organisms such as polychaetes, amphipods, small crabs, gastropods and other bivalve species. These epibionts can negatively affect mussel development (growth and survival rate) due to competition for space and food. Fouling organisms can cover the shells and block filtration. Therefore, growth rate of mussel may reduce and harvested time may lengthen out. Furthermore, mussels can fall off the culture ropes due to the weight increase and resulting in decreased productivity (Arakawa, 1990; Enright, 1993; Freitas, 1997; Serdar et al., 2012). On the other hand, these fouling organisms may form attractive microhabitats or some macroinvertebrates for a great number of species such as fish, shrimps and lobsters, which have commercial value (Souza-Conceição et al., 2003; Morrissey et al., 2006; Serdar et al., 2012). At the same time, this situation provide food and shelter against predators for commercial value species. The aim of this study to determine some macroinvertebrate community around mussel culture area one year later after establishment floating system.

Material and Methods

This study was conducted between March 2019 to August 2019 at mussel farm units which are one year later after establishment in Balıkhlova where located in South-western coast of İzmir Bay (Fig. 1.). The goal of this study was to determine macro-invertebrates, settled different parts of mussel culture units such as rope collector, main rope, pipe float and main float.

During samplings, scuba and skin divers collected macro invertebrates by scratching from mussel culture system. The specimens were fixed 5% formaldehyde solution. Also visual census method with GoPRO Hero4 black edition was used in sampling site. Species and their abundance were identified both during monitoring and in laboratory (Fig. 2, Fig. 3).



Figure 1. Map of the study area



Figure 2. Underwater scene from mussel culture units



Figure 3. Classification of sampling materials in laboratory

Results

As a result, totally 16 macroinvertebrate species were determined. Seven species belongs to Bivalvia and 1 species in gastropoda. Six species belongs to Crustacea and 1 species was found in Echinodermata. There was a 1 species from Annelida in sampling materials. *Mytilus galloprovincialis*, *Balanus* sp. and *Hyperia galba* were determined in all sampling units (Fig. 4 and Table 1).

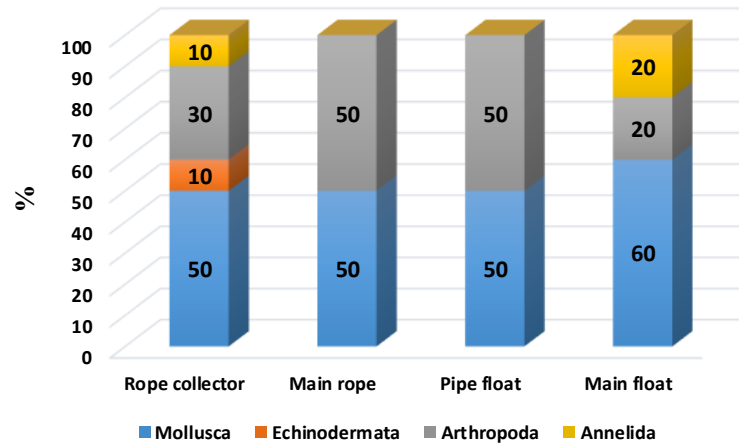


Figure 4. Distribution of phylums according to mussel culture units.

While 10 species were found in rope collector and main rope, 4 species were recorded in pipe float and 6 species were observed in main float.

Table 1. List of the species in different sampling materials

	Rope collector	Main rope	Pipe float	Main float
Mollusca				
Bivalvia				
<i>Mytilus galloprovincialis</i>	+	+	+	+
<i>Pinctada radiata</i>	+	-	-	+
<i>Ostrea edulis</i>	+	+	-	+
<i>Anomia ephippium</i>	+	+	-	-
<i>Chlamys varia</i>	+	-	-	-
<i>Modiolus barbatus</i>	-	+	-	-
<i>Lima</i> sp.	-	+	-	-
Gastropoda				
<i>Patella</i> sp.	-	-	+	-
Echinodermata				
Echinoidea				
<i>Paracentrotus lividus</i>	+	-	-	-
Arthropoda				
Crustacea				
<i>Penaeus elegans</i>	-	+	-	-
<i>Hyperia galba</i>	+	+	+	+
<i>Balanus</i> sp.	+	+	+	+
<i>Liocarcinus</i> sp	+	-	-	-
<i>Pilumnus hirtellus</i>	-	+	-	-
<i>Pisidia bluteli</i>	-	+	-	-
Annelida				
Clitellata				
<i>Tubificoides</i> sp.	+	-	-	+



Discussion

Mussel farms as a commercial size have been increasing day by day in Turkey coasts. Mussel production become a popular activity from spat collection to the harvesting stage for investments. Furthermore, this kind of units are one of the most important new habitats in the marine ecosystem that provides habitat for many species. Large amount of epifauna associated with the mussel ropes provides a food resource for the benthic communities (Tenore and Gonzalez, 1976; Ulas et al., 2014; Serdar and Yıldırım, 2018). Our results showed similar findings as Freitas (1997) and Monteiro and Silva (1995). They reported that barnacle and oysters except for mussel in culture area. It should also be considered that this fouling community may form attractive microhabitats for a great number of species with a commercial value (fish, shrimps and lobsters) (Souza-Conceição et al., 2003). Mussel farms offer new areas for small-scale fishing as well as increased biodiversity. This situation alleviates the stress of the regions where fishing pressure is intense. At the same time, fish farms are preferred as suitable regions for recreational fishing activities.

References

- Arakawa, K. Y. 1990. Competitors and fouling organisms in the hanging culture of the Pacific oyster, *Crassostrea gigas* (Thunberg). *Mar. Behav. Physiol.*, 17:67-94.
- Enright, C.; Krailo, D.; Staples, L.; Smith, M.; Vaughan, C.; Ward, D.; Gaul, P. & Borgese, E. 1983. Biological control of fouling algae in oyster aquaculture. *J. Shellfish Res.*, 3:41-44.
- Freitas, M. 1997. Incrustações biológicas no mexilhão *Perna perna* (Mollusca, Bivalvia), cultivado na Ilha de Ratonas, SC: efeito da exposição ao ar. Dissertação de Mestrado em Aquicultura. Universidade Federal de Santa Catarina, Brasil. 231 p.
- Monteiro, L. P., Silva, S. H. G. 1995. Influência da exposição ao ar sobre a epifauna, crescimento e índice de condição do mexilhão *Perna perna*, na Baía da Guanabara, Rio de Janeiro, Brasil. *Publção esp. Inst. Oceanogr.*, S Paulo, 11:115-121.
- Morrisey, D. J.; Cole, R. G.; Davey, N. K.; Handley, S. J. Bradley, A.; Brown, S. N. & Madarasz, A. L. 2006. Abundance and diversity of fish on mussel farms in New Zealand. *Aquaculture*, 252:277-288.
- Serdar, S., Lök, A., Küçükdermenci, A., Kırtık, A., Yiğitkurt, S. 2012. Relationship between bivalve culture and coastal ecosystem. *Türkiye'nin Kıyı ve Deniz Alanları IX. Ulusal Kongresi 14- 17 Kasım 2012, Hatay* (in Turkish).
- Serdar S., Yıldırım Ş. 2018 An Increasing Trend in Turkey: Mussel Culture. *The 2nd International Fisheries Symposium, Girne, Kuzey Kıbrıs Türk Cumhuriyeti, 4-8 Kasım 2018*, pp.106-107
- Souza-Conceição, J. M.; Castro-Silva, M. A.; Huergo, G. P. C. M.; Soares, G. S.; Marenzi, A. C. & Manzonì, G. C. 2003. Associação da ictiofauna capturada através de rede de emalhe com o cultivo de mexilhões da Enseada de Armação do Itapocoroy, em Penha (Santa Catarina – Brasil). *Bolm Inst. Pesca*, S Paulo, 29:117-121.
- Tenore, K. R., Gonzalez, N. : Food chain patterns in the Ria de Arosa, Spain: an intense mussel aquaculture. *Proc. 10th Eur. mar. Biol. Syrup.* 2, 601-619 (1976). Ed. by G. Persoone and E. Jaspers. Wetteren, Belgium: Universa Press.
- Ulaş, A., Serdar, S., Aydın, İ., Turan, G., Yıldırım, Ş., Akbilgiç, E. 2016. Determination of Some Algae and Macroinvertebrates Settled on Aquaculture cage Units in Izmir Bay (Eastern Coast of Aegean Sea). *International Symposium on Fisheries and Aquatic Science (FABA)*, 3-5 November 2016, Antalya, Turkey.



The Effect of Remote Monitoring Methods in the Fight Against Marine Pollution

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Abstract

There is a growing concern about the state of the World's oceans. The rapid growth of human populations in coastal regions has led to increasing dependence on marine resources. The need for basic energy sources is increasing day by day. Petroleum is the most widely used one of these energy sources. The transport of oil on earth is mainly by sea. Since the seas are the common area of the whole world, the fight against pollution is quite difficult. It is an important criteria to detect and intervene pollutant as soon as the leakage starts into the marine environment. The earlier the pollutants are detected, the more effective the fight against them. Traditional detection methods are far from meeting this need. Therefore, remote sensing technology has been used more and more widely in pollutant source detection. Widespread and effective use of remote sensing methods will increase the success of the fight against marine pollution.

Keywords: Remote monitoring, Sea water, Sea pollution, Oil pollution

Introduction

Obtain information about physical and spatial properties of the remote sensing objects without using physical touches, usually by using satellite images; and spatial and qualitative perception of objects (Jensen, 2005). Remote sensing methods are ideal for scanning hard-to-reach areas or for detecting hazardous waste discharges. Other advantages are high speed, wide monitoring range, continuous monitoring and no time constraints.

In the 1960s, remote sensing technology, which was first started to gather intelligence with spy satellites. Later that technology has been used for civilian purposes through the Landsat series of satellites developed by the United States since the 1970s. Landsat-1, the first earth observation satellite for civilian purposes, was placed in orbit by the American Space Center on July 23, 1972 (Kavzoğlu, 2019).

The use of remote sensing technology comes to Turkey quite late. The high-resolution domestic reconnaissance satellite GÖKTÜRK-2 was launched into orbit in 2012.

The ultimate goal of all kinds of environmental monitoring is to protect the environment and human health. It is also preferred in the field of hydrology. Used for water quality analysis, flood mapping, inland water pollution monitoring, ship waste and pollution, ice melting and movement monitoring.

Monitoring provides the information necessary to assess pollution mitigation actions. The systematic storage of data in specific areas has a significant role in the prevention of pollution. It also supports early warning systems that provide low-cost solutions to environmental problems.

The explosion at oil rig on the Gulf of Mexico on April 20, 2010, led to one of the largest environmental disasters in the world (Kavzoğlu, 2019). This event has once again highlighted the importance of early warning systems in reducing the impact of environmental disasters.



Figure 1. Oil spill in the Gulf of Mexico

Optical monitoring or artificial aperture radars can be used to detect oil contamination via satellites. Artificial aperture radar systems can capture images independent of cloud and lighting conditions. However, it takes time for the satellite to re-pass through the same point and the processing the data is also time consuming. Therefore, in the real world practice, the most reliable results are obtained by using satellite images and air vehicles together.

Turkey's straits (Bosphorus and Dardanel) are the most important transport route of Asian oil. Therefore, density of maritime traffic in these straits brings the high risk of leakage. If controls are not performed with sufficient frequency and accuracy, deterrence will be insufficient.

Material and Methods

From the past to the present, the development of remote sensing and its use for the prevention of marine pollution have been searched in the literature.

With the help of the compiled information, it has been proved that the use of the method should become more widespread, especially in our country.

Results

European Maritime Safety Agency (EMSA) offered by the "Clean Sea Net" service to Turkey in 2011, receiving the status of a candidate country to the European Union. This system, which is based in Portugal, detects abnormalities seen in the marine environment with the help of photographs taken from the satellites leased at certain times. Pollution source vessels can be found in the automatic identification system. This information is reported within 30 minutes. It is delivered by mail to the country concerned. Transmitting information to Turkey results Coast Guard deployment. If the criminal offense is found as a result of the audit, the penalty is applied. According to the statement made by the Ministry, knowing the existence of this system was a deterrent and reduced the denunciations.

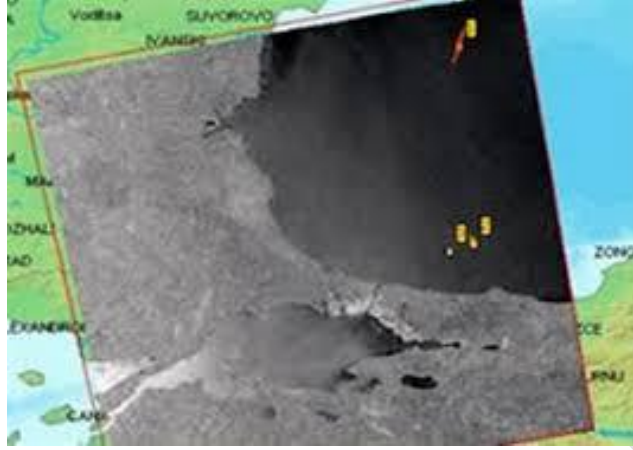


Figure 2. Sea clean net (Denizhaber, 2019)

As a result, the low number of satellites in our country, the limited financial resources for investment and the inability to make our own satellites cause us to be dependent on foreign sources. All these reasons prevent the spread use of remote sensing systems in our country.

It should be remembered that the main purpose in the fight against pollution is to prevent pollution at its source. The development and use of new techniques to ensure this is a requirement of our time. Increasing share of all countries in the world is inevitable for the protection of the common areas of the seas. Sea pollution cannot be prevented by boundary lines. The only solution is to work together.

References

- Jensen, J. R. (2005). *Digital Image Processing: A remote Sensing Perspective*. Second edition. Prentice-Hall: Upper Saddle River, N.J.
- Kavzođlu, T. And ölkesen, İ. (2019). www.gtu.edu.tr
(http://www.gtu.edu.tr/Files/UserFiles/80/jeodezi/yayinlar/pdf/kavzoglu_Colkesen_Calistay.pdf)
<https://www.denizhaber.net/clean-sea-net-hizmeti-devreye-alindi-haber-32163.htm>



Analysis and Comparison of Risk Factors in the Installation and Design of Potable Water Treatment Plants

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Abstract

The design of treatment plants should be made considering engineering, economic, energy and environmental factors. All possible alternatives should be considered. In this study, the importance of site selection of drinking water treatment plants, which is an indispensable requirement of today's urban life, is explained by supporting the literature. In addition, the current practices in the USA are presented with information compiled from the reports and compared with the practices in our country. The aim is to contribute to the sustainability of environmental awareness while meeting the changing and increasing needs in the new city life. This is done by comparing the different examples, offering alternatives. The study was carried out using literature. Treatment Plant Process Specification prepared by ILBANK Incorporated Company, Technical Specification of Drinking Water Facilities, Water Supply and Treatment Directive of American Military and Air Force, Reports on Drinking Water Supply Criteria of Colorado State etc. are used as sources. The way that the water resources we use in city life has reached us must be known and consumption should be monitored consciously. Even though there is a treatment plant in operation, every production has a waste. The important point is to achieve a minimum level of potentially harmful output. In doing so, it is necessary to be predictive of site selection at the installation stage and act with the worst scenario in mind.

Keywords: Water treatment, site selection, natural resource, waste water

Introduction

The ambition of people to make room for themselves in nature has brought environmental pollution. Nature's renewable capacity has been largely exceeded. This situation has increased the rate of increased the rate of pollution. (Şener, 2016)

Water is indispensable for the sustainability of life. It is also a serious mistake to think that water is an endless source. It is also impossible to replace the depleted water resources.

The depletion of water resources is a global problem. It requires a total struggle. Both water consumption and wastewater policies of countries need to be determined in the long term. It is indisputable that wastewater treatment should be given due importance in order to use water resources efficiently. Treated wastewater can be used in areas such as irrigation of agricultural areas, landscape applications, industrial use, cooling water for power plants and refineries, and construction activities. Thus, clean water resources will be used efficiently. According to Turkish Statistical Institute data, in 2001 there were 126 waste water treatment plants and 113 drinking and potable water treatment plants, while in 2016 this number was updated to 881 for waste water treatment plants and 516 for drinking and potable water treatment plants. Graph 1 shows the increase over the years.

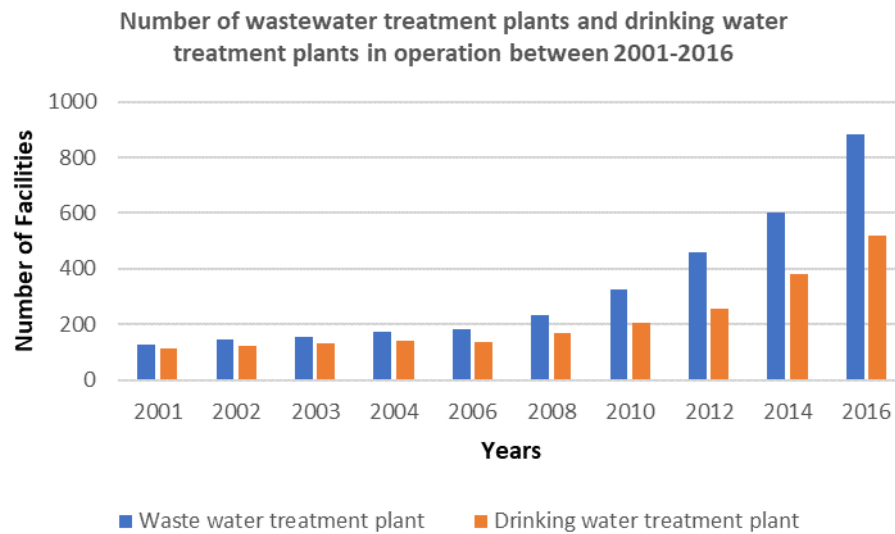


Figure 1. Number of wastewater treatment plants and drinking water treatment plants in operation between 2001-2016

This increase in visible speed inevitably brings to mind the positive aspects of these facilities as well as the fact that they may cause environmental damage. In order to detect and minimize potential negativities, locating and determining the technologies to be used have become even more important. When determining the drinking water treatment plant area, according to the Ministry of Agriculture and Forestry, considering the geological and topographic structure of the land, it should be in a position that requires the lowest level of energy use, providing the most economical and most comfortable use. (Web, 1)

12 evaluation criteria supporting this are included in the design and operation principles of water treatment plants. These Articles are listed below:

1. Is the area to be selected within special protected areas?
2. Is it a residential area that can be purchased in sufficient quantities and at reasonable prices?
3. Physical characteristics of the settlement area; Are there difficult and expensive problems to solve in terms of topography, drainage, groundwater and basic ground conditions (landslides, fault lines etc.)?
4. Are there energy supply facilities available?
5. Are there adequate transportation facilities for the supply of construction materials and materials during the construction and for the supply of chemicals after the plant is put into operation?
6. Are there any facilities for the treatment plant wastes to be disposed of in an environmentally friendly manner?
7. Does the facility have any social expropriation problems?
8. Is it located outside the natural drainage lines (river-stream bed) of the settlement site?
9. Is it close to the settlements in terms of supply of operation and maintenance personnel?
10. Are there areas that allow the raw water to come to the treatment plant by gravity and to be conveyed from the treatment plant to the city depots again using it?
11. Has the location been selected to decrease the length of the transport line as much as possible?
12. Is the site open to expansion if needed in the future?



This deficiency has been tried to be solved by regulating the necessity of preparing EIA report. First mentioned in the Environmental Impact Assessment Regulation published in the Official Newspaper No. 23028 in 1997. The last amendment was made in the Official Newspaper dated 25.11.2014 and numbered 29186. Accordingly: Selection criteria are applied to wastewater treatment plants with a capacity of 50000-150000 equivalent persons and / or 10000-30000 m³ / day. Wastewater treatment plants with a capacity of 150000 equivalent persons and / or over 30000 m³ are projects to be implemented in EIA.

In connection with water treatment plant location and design, the disposal of the wastes generated during the various treatment processes must receive careful consideration. Among these wastes are sludge from presedimentation basins, coalugation and/or softening sludge, filter wash water, spent regenerant and rinse water from ion-exchange softeners, diatomite filter sludge, and mineral wastes from desalination facilities. (ARMY TM, 1985)

Odor is the most frequently mentioned environmental damage caused by water treatment plants. The reason for this is that people who live around the facility express it. Because the smell is a condition that bothers people from the moment they appear. Many of the other effects manifest over time. It takes time to be noticed.

In any place where wastewater is delivered or collected, the gases produced by the biological decomposition of organic substances or chemicals that come with the wastewater cause odor. Although it is possible to reduce the odor by physical, chemical and biological methods, it cannot be completely eliminated. (Kara, 2018)

In drinking water treatment plants, treatment process results in a gel-like sludge as waste. This sludge should be properly evaluated since it is not normally found in nature. Otherwise, an environmentally hazardous situation may be encountered. (Arslan, 2005)

Water treatment plants can have negative impacts not only during operation but also during installation. Failure to select the installation site correctly may disturb all living things, including people living in the area. It may disrupt the natural structure. Heavy vehicles used for transporting material to the site during construction, roads opened for them, noise, dust emitted can be mentioned among the negative effects. The EIA process is very important to consider all these possibilities. It should be carried out with the required precision and transparency.

Clean Production Concept

The concept of clean production is defined by the United Nations Environment Program (UNEP) as “reducing the risks to humans and the environment through the continuous application of an integrated and preventive environmental strategy to products and processes”.

Contrary to the “pollution control” approach, which tries to eliminate environmental problems, “clean production” approaches should be included in the planning processes as a parameter during the design of any human activity. As of 2011, clean production technologies started to be supported in our country. Clean water can be disseminated in water treatment plants by encouraging the use of low energy consumption and high efficiency equipment. (Çakmakçı, 2014)

Impact of The European Union Process

In our country, the process of water treatment systems has accelerated with the effort to harmonize with the European Union. The point of view of the European Community is that the damage caused by the lack of attention to treatment in any member state affects all member states. For this reason, they published a council directive consisting of 20 articles and 3 appendices. Member countries have been obliged to make regulations and inform the commission in line with these decisions. (Web, 2)

US Case in Water Treatment Plants



In an article written by Rosanne Rible during her visits to and treatment in Washington in 2012, we see similar environmental problems, including the largest waste water treatment plant in the world. Blue Plains is the largest wastewater treatment plant in the world. Here, an average of 1.4 billion liters of water is treated daily. We understand from Rible's interview that in this system, microbes in the shredders break organic matter into pieces and convert it into methane gas. This gas is used in turbines that generate electricity. The remaining solid wastes are nutritious and marketed as fertilizer. This project is worth about \$ 4 billion. (Rible, 2012)

In the US, training of the operator of the treatment plant is very important. This training is provided by the Water Environment Federation. At the end of the training, an exam and certificate is given. (Samsunlu, 2003) Environmental engineers who work in these facilities must be trained especially about treatment plants.

For example, the report for the state of Colorado was examined. As stated in the report, 10 different working groups have already carried out benchmark development studies. It was stated that studies were carried out with the same sensitivity in order to keep the document up-to-date and that the authorities were informed about the developments every three months. (CDPHE, 2013)

Conclusion

Turkey has also visible increase in the number of water treatment plants as well as all over the world. The most important reason for this is the realization that natural resources are changing inversely with the increase in the number of people. Water is an indispensable source of life for all living things. The increasing number of water treatment plants brought about various environmental problems. In Europe, in America and in Turkey we tried to compare his attitude towards this problem and solution methods. Turkey has limited financial resources they can use for the installation and operation of these facilities. Therefore, research and development and following the developed countries practices are very important. The odor, waste sludge, washing water and similar substances emitted from the treatment plants to the environment inevitably both disturb people and other environmental elements. For this purpose, during installation, first of all, the easy operation of the plant should be taken into consideration as well as the discomfort that may be given around. While preparing EIA reports, solutions should be developed by producing different ideas with wider working groups.

Practices in the world should be monitored simultaneously and the fact that we now have to spend most of our material resources for the purpose of protecting natural resources should not be forgotten.

References

- Army TM. (1985). Water Supply, Water Treatment, ARMY TM 5-813-3 AIR FORCE AFM 88-10 vol.3, 16 September 1985 Department of the Army and the Air Force.
- Arslan, G. & Atakol, O. (2005). *Şehir İçme Suyu Arıtma Tesislerinde Çamur Atıklarının Değerlendirme Yollarının Araştırılması*. Selçuk Üniversitesi Fen Fakültesi Fen Dergisi, 1 (25), 73-78. Retrieved from <https://dergipark.org.tr/tr/pub/sufefd/issue/23134/247130>
- CDPHE. (2013). Colorado Department of Public Health and Environment, State of Colorado Design Criteria for Potable Water Systems, Water Quality Control Division Safe Drinking Water Program Implementation Policy #5 Effective September 1, 2013.
- Çakmakçı, M., Özkaya, B., Yetilmezsoy, K. & Demir, S. (2013). *Su arıtma tesislerinin tasarım ve işletme esasları*. Orman ve Su İşleri Bakanlığı Su Yönetimi Genel Müdürlüğü. Accessed: 2019.08.15.
- Kara, G., Akbulut, Z. & Toprak, A.N. (2018). *Türkiye'deki Atıksu Arıtma Tesislerinde Koku Problemleri*. Ulusal Çevre Bilimleri Araştırma Dergisi, 1 (4), 185-188. Retrieved from <https://dergipark.org.tr/tr/pub/ucbad/issue/41073/496430>
- Kentsel Atıksu Arıtması Hakkında 21 Mayıs 1991 tarih ve 91/271/EEC Sayılı Konsey Direktifi. [https://www.tarimorman.gov.tr/SYGM/Belgeler/ab%20mevzuatı/Kentsel%20Atıksu%20\(4\)](https://www.tarimorman.gov.tr/SYGM/Belgeler/ab%20mevzuatı/Kentsel%20Atıksu%20(4))



- Rible, R. (2012). Retrieved from www.amerikaninsesi/a/su-aritma-tesislerinin-yer-rolu/1543734.html
- Samsunlu, A. (2003). *Arıtma tesisleri kurulması işletilmesi ve eleman eğitimi, Ataköy Atıksu Arıtma Tesisi örneği*. V. Ulusal Çevre Müh. Kongresi.
- Şener, G. & Olhan, E. (2016). *The Environmental social and economic impact of wastewater treatment plants on rural areas*. Tarım Ekonomisi Dergisi, 22 (2), 9-16. Retrieved from <http://journal.tarekoder.org/en/issue/28531/304260>

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Distribution of the Genus *Garra* Hamilton, 1822 in Anatolia

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Abstract

The species belong to genus *Garra* in Anatolia were reviewed. Fish were collected with elektro-shock device between 2004-2019. Two valid species in *Garra* (*G. rufa* and *G. variabilis*) were recorded in Anatolia. Recently, *G. turcica* have been accepted as a valid species. On the other hand, molecular data reveal the genus *Hemigrammocapoeta*, which represented by five species in Anatolia, is synonym of the genus *Garra*. By the including these five species (*G. caudomaculata*, *G. culiciphaga*, *G. kemali*, *G. klatti*, *G. menderesensis*) in the genus, *Garra* comprises eight valid species. Besides, Orontes and upper Tigris *Garra* populations seem belong to two different potential new species.

Keywords: Biodiversity, Labeoninae, Cyprinidae, Pisces, Turkey.



Review of the genus *Gobio* Cuvier, 1816 in Turkey

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Abstract

The members of the genus *Gobio* are widespread in the from northern Asia to Europe. In Turkey, the genus occurs in the streams in the Black Sea, Marmara Sea, Aegean Sea, Mediterranean Sea, and Central Anatolia endorheic basins. 13 species of *Gobio* are recognized from Turkey, these are: *G. artvinicus* (Çoruh River basin), *G. baliki* (stream Büyük Melen), *G. bulgaricus* (Meriç and Ergene Rivers in Thrace), *G. fahrettini* (Lake Ilgın basin), *G. gymnostethus* (Melendiz River, southeastern Lake Tuz basin), *G. hettitorum* (streams close to Karaman province), *G. insuyanus* (western Lake Tuz basin), *G. intermedius* (Lake Eber and Akşehir basins), *G. kizilirmakensis* (stream Filyos) *Gobio kovatschevi* (streams Rezova, Kara Menderes, Kocadere), *G. maeandricus* (Büyük Menderes River and Lake Işıklı basins), *Gobio microlepidotus* (Lake Beyşehir basin and upper drainage of Göksu River and stream Limon) and *G. sakaryaensis* (Sakarya River and Lake Sapanca basins). Also, *G. batalgilae* was considered a valid species for a long time. According to recent studies, no differences were found between *G. battalgilae* and *G. microlepidotus*. Therefore, *G. batalgilae* accepted as a synonym of *G. microlepidotus*. In this study, the distribution ranges and diagnostic features of these species are discussed.

Keywords: Freshwater biodiversity, taxonomy, gudgeon, Gobionidae



The ancient Lake`s Ohrid and Prespa ecological status-a comparative study

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Abstract

The two Balkan ancient lakes, so called “sister lakes” – Lake Ohrid and Lake Prespa, despite their similar origin, geographical proximity and connectivity, feature clear differences in terms of benthic fauna diversity and endemism. It is clear that the hydro morphological characteristics of the lakes` basins have played an essential role in the presence and distribution of current benthic taxa, but certainly, the role of the anthropogenic factor cannot be overlooked, especially in the last few decades.

In order to make a comparative assessment of the ecological status of these two ancient lakes, based on the status of the communities of benthic fauna, a EWFD (WFD 2000) based researches were conducted during the spring 2016 and fall 2017. Based on the results of the research on the samples collected from 6 littoral transects (3-4 depth points on each transects) from both lakes, it was found out that the ecological status of these two lakes differs. In addition, a seasonal character in the ecological status has been confirmed for both lakes.

As expected, in general, Lake Prespa is characterized by a poorer ecological status than Lake Ohrid. Specifically, based on the values of the ASPT index, it was determined that the ecological status of Lake Ohrid varies from good (two sites) to low (three sites, i.e. moderate on one site). In Lake Prespa, 4 out of 6 sites were assessed as sites with very poor and two with poor quality ecological status. As mentioned, the negative anthropogenic impact specifically from the agriculture practices and tourism within the lake`s basin are of crucial importance for the poor ecological status of Lake Prespa.

Keywords: ecological status, impact, Lake Ohrid, Lake Prespa, competitive study, benthic fauna



Citizen Science Approach in North Macedonia - Protect Rare Snails from Lake Ohrid - an Innovative Approach to Biodiversity Conservation

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Abstract

Environmental issues are continually coming to the forefront of the attention of the public and government. Awareness of the challenges facing biodiversity and its potential to compromise the future of humankind have meant an ever-increasing demand on scientists to produce reliable analysis. However, obtaining data for sound analysis over a large geographic scale is intensive work and requires a large amount of time and effort. One solution is to draft in even more people to help scientists' work in the field and this is where *citizen scientists* come in, to act as a bridge between scientists and data in the field.

This practice is not very common in North Macedonia. During the implementation of the Project: "Developing Citizens Scientists' Initiative to Protect Rare Snails from Lake Ohrid - An Innovative Approach to Biodiversity Conservation", a first attempt has been conducted to establish such a practice in the city of Ohrid. The activities included training and participation of three different groups of citizens, i.e. students, tourists and domestic citizens and staff from small and medium sized businesses and restaurants along the shore of the lake.

A survey of the public opinion and knowledge on this kind of citizens' involvement has been conducted, including 100 people (tourists and locals). The results indicate that people tend to be highly interested in taking part in citizen science activities. In addition, there have been selected three local restaurants, three staff members of which have been trained to engage in activities for monitoring of the snails and their habitats. Finally, the training workshops included, besides the staff members from the restaurants, six students and six ordinary citizens.

The follow up of the project activities is pending and will include setting up equipment in the restaurants, which will be used to take pictures of the species and habitats and sharing them with the Hydrobiological Institute Ohrid and other scientific institutions.

Keywords: citizen science, North Macedonia, snails, monitoring, conservation, innovative



Polychaete (Annelida) Species of Golden Horn Estuary (Sea of Marmara)

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Abstract

The present study was carried out to determine the polychaete assemblages of the Golden Horn (Sea of Marmara). A total of four stations were sampled with three replicates for three years (2015, 2016 and 2017). A total of 29 species belonging to 11 families were identified. Among them, seven alien species [*Desdemonia ornata* Banse, 1957, *Ficopomatus enigmaticus* (Fauvel, 1923), *Hydroides elegans* (Haswell, 1883), *Polydora cornuta* Bosc, 1802, *Prionospio pulchra* Imajima, 1990, *Pseudopolydora paucibranchiata* (Okuda, 1937), *Streblospio gynobranchiata* Rice & Levin, 1998] were found. The most dominant species were *S. gynobranchiata* and *P. cornuta* in the area which known as opportunistic/indicator species. The maximum number of species (21 species) and the highest mean number of individuals were found in 2016 (12380 ind./m²).

Keywords: Polychaeta, Alien species, Indicator species, Distribution, Turkey

Introduction

The Golden Horn is heavily polluted water body in a large metropolitan area with population of approximately 10 million (Tuncer *et al.*, 2001). Increase in settlements and industrial facilities around the Golden Horn since the 1950s were accompanied with severe pollution, particularly from wastewaters of pharmaceutical, detergent, dye and leather industries and domestic discharges (Yüksek *et al.*, 2005). To improve the water quality, the industrial facilities were moved from the estuary in the 1980s, followed by a rehabilitation plan in the 1990s. Thus, wastewater discharges were gradually taken under control and connected to collector systems (Albayrak *et al.*, 2010).

Increasing population and inadequate environmental policies constitute one of the most important problem of pollution pressure in marine environments. Although it is mostly anthropogenic, the load of organic and chemical inputs to environment increases both in industrial and maritime transport in sensitive areas such as the Sea of Marmara.

Benthic organisms have important key role that gives information about ecological quality of environment, and they commonly use to assess the current situation of the marine ecosystem. Polychaetes are frequently used for monitoring studies, because they create dense populations in benthic habitats and react to environmental changes.

The aim of this study is to identify polychaetes collected during three cruises to the Golden Horn Estuary in the Sea of Marmara.

Material and Methods

Benthic materials were collected from four stations with soft substratum in the Golden Horn Estuary by using a van Veen grab (0.1 m² sampling area) for three years (2015, 2016 and 2017) (Fig. 1). Three replicates were collected at each station. Obtained materials were rinsed through a 0.5 mm mesh sieve and then placed in jars containing 4% formaldehyde solution in seawater. In the laboratory, samples were washed with tap water and sorted according to major systematic groups under a stereomicroscope. Details of sampling stations are shown at Table 1. The sorted animals

were then preserved in 70% ethanol. Polychaetes were identified and counted under stereo- and compound microscopes.

Table 1. Details of sampling stations

Station Cod	Location	Coordinates	Depth (m)	Biotope
GK	Galata Bridge	41° 01' 32" N 28° 58' 45" E	40	Detritus
UK	Unkapam	41° 01' 47" N 28° 57' 89" E	35	Detritus+shell fragm
CK	Camialtı Shipya	41° 01' 94" N 28° 57' 99" E	15	Phytodetritus
HK	Haliç Bridge	41° 02' 68" N 28° 56' 61" E	5	Phytodetritus+she fragments

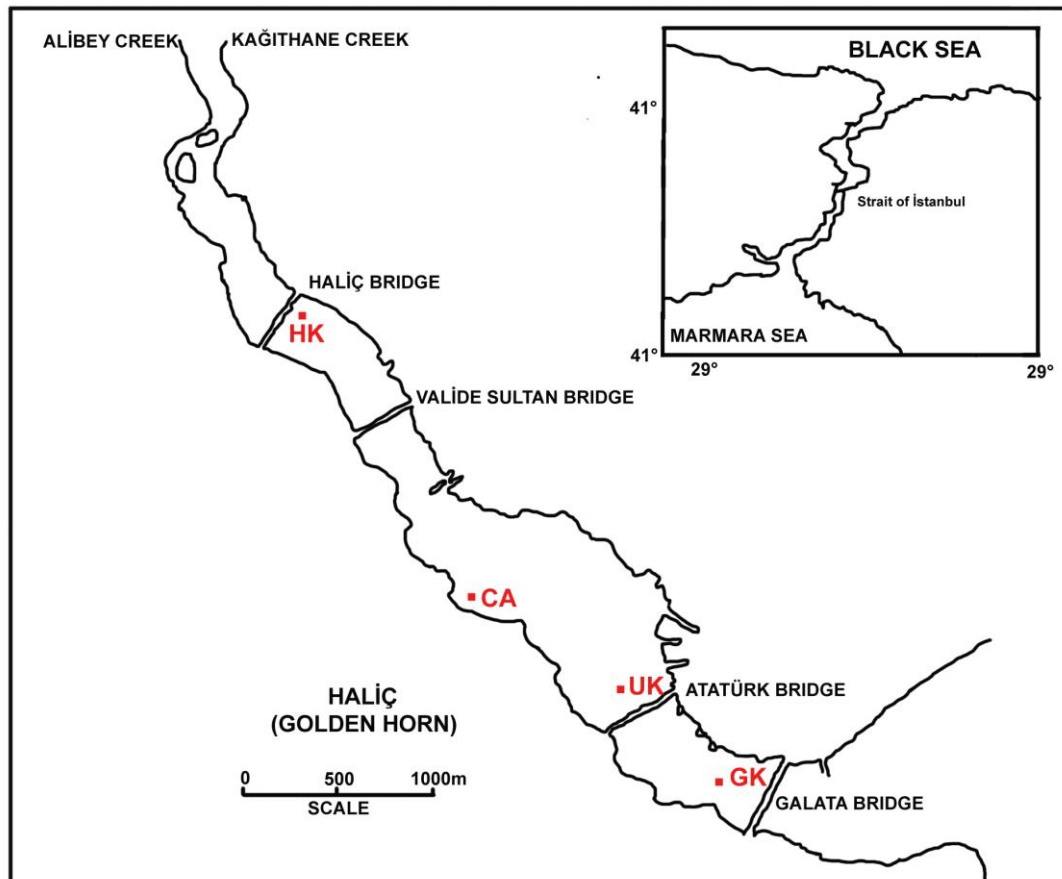


Figure 1. Map of the study area, with locations of sampling stations

Results and Discussion

A total of 29 species belonging to 11 families were recorded from the Golden Horn Estuary during the years 2015, 2016 and 2017 (Table 2). The Most abundant Polychaeta family in the area was Spionidae with 13 species. Seven alien species were found [*Desdemonia ornata*, *Ficopomatus enigmaticus*, *Hydroides elegans*, *Polydora cornuta*, *Prionospio pulchra*, *Pseudopolydora paucibranchiata*, *S. gynobranchiata*]. Among them, *P. agassizii* (37%) was the most dominant species following by *S. shrubsolii* (33%) in 2015; *S. gynobranchiata* (41%) was the most dominant species, followed by *P. paucibranchiata* (16%) and *P. cornuta* (15%) in 2016; and *S.*



gynobranchiata (44%) and *P. cornuta* (40%) were the most dominant species in 2017. According to frequency-index values, the most frequent species were *P. agassizii* (75%), *Spio decoratus* (50%) and *S. shrubsolii* (75%) in 2015; *S. gynobranchiata*, *P. paucibranchiata*, *P. cornuta* (75%) in 2016; and *S. gynobranchiata* (75%) and *Ficopomatus enigmaticus* (50%) in 2017.

The highest number of species (8 species) was found in the station HK and the lowest number of species was found in the station GK with 2 species in 2015. In 2016, the maximum number of species (16 species) found at the station HK, the lowest number of species (2 species) at the station GK; the maximum number of species in 2017 (6 species) was determined in the stations HK and CA and no polychaete species was found in the station GK. According to the number of individuals, the highest value was found (10027 ind./m²) in HK in 2016, while in 2017 no specimen was detected in the station GK. The highest number of species and individuals were encountered for all periods at the station HK, and the lowest number of species was determined at the station GK. Among alien species, *Streblospio gynobranchiata* had highest number of individuals in 2016 (4287.7 ind./m²) and 2017 (1247.7 ind./m²) and *Polydora cornuta* had 1656.7 ind./m² in 2016 and 1216.7 ind./m² in 2017 in the most diverse station HK.

Table 2. List of the species found in the Golden Horn with the mean number of their individuals at the stations (m²)

Sampling periods	2015				2016				2017			
	HI	CI	UI	GI	HI	CI	UI	GI	HI	CI	UI	GI
Polynoidae												
<i>Harmothoe antilopes</i> McIntosh, 1876									113			
<i>Harmothoe imbricata</i> (Linnaeus, 1767)	1.0				90.0		3.0					
Hesionidae												
<i>Oxydromus pallidus</i> (Claparède, 1864)							26.0					
Nereididae												
<i>Alitta succinea</i> (Frey & Leuckart, 1847)	8.0				36.0		10.0		46.0			
<i>Nereis</i> sp.									16.0	3.0		
Nephtyidae												
<i>Nephtys hombergii</i> Savigny, 1818		1.0										
Spionidae												
<i>Malacoceros fuliginosus</i> (Claparède, 1868)							876.0					
<i>Micronephthys stammeri</i> (Augener, 1932)										3.0		
<i>Polydora agassizii</i> Claparède, 1869	24.0		0.0	0.0	190.0							
* <i>Polydora cornuta</i> Bosc, 1802	0.0				1656.0	136.0	120.0		1216.0			
<i>Polydora</i> sp.					103.0		33.0					
<i>Prionospio maciolekae</i> Dagli & Çinar, 2011					756.0	26.0						
* <i>Prionospio pulchra</i> Imajima, 1990					190.0		3.0					
<i>Prionospio</i> sp.							3.0					
* <i>Pseudopolydora paucibranchiata</i> (Okuda, 1937)	0.0				202.0		23.0	3.0				
<i>Pseudopolydora pulchra</i> (Carazzi, 1893)					3.0							
<i>Spio decoratus</i> Bobretzky, 1870		2.0		0.0		180.0				6.0		
* <i>Streblospio gynobranchiata</i> Rice & Levin, 1998					4287.0	696.0		3.0	1247.0	176.0		
<i>Streblospio shrubsolii</i> (Buchanan, 1890)	17.0	4.0	0.0		126.0	40.0						
Paraonidae												
<i>Aricidea (Strelzovia) claudiae</i> Laubier, 1967										3.0		
Cirratulidae												
<i>Cirriformia</i> sp.	0.0											



Capitellidae				
<i>Capitella capitata</i> (Fabricius, 1780)	0.1	223		40.
<i>Heteromastus filiformis</i> (Claparède, 1864)	0.1	270	153	
Pectinariidae				
<i>Lagis koreni</i> Malmgren, 1866				13.
Sabellidae				
* <i>Desdemonia ornata</i> Banse, 1957		3.1		
Serpulidae				
* <i>Ficopomatus enigmaticus</i> (Fauvel, 1923)				153
* <i>Hydroides elegans</i> (Haswell, 1883)		50.		6.1
<i>Serpula vermicularis</i> Linnaeus, 1767	2.1			
<i>Spirobranchus triqueter</i> (Linnaeus, 1758)		13.		3.1
*Alien species				

A total of 390 species were reported from the Sea of Marmara up to date (Çınar *et al.*, 2014). Among them, 22 species were reported as alien species. A previously study carried out in the Golden Horn Estuary, 15 Polychaeta species belonging to 7 families (Polynoidae, Phyllodocidae, Nereididae, Spionidae, Capitellidae, Sabellidae, Serpulidae) were reported by Çınar *et al.* (2009). They also reported four alien species (*Desdemonia ornata*, *Ficopomatus enigmaticus*, *Polydora cornuta* and *Streblospio gynobranchiata*). In the present study, we found seven alien species: sabellid *D. ornata*; serpulids *F. enigmaticus* and *Hydroides elegans*; spionids *P. cornuta*, *Prionospio pulchra*, *Pseudopolydora paucibranchiata* and *S. gynobranchiata*. Additionally, the study area was dominated by first-order opportunistic species (*Oxydromus pallidus*, *Alitta succinea*, *Polydora agassizii*, *P. cornuta*, *Pseudopolydora paucibranchiata*, *S. gynobranchiata*, *S. shrubsolii*, *Capitella capitata*, *Heteromastus filiformis* etc.) (Çınar *et al.* 2015; author's database). Especially alien polychaetes *S. gynobranchiata* and *P. cornuta* were the most dominant and frequent species of the study area. Çınar *et al.* (2005) firstly reported the occurrence of *S. gynobranchiata* and *P. cornuta* from the Izmir Bay (Aegean Sea) for the Mediterranean. They noticed that species establishment in the area is the most probably transport by ballast water since these two species greatly dominated polluted muddy bottoms near and in the Alsancak Harbour.

Faunistic analysis of soft-bottom polychaetes inhabiting the Golden Horn Estuary showed that the area is polluted and under the pressure of alien opportunistic species. Annual monitoring activities in the region will allow the assessment of the future situation.

Acknowledgements

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References

- Albayrak, S., Balkıs, N., Balkıs, H., Zenetos, A., Kurun, A., Karhan, S., Caglar, S., & Balcı, M. (2010). Golden Horn Estuary: Description of the ecosystem and an attempt to assess its ecological quality status using various classification metrics. *Mediterranean Marine Science*, 11(2), 295-314. doi:http://dx.doi.org/10.12681/mms.78.
- Çınar M.E, Ergen, Z., Dagli, E., & Petersen M.E., (2005). Alien species of spionid polychaetes (*Streblospio gynobranchiata* and *Polydora cornuta*) in Izmir Bay, eastern Mediterranean. *Journal of Marine Biological Association of the United Kingdom*, 85: 821–827.
- Çınar, M.E., Bakir K., Öztürk, B., Katagan, T., Dagli, E., Açık, S., Dogan, A. & Bitlis Bakir, B. (2015). TUBI (Turkish Benthic Index): A new biotic index for assessing impacts of organic pollution on benthic communities. *Journal of Black Sea and Mediterranean Environment*, 21, 135-168.
- Dagli, E. & Çınar M.E. (2008). Invasion of polluted soft substratum of Izmir Bay (Aegean Sea , eastern Mediterranean) by the spionid polychaete worm, *Pseudopolydora paucibranchiata*



- (Polychaeta: Spionidae). *Cahiers de Biologie Marine*, 49: 87-96.
- Çınar, M. E., Balkis, H., Albayrak, S., Daglı, E. & Karhan, S. Ü. (2009). Distribution of polychaete species (Polychaeta) on the polluted soft substrate of the Golden Horn Estuary (Sea of Marmara), with special emphasis on alien species. *Cahiers de Biologie Marine*, 50: 11-17.
- Çınar, M.E., Dağlı, E & Kurt Şahin, G. (2014). Checklist of Annelida from the coasts of Turkey. *Turkish Journal of Zoology*, 38: 734-764.
- Yüksek A., Okus E. & Yılmaz N. (2005). Rehabilitation studies and recovery of a once lifeless estuary: the Golden Horn. *Water Science & Technology*, 51: 27-35.
- Tuncer G., Tuncel G. & Balkas T. (2001). Evolution of Metal Pollution in the Golden Horn (Turkey) Sediments between 1912 and 1987, *Marine Pollution Bulletin*, 42: 350-360.

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Age and Growth of a Mullidae: *Mullus barbatus* (Linnaeus, 1758) caught in the Algerian West Coasts

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Abstract

The red mullet *Mullus barbatus* (Linnaeus, 1758) is a benthic-demersal species targeted by artisanal fishery and Trawler and of significant economic interest in the Algerian western Mediterranean. Five hundred twenty three (523) specimens measuring between 8.5 and 29.5 cm total length are captured during the year 2015. The age of the total population varies from 1 to 5 years. The female population is growing at a very fast rate compared to males, which is characteristic of teleosts. The growth parameters are estimated from the Bertalanffy equation and are respectively : Asymptomatic length (L_{∞}) = 31.65cm; Growth factor (K) = 0.39 year⁻¹ and theoretical time (t_0) = -0.170 The size-weight relationship is of type: $W_t = 0.0057 L^{3.167}$ with $r^2 = 0.954$. The t-test based on the comparison of two slopes provides a value of absolute value of t less than 1.96 for $\alpha = 5\%$. This demersal species is characterized by a positive allometry between its total weight (Wt) and its total length (Lt).

Keywords: Age, Algerian western coasts, Growth parameters, *Mullus barbatus*, Mullidae.



Annual variation in the abundance of prokaryotic picoplankton (*Synechococcus* and *Prochlorococcus*) in the Northeastern Mediterranean

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Abstract

In the ultraoligotrophic eastern Mediterranean, primary productivity mostly relies on marine cyanobacteria. In the present study, vertical and horizontal distribution of prokaryotic picoplankton (*Synechococcus* and *Prochlorococcus*) have been investigated. Seasonal sample collection was carried out at 50 different stations including west part of Mersin Bay, Göksu River discharge area and oligotrophic offshore waters. Cell counts were carried out using an Apogee brand flow-cytometer. Minimum and maximum abundance of *Synechococcus* and *Prochlorococcus* were found as 10^3 cell/mL - 3.3×10^4 cell/mL and 8×10^1 cell/mL - 7.3×10^4 cell/mL, respectively. Both *Synechococcus* and *Prochlorococcus* abundance was increase with depth and reach its maximum at deep chlorophyll maximum. Also, *Synechococcus* was the most abundant specie regardless of location or season. Temperature, nutrient enrichment coming from surface runoff, winter mixing, current systems were found to be main factors affecting prokaryotic abundance.

Keywords: pico-eukaryotes, *Synechococcus*, *Prochlorococcus*, abundance, Northeastern Mediterranean Sea



Variable glochidium prevalence on gills suggests different resistance potential in fish: a preliminary evidence in the fish community of a temperate small stream (Tersakan, Muğla)

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Abstract

Unio species are freshwater and threatened mussels, which are found naturally in Turkish inlands. It is crucial to understand their life cycles fully for the production and conservation purposes. This study was conducted in Tersakan stream (Dalaman, Muğla) between January and June 2014 to quantify effect of glochidia (larval stage of freshwater mussels) of *Unio* species on resident fish species and its attachment success. The special aims were to compare the level of resistance of fish species against glochidia infestation and discuss our results within the mussel-fish interactions context. Four species were collected; *Capoeta aydinensis*, *Barbus pergamonensis*, *Squalius fellowesii*, *Carassius gibelio* where all had variable numbers of glochidia. Most abundant glochidia on the gills of *C. aydinensis* and *B. pergamonensis* was detected in January and it decreased from this month to June. *S. fellowesii* had the lowest number of glochidia probably due to small gills area of the species. *C. gibelio* as only non-native species had two glochidia on its gills.

Keywords: *Unio* spp., Freshwater mussel, Glochidia, Fish gill, Dalaman

Introduction

Freshwater mussels have crucial importance for freshwater ecosystems with worldwide ecological and economic significance. Ecologically, their filter feeding behaviour removes phytoplankton and suspended particles from the water column and therefore potentially exert bottom-up control on phytoplankton blooms (Vaughn et al., 2008; Allen et al., 2011). Mussels also have an influence on the calcium budget of freshwater systems, and provide a complementary resource link between pelagic and benthic habitats (Howard and Cuffe, 2006; Strayer, 2008). Freshwater mussels can be utilized for rehabilitation of organically polluted waters, particularly in aquaculture facilities (Ercan, 2009). However, freshwater bivalves are threatened globally, primarily due to habitat deterioration and direct exploitation (Lydeard et al., 2004).

Unio crassus and *U. pictorum* are native mussel species in Turkish waters. Although there have been several studies on both species in Turkey (e.g. Koşal Şahin and Yıldırım 2007; Güreli and Özbek, 2012; Ercan et al., 2013), no studies have been conducted on its glochidia (larval stage of freshwater mussels) attachment success on fish gills, which is crucially important to complete their life cycle (Fig. 1).

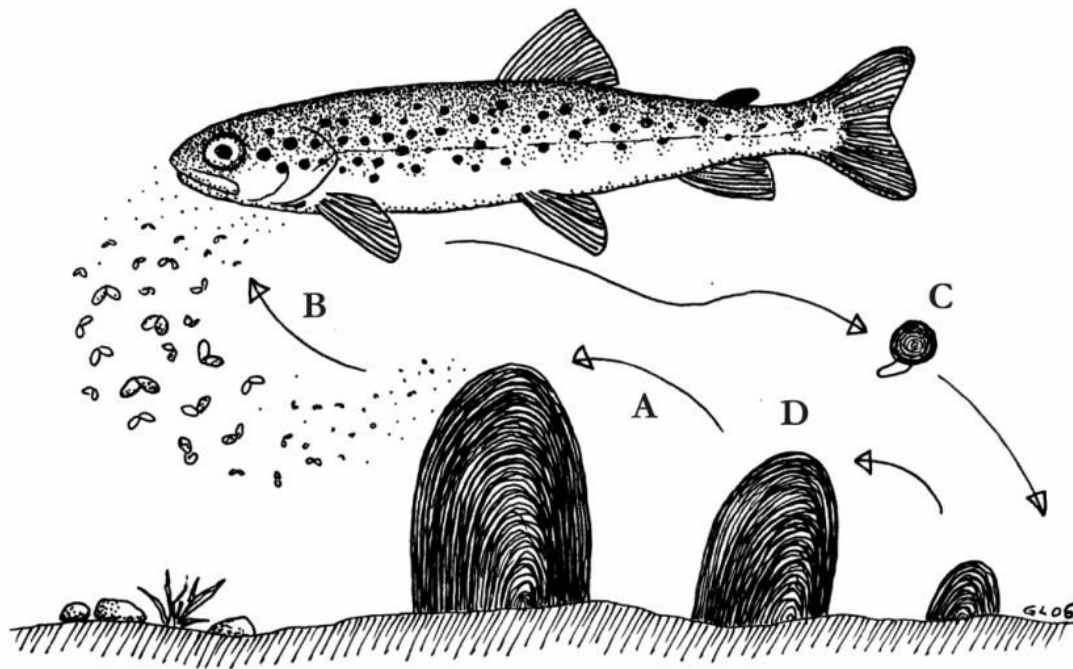


Figure 1. Life cycle of a freshwater mussel. A) fertilization B) free mussel larvae (glochidia) C) juvenile mussels detached from the host (fish) D) adult mussels after couple years buried at the bottom (Österling, 2006) (Drawing: Gunnar Lagerkvist).

In the present study, therefore, in order to understand effect of *Unio* species on resident fish species and attachment success of glochidia, density of glochidia on fish gills were calculated. Our special aims were to compare the level of resistance of fish species against glochidia infestation and discuss our results within the mussel-fish interactions context.

Material and Methods

Capoeta aydinensis, *Barbus pergamonensis*, *Squalius fellowesii*, *Carassius gibelio* were collected by electrofishing (SAMUS-725P) from Tersakan stream (Dalaman, Muğla) between January and June 2014 and then gills of all collected species were removed and brought to the laboratory to examine for glochidia presence under microscope (Fig. 2). All glochidia in each specimen were counted and its average load on each fish species was calculated.

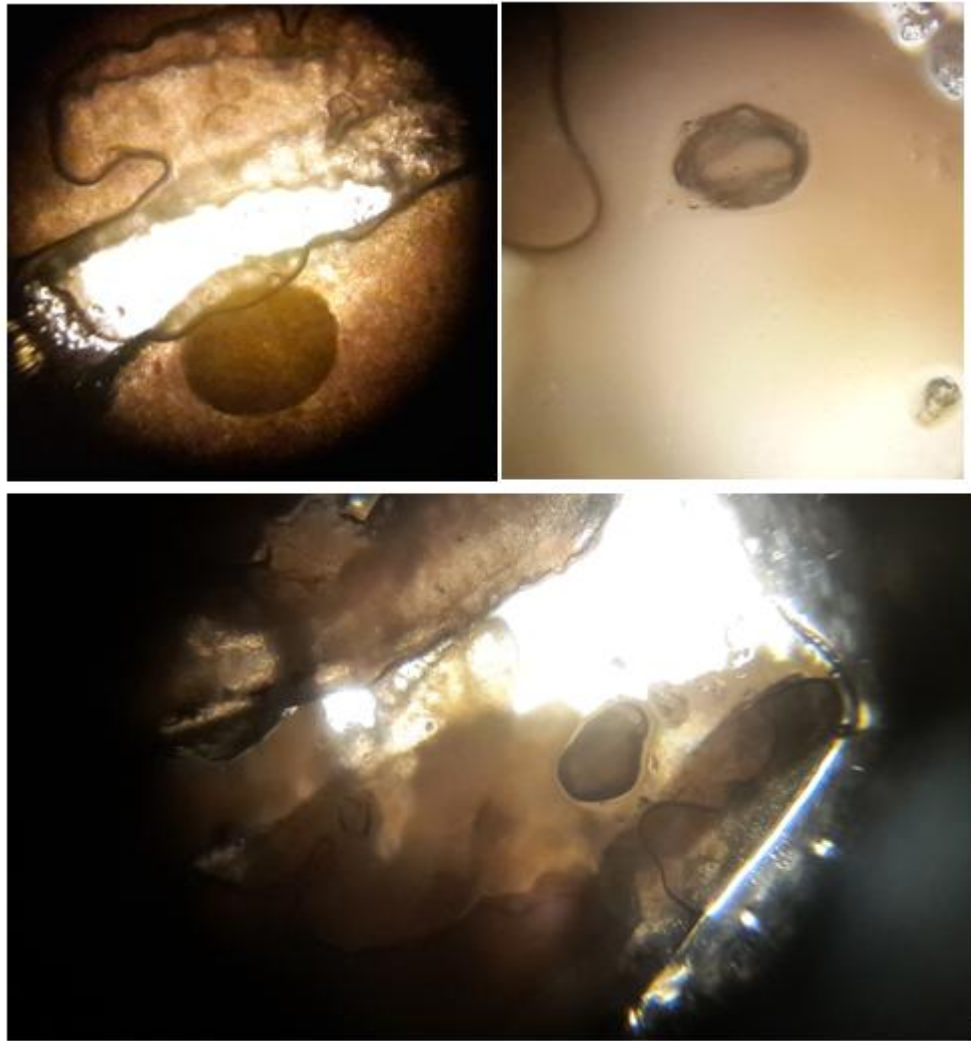


Figure 2. Microscopic view of glochidia on the fish gill (original).

Results

Glochidia was observed on all fish species collected. Most abundant glochidia on the fish gills was detected in January and it decreased from this month to June. *C. aydinensis* was found to have highest number of glochidia for all months sampled, followed by *B. pergamonensis* where glochidia was abundant between January and April (the latter was the highest). *S. fellowesii* had the lowest number of glochidia probably due to small gills area of the species. Only non-native species that was discovered in 2013 for the first time in the Tersakan stream, *C. gibelio* was caught only one specimen and it had only two glochidia (Fig. 3).

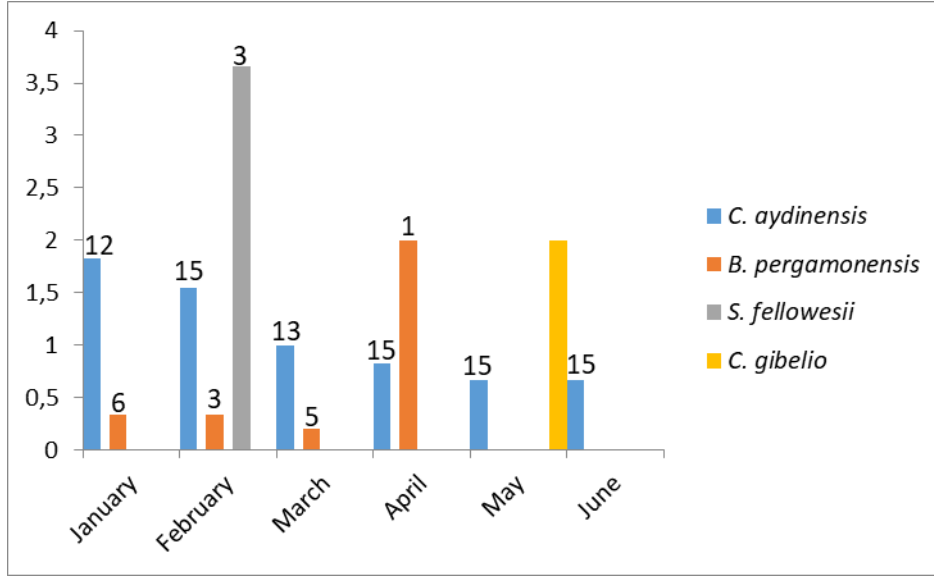


Figure 3. Average numbers of glochidia in *Capoeta aydinensis*, *Barbus pergamonensis*, *Squalius fellowesii* and *Carassius gibelio*. Numbers on the bars indicate numbers of specimens examined.

Discussion

In the present study, we found a new four host freshwater fish species besides Taubert et al. (2012) and Yılmaz and Barlas (2016) reported (i.e. *Cottus gobio*, *Leuciscus idus*, *Squalius cephalus*, *Scardinius erythrophthalmus*, *Chondrostomanus*, *Phoxinus phoxinus* ve *Gasterosteus aculeatus*). Our results suggested that in the studies for reproduction and survival of *Unio* species, especially *C. aydinensis* and *B. pergamonensis* with bigger gills can be used as proper hosts. We can also suggest that dominant and most abundant species would be exposed to glochidia in any environment. Also, although the data based on only one specimen glochidia infestation would be the possible regardless if fish species is allochthonous or autochthonous.

Acknowledgements

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References

- Allen, D.C., & Vaughn, C.C. (2011). Density-dependent biodiversity effects on physical habitat modification by freshwater bivalves. *Ecology*, 95, 1013–1019.
- Ercan, E. (2009). *Sazan balığı (Cyprinus carpio L.) yetiştiriciliğinde atık suların biyolojik entegre sistemle arıtımının araştırılması üzerine bir çalışma*. PhD, İstanbul Üniversitesi, Fen Bilimleri Enstitüsü, İstanbul.
- Ercan, E., Gaygusuz, Ö., Tarkan, A.S., Reichard, M., & Smith, C. (2013). The ecology of freshwater bivalves in the Lake Sapanca Basin, Turkey. *Turkish Journal of Zoology*, 37, 730-738.
- Howard, J.K., & Cuffe, K.M. (2006). The functional role of native freshwater mussels in the fluvial benthic environment. *Freshwater Biology*, 51, 460–474.
- Gürelli, G., & Özbek, M. (2012). Contribution to the knowledge on distribution of freshwater mollusc species of İzmir (Turkey). *Ege University Journal of Fisheries and Aquatic Sciences*, 29, 109–113.



- Koşal Şahin, S., & Yıldırım, Z. (2007). The mollusk fauna of Lake Sapanca (Turkey: Marmara) and some physico-chemical parameters of their abundance. *Turkish Journal of Zoology*, 31, 47–52.
- Lydeard, C., Cowie, R.H., Ponder, W.F., Bogan, A.E., Bouchet, P., Clark, S.A., Cummings, K.W., Frest, T.J., Gargominy, O., Herbert, D.G., Hershler, R., Perez, K.E., Rpth, B., Seddon, M., Strong, E.E., & Thompson, F.G. (2004). The global decline of nonmarine mussels. *BioScience*, 54, 321–330.
- Strayer, D.L. (2008). *Freshwater Mussel Ecology: A Multifactor Approach to Distribution and Abundance*. Berkeley, CA: University of California Press.
- Taeubert, J. E., Martinez, A.M.P., Gum, B., & Geist, J. (2012) The relationship between endangered thick-shelled river mussel (*Unio crassus*) and its host fishes. *Biological Conservation*, 155, 94–103.
- Vaughn, C.C., Nichols, S.J., & Spooner, D.E. (2008). Community and foodweb ecology of freshwater mussels. *Journal of the North American Benthological Society*, 27, 409–423.
- Yılmaz, Ö., & Barlas, M. (2016). Dipsiz-Çine çayı (Aydın)'nda yaşayan tatlısu midyesi *Unio crassus* (Philipsson, 1788) populasyonunun morfolojik özellikleri. *Turkish Journal of Agriculture - Food Science and Technology*, 4, 877– 881.



Occurrence *Beroe mitrata* (Beroidae) associated with its prey aggressive invader ctenophore *Mnemiopsis leidyi* A. Agassiz from Gökova Bay

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Abstract

The present study was carried out in Gökova Bay, which is one of the most important fishing area of the Levantine coasts of Turkey. Sampling of ctenophores for the study was done in October 2015 and February 2018. Samplings were performed by free diving and the specimens were collected by small hand nets from the depth of five meter to the water surface by Killi N. Temperature and salinity values were 21,5°C and 38,3 ppt in October 2015 and 15,06°C and 37,22 ppt in February, respectively.

These samples were analysed morphologically by Shiganova T. and genetically with ITS barcoding approach by Abyzova G. Resulting in the species was identified as *Beroe mitrata* (family Beroidae), which is distributed in the Mediterranean Sea, Atlantic and Pacific Oceans. It was first observation of *Beroe mitrata* in Turkish seas. *B. mitrata* is also predator of *Mnemiopsis leidyi*, which is invasive ctenophore species in the Gökova Bay and throughout the Mediterranean Sea.

In Gökova Bay *M. leidyi* could be found around a year, in low abundance in winter and highest abundance in spring and in early summer. Its predator *Beroe spp.* appears and reaches pick approximately in the same time when *M. leidyi* reaches peak.

Keywords: Invasive ctenophore *Mnemiopsis leidyi*, predator *Beroe* sp.



Nocturnal Activity of *Anatololacerta pelasgiana* (Mertens, 1959) from Çıglıkara Nature Reserve, Antalya, Turkey

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Abstract

Here, we present a case of nocturnal activity of a diurnal Pelasgian Rock Lizard, *Anatololacerta pelasgiana* (Mertens, 1959) in Çıglıkara Nature Reserve. During our fieldwork in August 2016, we detected the nocturnal behavior individuals on the walls of the fire tower/cabin in the cedar forest. Besides, there is this is the first case of a nocturnal behavior without any artificial light.

Keywords: Lacertidae; *Anatololacerta pelasgiana*; lizard; nocturnal activity; Turkey.

Introduction

Temperature and humidity are the most important factors in the distribution and diversity of reptile species. Therefore, reptile diversity is high in tropic and warm areas (Vitt & Caldwell, 2013). Most of the reptiles use the sun and hot surfaces to raise their body temperature, and shade areas, under rocks, water, and cold surfaces to cool them. Although the sun is an unlimited heat source, reptiles can increase their body temperature in an indirect way. However, since the temperature in arid habitats is quite high during the day, the activity times of reptiles may shift towards cooler times of the day (Vitt & Caldwell, 2013).

It is known that lizards can be active both in the daytime (Agamidae, Anguinae, most of Lacertidae, etc.) and at night (Eublepharidae; most of Gekkonidae, etc.). Some diurnal species are known to be active at night due to the effects of human light pollution, hot climates or global warming due to the effects of global change (Perry & Fisher, 2006; Perry et al. 2008). Lacertides are generally known to be active during the day (diurnal).

The nocturnal activity was observed in some lacertid species; *Podarcis muralis* (Serbia population, Carratero et al. 2012) and *Darevskia rudis* (Blacksea region, Turkey, Afsar et al. 2018). For both lacertids, the observations were made around the walls of historical places which lighted by light reflectors-a secondary light and heat source. In this study, we report another nocturnal activity of a diurnal lacertid lizard, *Anatololacerta pelasgiana* from Çıglıkara Forests, Elmalı, Antalya.

Material and Methods

Individuals were observed during fieldworks in July and August 2016. First observation was recorded on the 13th August 2016. We observed the *Anatololacerta pelasgiana* individuals on the walls of the fire tower/cabin (35 S 755877 4047505 1943 a.s.l.) in the cedar forest (Figure 1). The air temperature was 18-20°C, recorded during the night. The air temperatures varied between 30-35°C in daytime and the water source was very poor (almost dry).



Figure 1. Map of the study area in Çıglikara Nature Reserve, Antalya, Turkey.

Results

In August 2016, during the fieldwork in Çıglikara Forests, Elmalı/Antalya, *A. pelasgiana* individuals were found on the walls of a cabin/fire tower belong to the Ministry of Forestry and Water Affairs. Later, during the night studies, it was found that *A. pelasgiana* individuals actively circulated at night between 21.00-23.00 (Figure 2). There is no artificial light source in the area where these Lacertids have night activity. However, there were four days left for the moon to become a full moon. In the region where the samples observed, weather varies between 30-35°C in

the daytime, the temperature decreased to 19-20°C at night. In addition, during night field studies, *Bufo variabilis* individuals, an individual belong to the genus *Ablepharus* and *Telescopus fallax* were also observed to be active at night in the same environment.



Figure 2. The nocturnal activity of a male Pelasgian Rock Lizard in Çıgħkara Nature Reserve.

Discussion

In nocturnal ectotherms, body temperature changes are considerably higher than in diurnal species. Furthermore, when nocturnal geckos are considered, they prefer suboptimal conditions and nightlife, although their physiological activities are better at maximum conditions of a normal diurnal lizard. In this evolutionary process, it increases the likelihood of surviving by selecting nocturnality and consuming less energy by displacing less than a diurnal lizard (Vitt & Caldwell, 2013). Therefore, it is thought that the *A. pelasgiana* individuals are also active at night in addition to daytime activity. In addition, it is thought that the species is involved in night activities due to factors such as direct sunlight during the day and a high amount of radiation and lack of water sources. Also, there is no artificial light around the place that observation made and it is thought that the specimens could use the moonlight as a light source

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References

- Afsar, M., Sahin, M.K., Afsar, B., Çiçek, K. & Tok, C.V. (2018). Data on nocturnal activity of *Darevskia rudis* (Bedriaga, 1886)(Sauria: Lacertidae) in Central Black Sea Region, Turkey. *Ecologica Montenegrina*, 19, 125-129.
- Carretero, M.A., Sillero, N., Lazić, M.M. & Crnobrnja-Isailović, J. (2012). Nocturnal activity in a Serbian population of *Podarcis muralis*. *Herpetozoa*, 25, 87-89.
- Perry, G., Buchanan, B.W., Fisher, R.N., Salmon, M. & Wise, S.E. (2008). Effects of Artificial Night Lighting on Amphibians and Reptiles in Urban Environments. In J.C. Mitchell, R.E. Jung Brown, & B. Bartholomew (Eds.), *Society for the Study of Amphibians and Reptiles Urban Herpetology*. Herpetological Conservation 3, pp.239–256.
- Perry, G. & Fisher, R.N. (2006). Night lights and reptiles: observed and potential effects. In C. Rich & T. Longcore (Eds.), *Ecological Consequences of Artificial Night Lighting*. (pp. 169–191). Washington, DC: Island Press.



Vitt, L.J.& Caldwell, J.P. (2013). *Herpetology: an Introductory Biology of Amphibians and Reptiles*, 3rd Edition, Academic Press.

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Another Case of Piebaldism in *Blanus strauchi* (Bedriaga, 1884) from Kaş, Turkey

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Abstract

Color malformations such as albinism and melanism are common among the animals. Color pigments have a great role on these anomalies. Lack of color pigments can be seen on the whole body or only some parts. If this deficiency seen in the whole body, it is called albinism. Piebaldism is the lack of pigment in some parts of the body without any change in the color of the eyes also known as regional albinism. In this study we observed “piebaldism” in some of the *Blanus strauchi* specimens from Kaş, Antalya. Polymorphic individuals were also detected from the same locality as specimens with normal coloration.

Keywords: partially albinism, piebaldism, color malformation, *Blanus strauchi*, Turkey

Introduction

Albinism is an inherited disease that occurs when the melanin pigment is not produced in the eyes, skin or both (Bechtel, 1991). Piebaldism, also known as regional albinism, is the lack of pigment in some parts of the body without any change in the color of the eyes (Fertl & Rosel, 2002; Abreu et al. 2013). Studies on polymorphism and color malformation in reptiles have increased in recent years; e.g. *Podarcis muralis*-Albinism (Spadola & Toro, 2007), *Podarcis muralis*-Polymorphism (Lanuzza et al. 2012), *Xerotyphlops vermicularis*-Piebaldism (Kornilios, 2014), *Ctenosaura oedirhina*-Piebaldism (Goode & Pasachnik, 2016), *Natrix natrix*- Melanism (Habiboğlu et al. 2016).

Here we report “partial albinism” or “piebaldism” in *Blanus strauchi* found at Kaş-Kekova area during the fieldworks in the vicinity of Antalya in 2018. Polymorphic individuals were also detected from the same locality with some normal coloration specimens.

Material and Methods

Blanus strauchi specimens were collected during the fieldworks between 2016-2018 in the vicinity of Antalya (near Kaş/Kekova). The specimens photographed at the first moment of their capture for the color-pattern observation. Then it fixed in 96% ethanol and deposited at the Collection of the Molecular Zootaxonomy Laboratory of Çanakkale Onsekiz Mart University (COMU-ZDEU).

The mensural and pholidolial data were recorded following the terminology provided by Budak et al. (1998) and Yıldız et al. (2009) (Table 1). The metric measurements were taken using a digital caliper of 0.01 mm accuracy; TBL: total body length; SVL: snout-vent length; TL: tail length; LeP: length of prefrontal; WiP: width of prefrontal. The pholidolial characters; Boa: number of body annuli; Taa: number of tail annuli; Sma: Scales of a midbody annulus; Sp-Ps: second supralabial and prefrontal shields connection; Pm-Lp: postmental and lateral parts of postgenial connection; Pp: precloacal pores; Npp: number of precloacal pores; Inf: infralabials.

Results

During the fieldworks between 2016-2018, *B. strauchi* specimens were found in the vicinity of Kaş/Kekova, Antalya. Normally colored and polymorphic individuals were together in the same area. The first piebald specimens were collected 11.04.2016 under a stone (Figure 1). In another fieldwork, we found three more piebald specimens (Figure 2) in addition to other three normally colored specimens. All piebald specimens were measured and their pholidolial characters counted and given at Table 1.



Figure 1. The first observed piebald specimens of *B. strauchi* in Kaş, Turkey



Figure 2. The other piebald specimens of *B. strauchi* in Kaş, Turkey

Discussion

Similar cases of piebaldism in *Blanus strauchi* were given from Kazilas et al. (2018) in Kastellorizo Island, Greece and from Malkmus (1997) *B. cinereus* in Portugal. Also, in a master thesis on the taxonomy of *B. strauchi* distributed in the Aegean region, it was stated that only a few flakes could be white in the ventral region (Mutlu, 2011). In this case, the samples piebaldism said to be quite common for the specimens in the western part of Turkey.

As mentioned in previous studies (Kornilios, 2014; Kazilas et al., 2018), coloration anomalies seen in the species in question such as survive, thermoregulation, vision, etc. *B. strauchi*, which is a blind and fossorial species, is not considered to be effective in any case and therefore it has been reported that this color malformations could be carried without screening in the gene pool.

Table 1. Measurements and pholidolial characteristics of the piebald specimens of *B. strauchi*.

Specimens->	1	2	3	4
TBL	207.39	177.27	146.89	194.97
SVL	183.25	168.48	131.99	176.34
TL	24.25	8.69 (Autotomy)	14.72	18.35
LeP	3.04	2.49	2.88	3.19
WiP	2.98	2.23	2.47	2.97
Boa	105	107	106	101
Taa	19	-	16	19



Sma	34	30	33	34
Sp-Ps	Broad	Narrow	Narrow	Broad
Pm-Lp	Broad	Broad	Broad	Broad
Pp	Visible	Visible	Visible	Visible
Npp	5/5	5/5	4/4	4/4
Inf	3/3	2/2	3/3	3/3

Acknowledgements

The study were produced within the scope of a project entitled “The Task of Inventory and Monitoring of the Biological Diversity of the Terrestrial and Inland Water Ecosystems in Antalya Province”, funded by the Directorate of Antalya Branch of the 6th Regional Directorate of the Department of Nature Protection and National Parks of the Republic of Turkey, Ministry of Forestry and Water Affairs. We would like to thank the establishment concerned and Turunç Peyzaj Inc. Co. for the support to the study.

References

- Abreu, M.S.L., Machado, R., Barbieri, F., Freitas, N.S., & Oliveira, L.R. (2013). Anomalous colour in Neotropical mammals: a review with new records for *Didelphis sp.* (Didelphidae, Didelphimorphia) and *Arctocephalus australis* (Otariidae, Carnivora). *Brazilian Journal of Biology*, 73(1), 185-194.
- Bechtel, H.B. (1991). Inherited color defects: Comparisons between humans and snakes. *International Journal of Dermatology*, 30, 243–246.
- Fertl, D. & Rosel, P. (2002). Albinism. In: Perrin, W.F., Wursig, B. & Thewissen, J.G.M, (Eds.), *Encyclopedia of Marine Mammals*, (pp. 24–26)., San Diego, California, USA, Academic Press.
- Goode, A.B. & Pasachnik, S.A. (2016). Piebaldism in Roatán Spiny-tailed Iguanas, *Ctenosaura oedirhina*. *Herpetological Bulletin*, 136, 23-28.
- Habiboğlu, T., Çiçek, K., & Tok, C.V. (2016). A case of melanism in the Grass snake, *Natrix natrix* (L., 1758)(Reptilia: Colubridae) from Gökçeada (Imbros), Turkey. *Biharean Biologist*, 10(1), 60-61.
- Kazilas, C., Kalaentzis, K., & Strachinis, I. (2018). A case of piebaldism in the Anatolian Worm Lizard, *Blanus strauchi* (Bedriaga, 1884), from Kastellorizo Island, Greece (Squamata: Blanidae). *Herpetology Notes*, 11, 527-529.
- Kornilios, P. (2014): First report of piebaldism in scolecophidians: a case of *Typhlops vermicularis* (Squamata: Typhlopidae). *Herpetology Notes*, 7, 401-403.
- Lanuza, G., Font, E., & Carazo, P. (2012). Color-assortative mating in a color-polymorphic lacertid lizard. *Behavioral Ecology*, 24(1), 273-279.
- Malkmus, R. (1997): Partielle Albinismus bei der Netzwühle, *Blanus cinereus* (Vandelli, 1797) in Portugal (Reptilia: Amphisbaenidae). *Sauria*, 19 (4), 45–46.
- Mutlu, H.S. (2011). *Ege Bölgesinde Yaşayan Blanus strauchi (Bedriaga, 1884) (Amphisbaenia; Blanidae) Populasyonları Üzerine Morfolojik Bir Araştırma*. Yüksek Lisans Tezi. Ege Üniversitesi, Fen Bilimler Enstitüsü, Biyoloji Anabilim Dalı / Zooloji Bilim Dalı.
- Spadola, F., & Di Toro, F. (2007). Complete albinism in a *Podarcis muralis* newborn. *Acta Herpetologica*, 2(1), 49-51.



Beneficial Roles of Freshwater Mussels in the Ecosystem

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Abstract

Freshwater mussels are an important part of the ecosystem and has several important roles in the ecosystem such as recycling and storage of food, substrate and food network modification, environmental monitoring feature (ecological indicator), water treatment (biofiltration), mussel crust industry, jewelery making and being a food source. The ecosystem services provided by mussels are directly proportional to the decrease in the mussel population. Much more information is needed about the economic, social, ecological value and magnitude of these ecological roles provided by freshwater mussels. They contribute to the food web ecology by affecting the bio-sedimentation and biodegradation of nutrients in the sediment directly or indirectly. In addition, the physical structure of mussel shells constitutes an habitat for other organisms. In this review, the beneficial roles of bivalve members, which constitute an important group of biodiversity at the point of biodiversity, have been examined in detail and it is tried to be emphasized that they are very important for aquatic ecosystem.

Keywords: Associated fauna, Diversity, *Sarcotragus foetidus*, Decapod, Levantine Sea, Turkey

Introduction

Mussels are the most well-known organisms among aquatic organisms. Many of these creatures have been an important source of food and decoration for human beings for centuries, and some have been economically detrimental to water inlets or other structures. In recent years, important roles of bivalves on the ecosystem have started to be understood (Dame 1996). Unfortunately, the functional importance of bivalves in fresh waters is not appreciated as much as they deserve. In some important ecology books (Wetzel 1983, Horne and Goldman 1994, Allan 1995, Petts and Calow 1996), there is little information related with the ecological roles of mussels. Bivalves constitute the majority of zoobenthic biomass in many rivers, streams, lakes, estuaries and shallow coastal waters. The filtration rates of bivalve populations can be as large as 10-100% of the daily water column. These rates are generally higher than those of other filter feeding in the ecosystem. The ecological effect of filter fed bivalves depends on the primary production of phytoplankton, the load of organic matter in the medium, sedimentation and consumption of other filter fed (Dame 1996). Downstream advances for river mouths and rivers are a major loss for edible particles in the environment. In many shallow water ecosystems (rivers, estuaries and coastal marine waters), the crustal power of bivalve species is greater than that of advective losses.

Human activities has caused sudden, large increases or decreases in bivalve populations. Crops used for food or ornamentation have been heavily collected, causing their population to be severely reduced or locally destroyed.

615 million kilograms of oyster (*Crassostrea virginica*) was harvested per year only in Maryland which lead to reduction of population to 1% of its former size (Rothschild et al. 1994, Dame 1996). For the American pearl button industry, over 13 million kg of shells have been collected from the

Illinois rivers in one year (Claassen 1994). Likewise, for freshwater pearls, mussel *Margaritifera margaritifera* is largely harvested, which is the primary cause of a 90% decrease in the global population of this species (Ziuganov et al. 1994).

In many shallow waters, pollution and habitat changes have also destroyed bivalve populations (Neves 1993). Thousands of kilometers of rivers in the United States have been completely eradicated by indigenous bivalve communities due to over-watering, sewage toxic and organic pollution, and other human influences (Strayer 1980). Incidentally or intentionally, some human activities have caused damage to the natural bivalve population, leading to the development of invasive bivalves. Species such as *Dreissena* spp., *Corbicula* spp., *Limnoperna fortunei*, *Potamocorbula amurensis* and *Rangia cuneata*; it now continues to spread outside its natural range (Carlton 1992, Morton 1997).

Although ecologists have focused on changes in phytoplanktons and consumers associated with phytoplankton as the primary cause of bivalve infestation (and harms), the link between bivalve and ecosystem is complex.

Freshwater mussels (later mussels) perform many well-defined functions in water ecosystems (Vaughn et al., 2008; Haag, 2012). Mussels in the ecosystem have a number of utilitarian roles defined as ecosystem services. The ecosystem services that mussels contribute to include the regulation of the water treatment system (biofiltration); supportive services such as food recovery and storage, structural habitat, substrate and food network modification, use as a food source, ornamentation as jewelry and use in the shell industry.

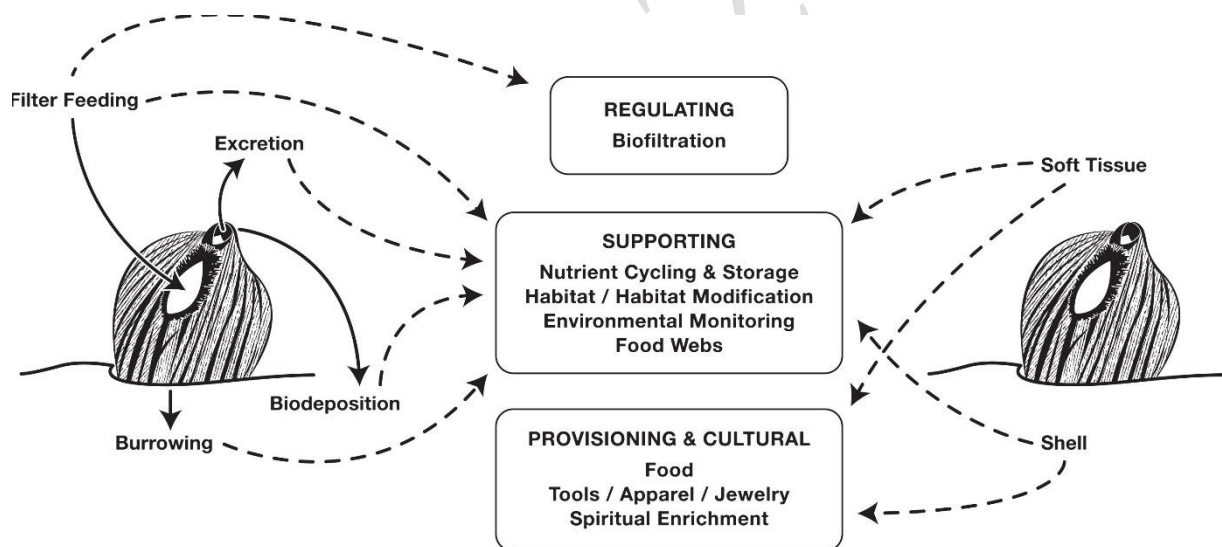


Figure. 1 Mussel tissue and activities that mussels perform can be translated into ecosystem services that are beneficial to humans

Mussel's role in biofiltration

Mussels are powerful filter feeders that remove particles from both the water column and the interstitial sediments (Figure 1) (Vaughn et al., 2008). Mussels, which are mainly fed with phytoplankton, are omnivores (Christian et al., 2004; Vaughn et al., 2008; Newton et al., 2013). Mussels in small temperate streams feed on a mixture of bacteria and suspended algae (Raikow and Hamilton, 2001), while mussels in large fertile rivers are mainly fed with phytoplankton (Thorpe et al., 1998).

A significant amount of particles can be removed from the water column by biofiltration by the mussels. Welker and Walz (1998) reported that high-density *Unionides* abolish phytoplankton in

the Spree River of Germany, leading to biological oligotrophication. Recently, Pigneur et al. (2014) reported that phytoplankton biomass loss is recorded by 70% and annual primary production is reduced by 61% in areas of high density of invasive *Corbicula* in the Meuse River. Chowdhury et al. (2016) found that mussels in a Lake Bangladesh filter lake margins in 21 hours, achieving high water clarity despite high nutrient levels.

Vanden Byllaardt and Ackerman (2014) reported that unionid filtration rate may vary depending on hydrodynamic conditions and algae status. The biofiltration capacities of mussel populations can vary greatly depending on mussel abundance, species composition and environmental conditions such as discharge, temperature and productivity (Spooner and Vaughn, 2008; Vaughn, 2010). Individual mussel filtration rates depend, among other factors, on mussel physiology and the availability of nutrients in the environment. Mussel species have different temperature-dependent filtration rates (Spooner and Vaughn, 2008). Thus, the biofiltration capacity of a mussel community can vary considerably with the temperature, seasonally. In addition, mussel nutrition rate is adjusted according to nutrient concentrations (Bril et al. 2014). The biofiltration capacity depends largely on the mussel biomass and on the volume and residence time of the water above it (Strayer et al. 1999). Mussels found in a small US river (Kiamichi River, Oklahoma) can process water several times during the low discharge periods of summer, but it is reported that only a portion of the water column can process during high spring and winter months (Vaughn et al., 2004; Vaughn, 2010).

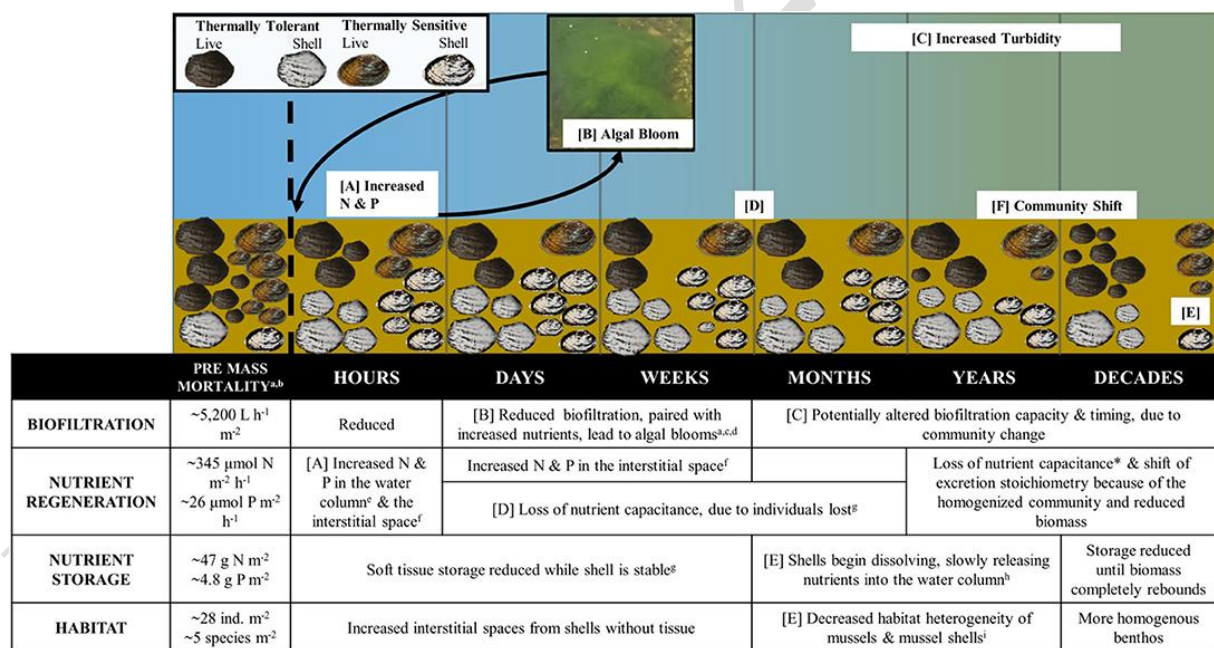


Figure 2. Conceptual model depicting ecosystem function shift due to unionids at short and long time scales Vaughn et al. (2015)) Atkinson et al. (2018).

Mussel's role in food cycle and storage

Mussels are fed with particulate nutrients and convert them into soft tissues and shells, biological structures, and dissolved nutrients (Figure 1) (Strayer, 2014). Therefore, where mussel biomass is high, mussels play an important role in nutrient recycling, alter water quality, and potentially play a role in nutrient reduction.

It is stated that mussel communities can have great effects on species composition, food recycling and storage rates in all rivers (Vaughn, 2010; Atkinson et al., 2013b; Atkinson and Vaughn, 2015). Mussels accumulate nutrients as they grow in both soft tissues and shells. These nutrients are then released as reproductive products (structures supporting sperm, larvae and larvae).

Thermally sensitive species will catabolize their tissues at high temperatures, leading to nutrient cycling (Spooner and Vaughn, 2008). Foods stored in mussel soft tissue are released by post-mortem decomposition. If mussel deaths occur at regular intervals throughout the year, food release from tissue fragmentation can be balanced by food intake by growing animals (Strayer, 2014). In these cases, the death of mussels can cause very large nutrients (Sousa et al., 2012; Bo'dis et al., 2014; McDowell et al., 2016). Mussel stores significant amounts of nutrients in their shells (Atkinson et al., 2014b; Vaughn et al., 2015), as the shells dissolve slowly released into the ecosystem (Strayer and Malcom, 2007). For example, recent studies have shown that mussel shells behave like a "slow-release gbre fertilizer, increase calcium and phosphorus in the soil, reduce soil acidity, and lead to increased forest growth, according to Canadian First Native groups in British Columbia (eg Trant et al. 2016).

Mussels are creatures with strong effects on nitrification - denitrification. Denitrification is a particularly important ecosystem service because it converts organic nitrogen to molecular nitrogen and returns it to the atmosphere in an inorganic form. Sea bivalve has been shown to enhance denitrification of freshwater zebra mussels and *Corbicula* depending on environmental conditions (Bruesewitz et al., 2009; Hoellein and Zarnoch, 2014; Turek and Hoellein, 2015).

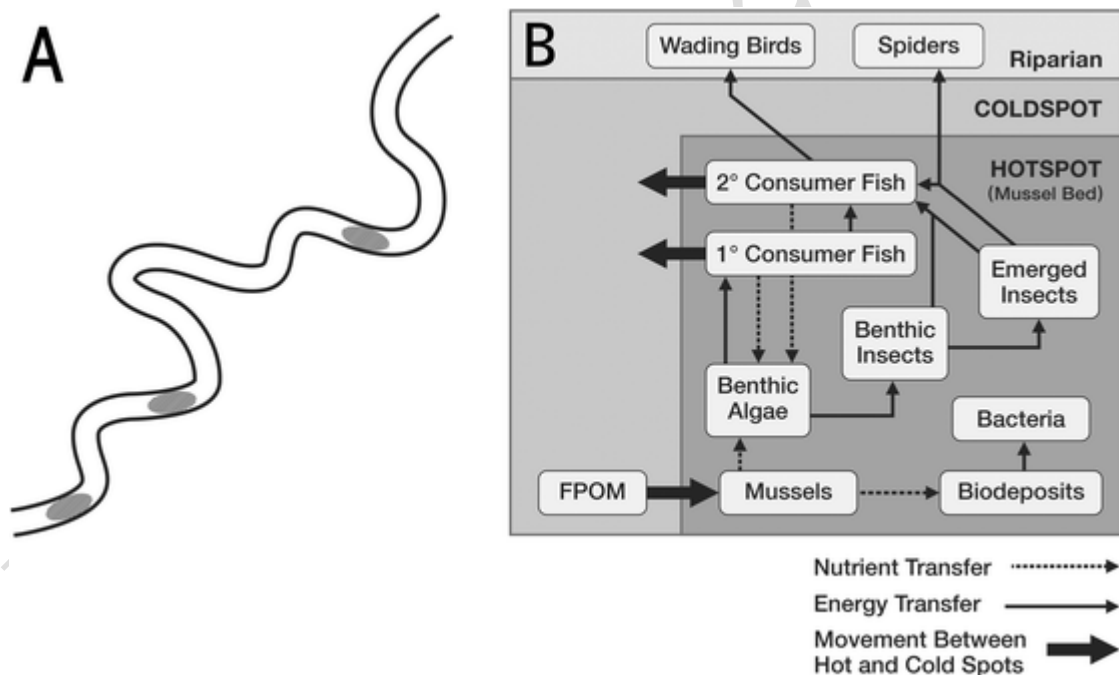


Figure. 3 A Schematic showing that mussel beds are patchily distributed in rivers, separated by areas with no mussels or low mussel abundance. In many rivers, mussel beds will be further apart than shown here. B Potential fluxes in and out of mussel beds (hotspots of biological activity) and other river areas (coldspots)

Mussels in habitat regulation

On a global basis, mollusks cause biogenic habitats such as oyster reefs by adding a physical structure to the environment with the accumulation of their shells (Gutierrez et al., 2003).

Freshwater mussel shells provide habitat for other organisms and play a role in the biogeochemical cycle (Strayer and Malcom, 2007).

Shell production and decay rates depend on the amount of spent shell material accumulated, which may exceed 10 kg dry mass / m² (Strayer & Malcom, 2007; Ilarri et al., 2015a, b). Mussel communities can support many more and various macro-invertebrate communities than similar habitats without mussels (Beckett et al., 1996; Howard and Cuffey, 2006; Vaughn & Spooner, 2006; Aldridge et al., 2007). The soft deposits formed on the shells themselves create habitats for the new living group and protect them from wear on the shells. (Spooner and Vaughn, 2006; Vaughn et al., 2008; Bo'dis et al., 2014; Ilarri et al., 2015a, b). Algae grow on mussel shells that attract herbivorous invertebrates (Francoeur et al., 2002; Allen et al., 2012; Spooner et al., 2012) and form a strong network in the food chain.



Figure 4. Mussels and habitat

Mussel as environmental observer

Freshwater mussels have the potential to serve as important outbreaks or bimonitors of environmental change, such as the emergence of environmental conditions and monitoring future changes. Since they are sessile filter feeders, they bioaccumulate particles that allow the measurement of stress agent levels in soft tissues (Green et al., 1985; Rocha et al., 2015). The geochemistry of mussel shells can reveal past physical and chemical conditions on both large spatial and temporal scales (Brown et al. 2005). Shells combine and store chemical and physical environmental patterns after a long time after the death of the animal and thus serve as historical archives to reveal long-term environmental change.

First, simple patterns of aragonite deposition that appear as growth lines similar to tree rings in bark can reflect past temperature, flow, and other conditions in which stomachs grow (Schone et al., 2004; Dunca et al., 2005; Geist). et al., 2005; Rypel et al., 2009; Black et al., 2010; Fritts et al., 2017). Trace metals incorporated into the crust tissue can be used to reveal past contamination events (Jamil et al., 1999; Brown et al., 2005) and elevation periods (Langlet et al., 2007). The isotopic traces of O18 and C13 found in mussels were used to reveal the old climatic conditions up to Miocene (Blazejowski et al., 2013).

Mussel soft tissue can be used to assess environmental conditions on scales in less time. Chemical content in mussel hemolymph, mantle or foot tissue can be used as sub-biological

markers to monitor water quality with stress and immune responses (Newton & Cope, 2007; Fritts et al., 2015; Goodchild et al., 2015; Jasinska et al., 2015; Kolarevic and et al., 2016). Pharmaceuticals are bioaccumulated in mussels at higher levels than many other aquatic organisms (Du et al., 2014). Nitrogen content in mussel soft tissue can be used as a biological assessment tool to monitor background nutrient conditions (Wen et al., 2010), especially residential and agricultural land use (McKinney et al., 2002) and agricultural nitrogen sources such as net nitrogen loading (Atkinson and others, 2014a). Finally, the fixed isotope composition of the periostracum on the outer side of the shell can also be used to monitor environmental change. Mussels are used as a suitable biomonitor tool to detect “real-time” changes in water quality by monitoring physiological responses such as gape (shell opening and closing), changes in heart rate, and changes in filtration and behavior (Hauser, 2015; Goodchild et al., 2016).

Table 1. Ecosystem service classes, mussel-provided ecosystem services, and the benefits that they provide for human

Ecosystem service class	Mussel-provided ecosystem service	Benefits for humans
Supporting	Nutrient cycling and storage Habitat/habitat modification Environmental monitoring Food webs	Water quality Fish habitat Water quality Biodiversity
Regulating	Bio filtration	Water quality
Provisioning	Food for other species Food for humans Products from mussel shells	Biodiversity Food provisioning Pottery, jewelry, art
Cultural	Cultural value Existence value	Spiritual benefits Conservation value

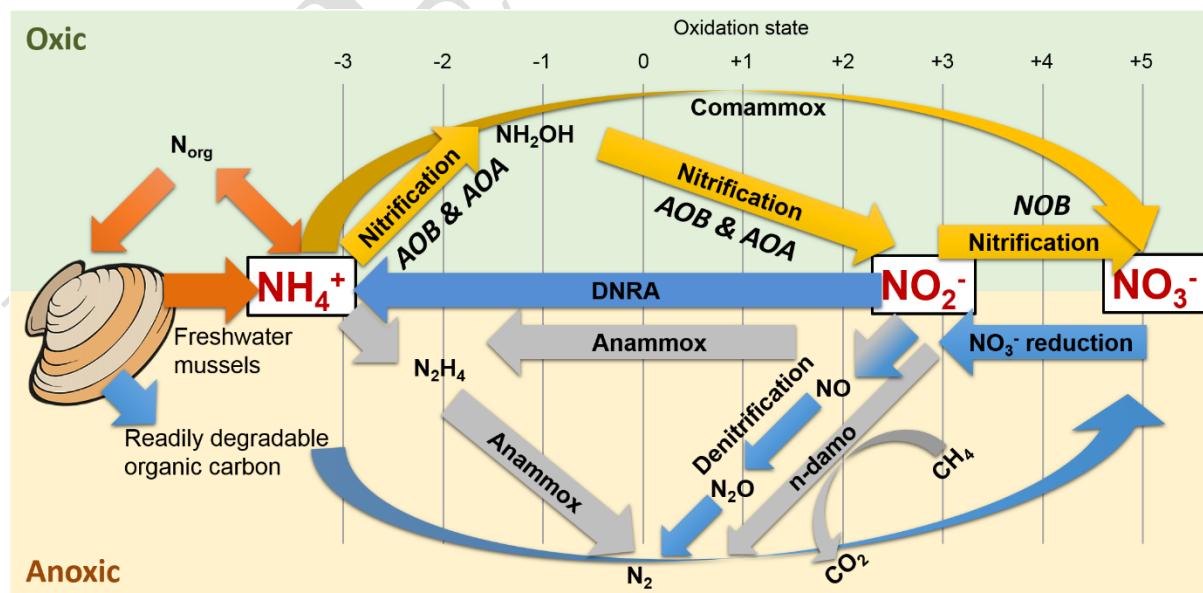


Figure 5. Freshwater mussels deposit feces and pseudofeces containing nitrogen and carbon at the water-sediment interface (i.e., oxic-anoxic transition).

The role of mussels in cultural services;

Mussels are a prey for turtles, marbles and other organisms (Atkinson, 2013). Prehistoric people used mussels as nutrients and their shells as ornaments, tools and utensils. In the US, archaeological data show that Native Americans gather mussels for food for as long as 10,000 years (Haag, 2012). Beads and other ornaments made from mussel shells played an important role in Native American rituals and ceremonies (Claassen, 2008). Established in the world based on mussel shell, the art of decoration, the formation of jewelry and the pearl sector are an important market with a cultural transition with high economic returns. (Choctaw Nation, 2016 Haag, 2012).

White



Figure 6. Freshwater mussel pearls

Protecting mussels is a very important issue because of its benefits to ecosystems. To achieve this, we need much more information about the value and size of ecosystem services provided by mussels, between species, habitats and environmental conditions and spreading across all basins (Haag and Williams, 2014). The continued use of mussels in the ecosystem will require cooperation with social scientists, economists and other stakeholders. The maintenance and recovery of mussel ecosystem services represents an interdisciplinary situation.

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References

- Bellan-Santini, D. (1969). Contribution à l'étude des peuplement infralittoraux sur substrat rocheux (Etude qualitative et quantitative de la franch Superiere). *Recherche Travaux Station Marine Endoume, France*, 63, 9-294.
- Cook, S.C., & Bergquist, P.R. (2002). Family Irciniidae Gray, 1867. In J.N.A. Hooper & R.W.M. Van Soest (Eds.), *Systema Porifera: A Guide to the Classification of Sponges* (pp.1022-1027). New York, USA: Kluwer Academic/Plenum Publishers.
- Çınar, M.E., & Ergen, Z. (1998). Polychaetes associated with the sponge *Sarcotragus foetidus* Schmidt, 1864 from the Turkish Aegean coast. *Ophelia*, 48(3), 167-183.



- Çınar, M.E., Katağan, T., Ergen, Z., & Sezgin, M. (2002). Zoobenthos inhabiting *Sarcotragus foetidus* (Porifera: Demospongia) from the Aegean Sea. *Hydrobiologia*, 482,107-117.
- Duarte, L.F.L., & Nalesso, R.C. (1996). The sponge *Zygomyscale parishii* (Bowerbank) and its endobiotic fauna. *Estuarine, Coastal and Shelf Science*, 42, 139-151.
- Falciai, L., & Minervini, R. (1996). *Guide des homards, crabes, langoustes, crevettes et autres crustacés décapodos d'Europe*. Lausanne-Paris, France: Delachaux et Niestle SA.
- Ingle, R. (1993). *Hermit crabs of the northeastern Atlantic Ocean and Mediterranean Sea*. London, England: Natural History Museum Publications, Chapman & Hall.
- WoRMS Editorial Board. (2019). World Register of Marine Species. Available from <http://www.marinespecies.org> at VLIZ. Accessed 2019-02-11. doi:10.14284/170
- Noël, P.Y. (1992). Clé préliminaire d'identification des Crustacea Decapoda de France et des principales autres espèces d'Europe. *Patrimoines Naturels*, 9, 1-145.
- Soyer, J. (1970). Bionomie benthique du plateau continental de la cote catalana Française, III. Les Peuplements de Copepodes Harpacticoides (Crustacea). *Vie Milieu*, 21, 377-511.
- Voultsiadou-Koukoura, E., & Koukouras, A. (1993). Remarks on sponge-decapod associations in the North Aegean Sea. *Bios (Macedonia, Greece)*, 1(1), 251-256.
- Wendt, P.H., Van Dolah, R.F., & O'Rourke, C.B. (1985). A comparative study of the invertebrate macrofauna associated with seven sponge and coral species collected from the South Atlantic Bight. *The Journal of the Elisha Mitchell Scientific Society*, 101, 187-203.
- Zariquiey-Álvarez, R. (1968). Crustáceos decápodos ibéricos. *Investigación Pesquera*, 32, 1-510.



Adapted Seagrass Watch Protocol to evaluate *Posidonia oceanica* health, in the Eastern Aegean Sea

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Abstract

Seagrass meadows, in particular, *Posidonia oceanica* (L. Delile) play an important role within Mediterranean coastal systems, providing numerous key ecosystem services. While acting as an ecosystem architect, *P. oceanica* ensures balanced physical, chemical and biological environmental factors in respective marine ecosystems. Its ecological importance and its known response to a variety of anthropogenic impacts, including effects of global climate change, has resulted in an increasing interest in using *P. oceanica* as a health indicator of Mediterranean coastal systems.

P. oceanica vitality was evaluated at 10 sites around Lipsi Island in Greece to determine the health status and the impact of various anthropogenic activities. The Seagrass-Watch Protocol was partly modified and implemented to assess biological and environmental data.

The percentage cover of *P. oceanica*, shoot density, blade length and epiphyte cover were found to be correlated parameters defining the health status of the seagrass meadows. Healthy meadows are known to be sites with a high cover, high shoot density and long blades. In contrast, where high epiphyte cover was observed it appeared that *P. oceanica* health was generally poorer. Phosphorus and nitrite concentrations in the water seem to be at a level not influencing *P. oceanica* negatively. In addition, water transparency was high at most sites and did not appear to inhibit *P. oceanica* growth.

The data further suggest that in shallow coastal waters direct physical anthropogenic pressure due to boat anchoring plays a more important role for the *P. oceanica* meadow than damage caused by reduced water quality. It is therefore suggested that actions should be taken to reduce anchoring within the seagrass by implementing a system of permanent mooring buoys and raising public awareness in order to protect the species which is crucial in the Mediterranean Sea.

Keywords: *Posidonia oceanica*, ecosystem health, citizen science, Eastern Aegean



Analysis of the trawl landings in Foça (Turkey) for the second half of 1990s

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Abstract

The purpose of the study is to present and analyze the daily marine fisheries landings data by trawl fishery (TF) collected from the Foça town fish market auction between 1994 and 1998. A total of 147 049.5 kg of marine fisheries capture landings - comprised of 84 % demersal fish species, 10 % pelagic fish species, 4% Cephalopods and 2% Crustaceans - was recorded. It is suggested to collect and estimate the marine commercial landings including the discard data in order to better manage the fisheries in particular at the important fishing towns.

Keywords: Izmir Bay, Trawling, Landing.

Introduction

The town of Foça is situated at the entrance of Izmir Bay on the central Aegean coast of Turkey and about 50 km north of the Izmir metropolitan area. It is one of Turkey's 18 Special Environmental Protection Areas (tvk.csb.gov.tr). In 1991, Foça was selected as a Pilot Monk Seal Conservation Area (PMSCA) where industrial fisheries, including purse-seine fishery and trawling, were banned in 1992, in order to implement the National Strategy for the Conservation of the Monk Seal issued by the National Monk Seal Committee of Turkey (Güçlüsoy & Savaş, 2003).

In Foça, trawl fishery commenced in late 1940s. At the time of the present study, a fleet of approximately 40 trawl vessels - about 60 % of the vessels in Turkish Aegean - operated from the port of Foça (Ünal et al., 1998; Ünal, 2004). Fishermen usually worked from 60 to 130 isobaths at the outer parts of Izmir and Çandarlı Bays and in the international waters between Karaburun (TR) and Lesvos (GR). Most boats (n=30) were wooden made and between 16 and 20 m in length, and powered by inboard engines - 160 to 360 HP. The others (n=7) steel constructed, and between 20 and 26.5 m in length and powered by inboard engines - 360 to 400 HP (Ünal et al., 1998). Daily fishing trips generally occurred during day time. The average number of fishing day was calculated as 220 days for 1997-1998 fishing season, and the number of fishing days ranged from 110 to 270 days for the 1999-2000 fishing season (Ünal et al., 1998; Ünal, 2004). In Foça, Italian type bottom trawl nets were in use, the characteristics of this fishing gear was described previously by Ünal et al. (1998). Though a total of 52 species were reported to be sold by TF in Foça (Ünal, 2004) in a recent study when considering the bycaught species, a total of 90 fish species belonging to 41 families were reported to be caught in the outer and central parts of Izmir Bay (Kinacıgil et al., 2008).

The socio-economics of Foça TF was also studied for the late 1990s. The analysis of investment profitability in TF revealed that 70% of trawlers were not economically sustainable and needed a better management (Ünal, 2002). Finally, the interactions of Foça TF with cetaceans was also delivered by Enül et al. (2009) for 2007-2008 fishing season. It was found out that only interaction was with bottlenose dolphin *Tursiops truncatus*.

To date, landing records were only given in provincial level by Turkish Statistical Institute (e.g. TUIK, 2018), and no record was available on landings in town level. Therefore, the purpose of



the study is to present and analyze the daily marine fisheries landings data by trawl fishery (TF) collected from the Foça town fish market auction between 1994 and 1998.

Material and Methods

The marine fisheries landings data by TF was collected on daily basis at the Foça fish market during auction time between 11 April 1994 and 30 December 1998 (Table 1). The landed species were identified according to FishBase, www.fishbase.org, and the nomenclature was verified by both FishBase and WoRMS, www.marinespecies.org during preparation of the present proceeding. The descriptive statistics analysis of the data was performed by MS-Excel.

With the aim to compare mean landings per trip among the years, the following steps were followed: in order to test for normality and homoscedasticity, the data were evaluated by using the tests of: Kolmogorov-Smirnov (Zar, 1999) and examining Skewness and Kurtosis (Tabachnick and Fidell, 2013). The datasets and their log-transformed versions did not pass the normality test, parametric procedures were employed (Zar, 1999). Therefore, the data sets were analysed with non-parametric Kruskal-Wallis H test was to compare mean landings per trip among the years. Mann Whitney-U test was also used to detect differences among the years. All these statistical analyses were performed by SPSS 20.0.

Results and Discussion

A total of 147 049.5 kg of marine fish and invertebrates were landed by TF in Foça between 1994 and 1998, comprised of 84 % demersal fish species, 10 % pelagic fish species, 4% Cephalopods and 2% Crustaceans. With regards to species diversity, a total of 30 demersal fish species, 11 pelagic fish species, 4 cephalopod species and 5 crustacean species were identified (Table 1). The descriptive statistics of the landing data is delivered in Table 2. The most important genus/species regardless of their value for SSF in Foça can be given as *Mullus* pp., Poor code, *Trisopterus minutus capelanus*, *Lophius* spp., Common pandora, *Pagellus*, and Bogue, *Boops boops*. After Kruskal-Wallis H test, the differences (p-value) between the years' mean landings per trips according to Mann-Whitney-U test are given in Table 3.

At the time of the study, although we do not have any data on the fishing gear effort/fishing power at the sea, the Foça marine fisheries landings showed typical benthic species targeted fishery that is characteristic of TF in the Mediterranean (FAO, 2018). It is also worth noting that among 50 marine species no alien species were recorded as marketed. We found out that there were some differences among the mean landings per trip among the years. This may be because we cannot normalize the data according to fishing effort. Moreover, the TF landings were not only brought to the auction, they were and still nowadays are also sold to fish mongers or in Izmir Fish Market by the fishers. This was also supported by the fact that our daily mean landing figures by boat per trip have never reached to 224 kg as indicated by (Ünal et al., 1998). Finally, it is worth noting that as there were no samplings during the first three months of 1994 (including most of the winter period), most probably the average daily landings of 1994 are biased high.

Because the authors could not get any estimation nor any data from neither from TUIK Izmir Regional Directorate nor from Foça Forestry and Agriculture Town Directorate, we cannot compare our findings with State figures. We believe, it is important to collect and



Table 1. The total landings data, at genus or species level, recorded in the Foça fish market from 1994 to 1998.

Demersal	kg	Sharpsnout seabream, <i>Diplodus puntazzo</i> (Walbaum, 1792)	2
Red scorpionfish, <i>Scorpaena scrofa</i> Linnaeus, 1758	16	Mixed benthic spp.	28 42
Mullus spp.	42 60	Total	123 90
Common sole, <i>Solea solea</i> (Linnaeus, 1758)	3 68	Pelagic	Kg
Shi drum, <i>Umbrina cirrosa</i> (Linnaeus, 1758)	2	European anchovy, <i>Engraulis encrasicolus</i> (Linnaeus, 1758)	18
Red pogry, <i>Pagrus pagrus</i> (Linnaeus, 1758)		Trachurus spp.	7 81
Lophius spp.	12 22	Mugilidae spp.	10
Tub gurnard, <i>Chelidonichthys lucerna</i> (Linnaeus, 1758)	1 22	Chub mackerel, <i>Scomber japonicus</i> Houttuyn, 1782	15
Axillary seabream, <i>Pagellus acarne</i> (Risso, 1827)	11	Bullet tuna, <i>Auxis rochei</i> (Risso, 1810)	1
Meagre, <i>Argyrosomus regius</i> (Asso, 1801)	2	European pilchard, <i>Sardina pilchardus</i> (Walbaum, 1792)	10
Common pandora, <i>Pagellus erythrinus</i> (Linnaeus, 1758)	10 91	Round sardinella, <i>Sardinella aurita</i> Valenciennes, 1847	7
European conger, <i>Conger conger</i> (Linnaeus, 1758)	1	European barracuda, <i>Sphyrna sphyraena</i> (Linnaeus, 1758)	7
Largehead hairtail, <i>Trichiurus lepturus</i> Linnaeus, 1758	21	Atlantic mackerel, <i>Scomber scombrus</i> Linnaeus, 1758	16
John dory, <i>Zeus faber</i> Linnaeus, 1758	14	Garfish, <i>Belone belone</i> (Linnaeus, 1760)	2
European flounder, <i>Platichthys flesus</i> (Linnaeus, 1758)	22	Bogue, <i>Boops boops</i> (Linnaeus, 1758)	6 09
European hake, <i>Merluccius merluccius</i> (Linnaeus, 1758)	2	Total	14 60
Pink dentex, <i>Dentex gibbosus</i> (Rafinesque, 1810)	7	Cephalapods	kg
Poor code, <i>Trisopterus minutus capelanus</i> (Lacepède, 1800)	19 60	Common octopus, <i>Octopus vulgaris</i> Cuvier, 1797	1 62
Gilthead seabream, <i>Sparus aurata</i> Linnaeus, 1758	2	European squid, <i>Loligo vulgaris</i> Lamarck, 1798	3 97
Trachinus spp.	1 61	Musky octopus, <i>Eledone moschata</i> (Lamarck, 1798)	13
Annular seabream, <i>Diplodus annularis</i> (Linnaeus, 1758)	34	Cuttlefish, <i>Sepia officinalis</i> Linnaeus, 1758	4
Picarel, <i>Spicara smaris</i> (Linnaeus, 1758)	7	Total	5 78
Com.two-banded seabream, <i>Diplodus vulgaris</i> (GeoffroySaint-Hilaire, 1817)	8	Crustaceans	kg
Smooth-hound, <i>Mustelus mustelus</i> (Linnaeus, 1758)	54	European lobster, <i>Homarus gammarus</i> (Linnaeus, 1758)	7
European seabass, <i>Dicentrarchus labrax</i> (Linnaeus, 1758)	3	Caramote prawn, <i>Penaeus kerathurus</i> (Forskål, 1775)	60
Saddled seabream, <i>Oblada melanura</i> (Linnaeus, 1758)		Deep-water pink shrimp, <i>Parapenaeus longirostris</i> (Lucas, 1846)	1 68
Blotched picarel, <i>Spicara maena</i> (Linnaeus, 1758)	3	Spottail mantis shrimp, <i>Squilla mantis</i> (Linnaeus, 1758)	11
Shore rockling, <i>Gaidropsarus mediterraneus</i> (Linnaeus, 1758)	1	European spiny lobster, <i>Palinurus elephas</i> (Fabricius, 1787)	16
White seabream, <i>Diplodus sargus</i> (Linnaeus, 1758)	1	Total	263
Common dentex, <i>Dentex dentex</i> (Linnaeus, 1758)	2		

estimate the marine commercial landings including the discard data in order to better manage the fisheries in particular at the important fishing towns.



Table 2. The descriptive statistics of marine fisheries landings between 1995 and 1998.

	Year	Day	Mean (kg/d)	Std.D	Min (kg)	Max (kg)	Total (kg)	Trips	Mean (kg/trip)
All	1995	105	467.5	322.5	30.0	1772.0	49092.5	324	151.52
	1996	128	260.7	189.9	40.0	1160.0	33363.5	252	132.39
	1997	184	215.0	181.0	5.0	1140.0	39563.5	327	120.99
	1998	130	192.5	98.1	25.0	450.0	25030.0	306	81.80
	Total	547	268.8	226.8	5.0	1772.0	147049	1209	121.63
Demersal	1995	105	400.2	267.4	30.0	1315.0	42021.0	324	129.69
	1996	128	228.2	178.3	11.5	1110.0	29214.5	252	115.93
	1997	184	171.0	145.6	0.0	850.0	31463.0	327	96.22
	1998	130	163.6	85.1	15.0	410.0	21270.0	306	69.51
	Total	547	226.6	193.9	0.0	1315.0	123968	1209	102.54
Pelagic	1995	105	36.7	53.2	0.0	426.0	3856.0	324	11.90
	1996	128	20.8	26.1	0.0	110.0	2668.0	252	10.59
	1997	184	31.7	43.3	0.0	280.0	5832.0	327	17.83
	1998	130	17.8	25.7	0.0	130.0	2307.5	306	7.54
	Total	547	26.8	39.2	0.0	426.0	14663.5	1209	12.13
Cephalopods	1995	105	24.8	24.5	0.0	100.0	2607.0	324	8.05
	1996	128	5.9	9.7	0.0	40.0	761.0	252	3.02
	1997	184	7.2	15.9	0.0	160.0	1324.5	327	4.05
	1998	130	8.4	10.8	0.0	60.0	1087.5	306	3.55
	Total	547	10.6	17.2	0.0	160.0	5780.0	1209	4.78
Crustaceans	1995	105	5.8	13.1	0.0	90.0	608.5	324	1.88
	1996	128	5.6	13.8	0.0	100.0	720.0	252	2.86
	1997	184	5.1	11.8	0.0	60.0	944.0	327	2.89
	1998	130	2.8	6.5	0.0	30.0	365.0	306	1.19
	Total	547	4.8	11.6	0.0	100.0	2637.5	1209	2.18

Table 3. Statistical differences for the mean landings per trips among the years calculated by Mann-Whitney-U test.

	1995-1	1995-1	1995-1	1996-1	1996-1	1997-1
All	0.038	0.000	0.000	0.018	0.000	0.000
Demersal	0.034	0.000	0.000	0.001	0.000	0.000
Pelagic	0.15	0.28	0.001	0.036	0.14	0.000
Cephalo	0.000	0.000	0.000	0.23	0.010	0.08
Crustace	0.78	0.80	0.10	0.90	0.20	0.14

* Denotes statistically differences.

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References

- Enül, E., Bizsel, K.C., & Güçlüsoy, H. (2009). Interaction between trawlers and cetaceans in Izmir Bay: Preliminary findings. *Abstract Book of 23rd Annual Conference of European Cetacean Society*, 87-88.
- FAO (2018). *The State of Mediterranean and Black Sea Fisheries*. General Fisheries Commission for the Mediterranean. Rome.
- Güçlüsoy, H. & Savaş, Y. (2003). Status of the Mediterranean monk seal, *Monachus monachus*, in the Foça Pilot Monk Seal Conservation Area, Turkey. *Zoology in the Middle East*, 28, 5-16. DOI:10.1080/09397140.2003.10637951



- Kınacıgil, T., İlkyaz, A.T., Metin, G., Ulaş, A., Soykan, O., Akyol, O., & Gurbet, R. (2008). *Balıkçılık Yönetimi Açısından Ege Denizi Demersal Balık Stoklarının İlk Ürüne Boyları, Yaşları ve Büyüme Parametrelerinin Tespiti*. TÜBİTAK Proje No. 103Y132.
- Tabachnick, B.G., & Fidell, L.S. (2013). *Using Multivariate Statistics*, 6th ed. Pearson Education Inc., USA.
- TUIK (2018). *Fisheries Statistics 2017 (in Turkish)*. Turkish Statistics Institution, Ankara.
- Ünal, V. (2002). Analysis of investment profitability in trawl fishery, Foça (Aegean Sea) (in Turkish). *Ege Journal of Fisheries and Aquatic Sciences*, 19, 411-418.
- Ünal, V. (2004). Viability of trawl fishing fleet in Foça (the Aegean Sea), Turkey and some advices to central management authority. *Turkish Journal of Fisheries and Aquatic Sciences*, 4, 93-97.
- Ünal, V., Özekinci, U., & Akyol, O. (1998). Foça trol balıkçılığının bugünkü durumu. *III. Su Ürünleri Sempozyumu Bildiriler Kitabı*, 221-230.
- Zar, JH (1999). *Biostatistical Analysis*, 4th ed. Prentice - Hall, USA.

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The first *Xennella* Cobb, 1920 (Nematoda: Xenellidae) specimen from the Black Sea

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Abstract

Xenellidae de Coninck, 1965 is a small family with only two genera, i.e. *Porocoma* Cobb, 1920 and *Xennella* Cobb, 1920, and a total of five species, which are very rare in the world. *Porocoma* is represented only by one species, *P. striata* Cobb, 1920 whereas four species of *Xennella* are reported to date, i.e., *X. cephalata* Cobb, 1920, *X. filicaudata* Allgen, 1954, *X. metallica* Tchesunov, 1988 and *Xennella suecica* Allgen, 1935. An ecological and taxonomical study of the meiobenthos of Sinop Bay conducted between summer 2015 and spring 2016 (2-4 m depth) resulted in discovery of *Xennella* in this region (Southern Black Sea). The nematodes were separated under a stereomicroscope using modified Bogorov chambers. Permanent slides of the nematodes were prepared using slow evaporation method. The measurements were made under Leica DM 2500 light microscope using LAS version 4.0 software. This study represents the first record of this uncommon genus and also Xenellidae de Coninck, 1965 both in Turkey and in the Black Sea basin.

Keywords: Free-living marine nematodes, new record, Black Sea, Turkey, *Xennella*, Xenellidae



First Record of the Starfish *Asterina phylactica* (Echinodermata: Asteroidea) from the Eastern Mediterranean

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Abstract

Information is provided about *Asterina phylactica* which is reported for the first time from the eastern Mediterranean within the frame of the present study. The genus *Asterina* is represented by 15 species in world seas while three and two of which are known from the Mediterranean and the Turkish seas respectively. *Asterina phylactica* has been the third species of this genus known from the Turkish seas. Morphological, ecological and distributional features of this species are given in the present study.

Keywords: Echinodermata, *Asterina*, Turkish seas, Aegean Sea, new record

Introduction

The phylum Echinodermata which generally live in the marine benthic environment is represented by 7291 species in the world's oceans and has 5 classes, namely Crinoidea (623 species), Asteroidea (1922 species), Ophiuroidea (2064 species), Echinoidea (999 species) and Holothuroidea (1683 species) (Appeltans et al., 2012; Uysal et al., 2018). According to Öztoprak, et al., 2014, there are 23 species reported from the Turkish Seas belonging to the class Asteroidea. The genus *Asterina* which is represented by 15 species in World seas has three representatives [*Asterina gibbosa* (Pennant, 1777), *A. panzerii* (Gasco, 1876) and *A. phylactica* Emson & Crump, 1979] in the Mediterranean Sea two of which (*Asterina gibbosa*, *A. panzerii*) is reported from the Turkish Seas up to date. *Asterina phylactica* is reported for the first time from the eastern Mediterranean within the frame of the present study. Systematical, morphological, ecological and distributional features of *A. phylactica* are also provided in this study.

Material and Method

Starfish samples were collected between 22.07.2016 and 14.08.2016 at 3 sampling stations in the Aegean Sea (Figure 1).



Figure 1. Map of the investigated area with the location of sampling sites.

Three random replicates were taken at each station using a quadrat of 20×20 cm in dimension and all materials within each quadrat were carefully scraped by a spatula and immediately put in jars with 10% seawater formalin solution. In the laboratory, material was first washed with tap water on a 0.5 mm mesh and then sorted under a stereomicroscope. Specimens belonging to each taxonomic group were put into separate vials and preserved with 70% alcohol. Specimens were then identified to species level and counted. The macro-benthic individuals identified were deposited at ESFM (Ege University Faculty of Fisheries Museum).

Results and Discussion

As a result of evaluating the samples, 21 specimens of *Asterina phylactica* were encountered. Systematic and taxonomic features of the species as given below.

Phylum: Echinodermata
Subphylum: Eleutherozoa
Class: Asteroidea
Order: Valvatida
Family: Asterinidae
Genus: *Asterina*

Asterina phylactica Emson & Crump, 1979

(Figure 2)

Asterina phylactica: Emson & Crump 1979: 78–79, figs. 1–3; 94: Plt 1; Oliver et al. 1997: 104–105, Figs.1 and 5; Lopez–Marquez et al., 2018: 516, Fig. 4.

Material examined: ESFM–ECH/16–1, 1 specimen, 22 July 2016, Gokçeada, Sta. 3, $40^{\circ}14'13''\text{N} - 25^{\circ}56'26''\text{E}$, 10 m, *P. oceanica*; ESFM–ECH/16–2, 11 specimens, 14 August 2016, Gokova Bay, Sta. 2, $37^{\circ}02'05''\text{N} - 28^{\circ}11'11''\text{E}$ *P. oceanica*, 5 m; ESFM–ECH/16–3, 6 specimens, 14 August 2016, Gokova

Bay, Sta. 2, 37°02'05"N – 28°11'11"E *P. oceanica*, random; ESFM–ECH/16–4, 3 specimens, 09 August 2016, Turunç, Sta. 1, 36°44'16"N - 28°17'55"E *P.oceanica*, mud, 5 m.



Figure 2. Dorsal and ventral view of *Asterina phylactica*.

Specimens of *A. phylactica* resemble those mentioned by Emson and Crump (1979). The body shape is a regular pentagon, the arms short with rounded tips. The abactinal surface bears a large number of short spines in groups of 2–6, arranged in rows running to the arm tips (Figure 2). A distinct row of larger plates runs down the arm and terminates at the large. The spines are usually pairs, but sometimes in single. Each of the paired mouth angle plates bears three or four marginal spines. Spines are usually absent from the ventral surface of the mouth angle plates. The general background colour of the abactinal surface of living animals is red or orange with the radial areas softly grey. The spinelet groups on the radial areas are a pink colour except near the arm tips where they are unpigmented (Figure 3).

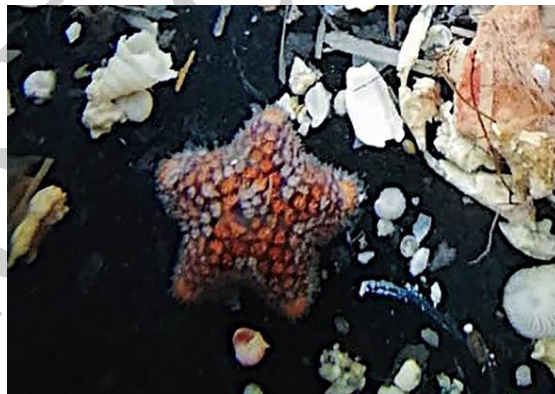


Figure 3. Colour pattern of *Asterina phylactica* on dorsal side.

Ecology: Specimens were collected from the sandy muddy and *Posidonia* biotops at 5–10 m depths. *Asterina phylactica* were generally found on rhizoms and thalli of *P. oceanica* as epiphyte. In other studies, *A. phylactica* was reported in large, deep, high-level rock pools on fairly exposed shores; less common in lower pools and sublittoral and carpeted with perennial algae, the density of very considerably higher and the species is commonly found feeding on the tops of rocks and on the fronds of perennial algae on overcast days and even on intermittently sunny days in autumn and winter. (Southward and Campbell, 2006).



Distribution: *Asterina phylactica* was firstly recorded in British Waters South Wales (West Angle Bay, Dyfed) by Emson and Crump (1979). It is also distributed in Adriatic Sea, France, Ireland, Irish Sea and St. George's Channel, Mediterranean Sea, North Atlantic Ocean, United Kingdom, Southwest England, South Ireland (Southward and Campbell, 2006). This species was reported for the first time from the eastern Mediterranean (Aegean Sea) within the frame of the present study.

Results

There are two species of the genus *Asterina* known to occur in the Turkish seas. These species (*Asterina gibbosa*, *A. panzerii*) was first recorded from the Sea of Marmara by Tortonese and Demir (1960). *Asterina gibbosa* prefers rocky, stony and sandy bottoms up to 125 m depths from the shore (Buharalı, 2018). *Asterina panzerii* lives on thalli of the phanerogams between 0–177 m depths (Coll et al., 2010). Species of the genus *Asterina* are small invertebrates without economic importance. *Asterina panzerii* is known as an indicator species of pristine waters is in the list of endangered species according to the National Biodiversity Strategy and Action Plan (2007) of the Ministry of Environment and Forestry and its catching was forbidden. (Buharalı, 2018). As a result of the present study, number of the echinoderm species distributing along the Turkish seas has increased to 92. There are quite a few studies were performed in Turkish seas about the phylum Echinodermata (especially about the genus *Asterina*). Increase is expected in the number of echinoderm species distributed along the Turkish seas within the frame of more detailed ecological studies will be conducted in the Turkish seas considering the biology and the ecology of these species.

References

- Appeltans, W., Ahyong, S. T., Anderson, G., Angel, M.V., Artois, T., Bailly, N., *et al.*, 2012, The magnitude of global marine species diversity. *Current Biology*, 22: 2189–2202.
- Buharalı, B., 2018, Bioecological Features of Echinodermata Distributing Along Turkish Coasts of Marmara Sea and Turkish Straits System, MSc Thesis, Ege University, Graduate Faculty of Natural and Applied Science, İzmir, 162 p. (in Turkish).
- Coll, M., Piroddi, C., Steenbeek, J., Kaschner K., Lasram, F. B. R., Aguzzi, J., Ballesteros, E., Bianchi, C. N., Corbera, J., Dailianis, T., Danovaro, R., Estrada, M., Frogli, C., Galil, B. S., Gasol, J. M., Gertwagen, R., Gil, J., Guilhaumon, F., Kesner-Reyes, K., Kitsos, M-S., Koukouras, A., Lampadariou, N., Laxamana, E., Lopez-Fe de la Quadra, C. M., Lotze, H. K., Martin, D., Mouillot, D., Raicevich, S., Rius-Barile, J., Saiz-Salinas, J. I., San Vicente, C., Somot, S., Templado, J., Turon, X., Vafidis, D., Villanueva, R. & Voultziadou, E. 2010, The biodiversity of the Mediterranean Sea: estimates, patterns, and threats, *Plos One*, 5(8): 1–334 pp.
- Emson, R. H., & Crump, R. G. 1979, Description of a new species of *Asterina* (Asteroidea), with an account of its ecology. *Journal of the Marine Biological Association of the United Kingdom*, 59(1), 77–94.
- López-Márquez, V., Acevedo, I., Manjón-Cabeza, M. E., García-Jiménez, R., Templado, J., & Machordom, A. 2018, Looking for morphological evidence of cryptic species in *Asterina* Nardo, 1834 (Echinodermata: Asteroidea). The redescription of *Asterina panzerii* (Gasco, 1870) and the description of two new species. *Invertebrate systematics*, 32(3), 505–523.
- Oliver, J. A., Terrasa, J., & Guillen, M. 1997, Dos nuevas citas de *Asterinas* (Asteroidea, Asterninidae) en Mallorca: *Asterina panzerii* (Gasco, 1870) y *A. phylactica* (Emson y Crump, 1979). *Bolletí de la Societat d'Història Natural de les Balears*, 40, 103–107.
- Öztoprak, B., Doğan, A. & Dağlı, E., 2014, Checklist of Echinodermata from the coasts of Turkey. *Turkish Journal of Zoology*, 38: 892–900.



- Southward, E.C. & Campbell, A.C., 2006, Echinoderms: Keys and Notes for the Identification of British Species, Synopses of the British Fauna (New Series), 56. Field Studies Council, Shrewsbury, UK. ISBN 1-85153-269-2, 272 p.
- Tortonese, E. & Demir, M., 1960, The Echinoderm fauna of the Sea of Marmara and the Bosphorus, İstanbul Üniv. Fen Fak Hidrobiologi Araştırma Enstitüsü Yayınları, Serie B, Fas 1,2: 1–16 pp (in Turkish).
- Uysal, A., Doğan, A., Dağlı, E., 2018. Distribution of the Economically Important Echinoderm Species along the Turkish Seas International Marine & Freshwater Sciences Symposium Proceedings. October 18-21, 2018 Antalya / Turkey, p. 148–150.

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POSTER PRESENTATIONS



Benefits of Shellfish Aquaculture for the Environment

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Abstract

Aquaculture production has a wide impact on the ecosystem in which it takes place, as in other agricultural activities. Therefore, aquaculture sector is expected to contribute to economic development with minimum impact on environment and maximum benefit to society. Shellfish have an important role in improving water quality because they are filtering water for feeding. Shellfish culture is sustainable and good for the environment. As they feed, it cleans water, removes nitrogen, accelerates denitrification and enhances water clarity. In particular, oysters and mussels provide excellent habitat for myriad juvenile fish, crustaceans, crabs and other organisms by cleaning the water in their environment and this shellfish improves species diversity. Shellfish farming has proven to be sustainable because it does not harm the environment or endanger future productivity. Annual harvests are made possible by replanting hatchery-reared seed. Shellfish farming has a much lower environmental impact than fish farming. This paper will include information on the role of shellfish aquaculture in improving sea water quality and its benefits to the ecosystem.

Keywords: Shellfish Aquaculture, Bivalve, Environment, Oyster, Mussel



Histological Examination of Black Sea Trout (*Salmo labrax*) Fed by Carotenoid Containing Diets

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Abstract

In this research, Black Sea trout (*Salmo labrax*) individuals have been fed by different doses of astaxanthine, canthaxanthin and lycopene containing diets (ranged from 100 ppm to 300 ppm) for three months. Sampling was carried out in every month in order to collect muscle tissues for the histological examination. Primarily, meat tissues were fixed in Bouin's solution for further examinations. In the following, samples which are in size of 1.0x0.5cm were sectioned from meat tissues and they were transferred to tissue embedding cassettes. Obtained samples were dehydrated with ethanol (started from 70% to 100% with gradually increasing) and embedded into paraffin. Moreover, samples were cut via Leica RM2135 within the size of 5-7 microns model microtome and obtained sections were stained with hematoxylin-eosin. Finally, histological sections were examined under the light microscope via NIS-Elements Advanced Research software. According to the examinations; there were no statistically differences in thickness of epidermis, dermis, basal membrane and hypodermis among the groups ($P \geq 0.05$). Skin tissue of fish consists of two main structure such as epidermis and dermis. The other structures that belongs the skin tissue just as scales, chromatophores and mucosal cells located between those aforementioned structures in the Black Sea trout similar to other salmonids. However, count of the mucosal cells were found to be the highest in carotenoid fed groups than the control groups. Especially, the highest mucosal cell number were counted in 300 ppm astaxanthine and canthaxanthin groups in the end of a 3-month feeding trial. In salmonids, myotomal muscles has located underneath the fish skin throughout the body in both sides. In Black Sea trout, myotomal muscles from dorsal and caudal sections exhibited a firm structure when comparing to the samples of abdomen section. Myotomal muscles are responsible for the providing thrust force for required for swimming and they can be more abundant in the fish species can reach higher speeds like Black Sea trout. That's the reason why dorsal and caudal sections were more firm than abdomen along with fat accumulation to be expected in the abdomen.

Keywords: *Salmo trutta labrax*, astaxanthine, canthaxanthin, lycopene, muscle tissue

Acknowledgement

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Reproduction and growth of *Sardina pilchardus* (Walbaum, 1792) in Western Mediterranean (Algerian eastern coast)

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Abstract

The first objective of this study consists of an exhaustive description of growth and, reproduction of *Sardina pilchardus* (N = 1146). Samples were collected monthly from November, 2017 to October, 2018 along the Algerian eastern coasts (Western Mediterranean).

The total population structure is composed of 59.49 % females, 37.11% males and 3.4% undetermined, their weight increases faster than the cube of their total lengths with $b=3.236$. The von Bertalanffy growth equation is of the genus $L_t = 21.58 [1 - e^{-0.39(t + 0.086)}]$. The breeding season for *S.pilchardus* runs from November to April.

The size at first sexual maturity is 11.7 cm in the male and 11.95 cm in the female. The sex ratio is in favor of females for most of the year except in autumn where it is reverses.

Keywords: Biology, Small pelagic, *Sardina pilchardus*, Western Mediterranean, Algeria



Allometric relationship between somatic growth and otolith growth in 2 pelagic species, *Sardina pilchardus* (Walbaum, 1792) and *Sardinella aurita* (Valenciennes, 1847) collected off the East-Algerian coasts (Western Mediterranean)

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Abstract

This study is designed to evaluate the allometric relationships between fish size and otolith size. The samples were collected monthly, between November, 2017 to October, 2018 from the contributions of the commercial fishing of the Algerian east coast (Western Mediterranean); a total of 112 specimens of *Sardina pilchardus* and 110 *Sardinella aurita* were examined.

The correlation coefficients "r" of the global size (LT) and otolith size (length Lo, width lo and surface So) relationships for both species are close to 1 ($0.87 \leq r \leq 0.88$ and $p \leq 0.001$) for *S. pilchardus* and ($0.91 \leq r \leq 0.93$ and $p \leq 0.001$) for *S. aurita*, indicating a very highly significant correlation of parameters. The overall statistical analysis shows minorant allometric growth ($t > 1.96$ and $b < 1$) compared to the total size of the fish for both species.

The study of the relation of the size and the weight of the fish with the otolith radius shows that the otoliths grow simultaneously in a linear way, they are fast then slow down to stabilize at the adulthood, which confirms that somatic growth and otolith growth are strongly correlated.

Keywords: Otolith, Allometric growth, *Sardina pilchardus*, *Sardinella aurita*, Algeria



Comparative study of insecticidal activity of two Essential Oils against *Culex pipiens* mosquito larvae

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Abstract

Mosquitoes are harmful agents and vectors of many diseases for humans and animals, to control these vectors, the use of chemical insecticides causes negative effects on humans and the environment. In this context, Plant products have been tested as insecticides against mosquitoes because they are not toxic to mammals and are promising candidates to replace conventional insecticides. Plant essential oils in general have been recognized as an important natural source of pesticides. Essential oil compounds and their derivatives are considered to be an alternative means of controlling many harmful insects and their rapid degradation in the environment have increased specificity that favours beneficial insects.

In the present study, the Essential Oils of two species of mint *Mentha pulegium* and *Mentha rotundifolia* were tested on fourth-stage larvae of *Culex pipiens* collected in the Annaba region, north-east of Algeria. EOs have shown a larvicidal effect with concentration-dependent mortality. The highest larval mortality was recorded using a concentration of 200ppm of *Mentha rotundifolia* Essential Oil against fourth-stage of *Culex pipiens* larvae, for *Mentha pulegium* we recorded the highest mortality rate with a concentration of 400ppm. From the toxicity tests we have determined the different lethal concentrations, for *Mentha rotundifolia* the LC₅₀ is calculated at 62,08 ppm, and 90,57 ppm for *Mentha pulegium*.

In view of these lethal concentrations, we can say that *Mentha rotundifolia* essential oil is more effective and more toxic against *Culex pipiens* larvae than *Mentha pulegium* essential oil

Keywords: Toxicity, Biocide, *Culex pipiens*, *Mentha rotundifolia*, *Mentha pulegium*



Arranging and establishment of drought-resistant, fertile apricot-intensive gardens in mountainous and mountainous areas of the Republic of Uzbekistan

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Abstract

In summary, the results of our experiments show that careful attention to a small beetle in the beginning of the enormous work, such as the expansion of the area of apricot varieties and the production of apricot fruits corresponding to world-class export standards, storage, processing, export of finished products and development of ecotourism and there is boundless affection for the seedling that grows in color. Only then will we be able to use our land purposefully and wisely.

Keywords: Apricot, Agrotechnical activities, intensive gardens, mountainous areas

Introduction

In the Republic of Uzbekistan, 44,896.9 thousand ha, of which irrigated area is 4 million ha. 273.3 thousand ha or 9.8% of the total area. Irrigated cropland - 9.8%; 1.85% of allotted land; perennial plantations - 0.85%; pastures and hayfields - 50.93%; land plots - 1.3%; lands allocated for land reclamation - 0,18%; orchards - 2.29%; Other lands - 32.38%; Total area of agricultural land - 61,13%; non-agricultural land - 39.78%. Today, in Uzbekistan, where human beings, people's well-being and land are more important than ever, it is important to build fruit gardens in the mountainous and piedmont areas that have not been used before.

The production of high-grade varieties and the creation of fruit-bearing orchards at industrial levels are largely dependent on the size and quality of seedlings being processed. It is impossible to develop horticulture without creating patterned plantations. Fruit nuts determine the state of the fruit, the type and grade of fruit crops in the region, district, orchard. It is necessary to produce seedlings consisting of species and varieties that meet the standard requirements for gardening in the fruiting area, which meet the requirements of the region and meet the needs of the population for wet and dry fruits and the food industry. At the same time, cultivated varieties must be productive, resistant to the conditions of the region (drought, frost, saline, etc.), fruits should be of high quality and resistant to diseases and pests.

Dissertation samples of apricot seedlings introduced in Germany in 2017 have been brought to the Jizzakh scientific-experimental station in the system of gardening, viticulture and winemaking named after academician Mahmud Mirzaev, and collections of them have been created.

At present, the establishment of industrial plots in Uzbekistan on land plots is a key task of providing climatic varieties of apricot varieties that are resistant to extreme conditions of high quality fruits, high yield, early harvesting, disease and pest, and environment. In many farms, this need is still met by the poor quality seedlings grown from the orchards of the gardens. Gardens built of such seedlings do not always allow for high and stable yields. Therefore, special attention must be paid to the creation of healthy maternity gardens that will enable the cultivation of healthy fruit trees, the development of intensive technologies for the primary sowing material - the phyto-sanitary condition of maternity orchards, as well as the cultivation of rare and valuable varieties.

It is important to choose from the varietal varieties of apricot introduced in the Lalmi earth, which are of high economic value. It is one of the main measures of high-temperature, resistant to high temperatures, storage of harvest elements, early maturing and latex, selection of apricot and cherry



varieties resistant to diseases and pests, placement in areas with adverse climatic conditions, growing on the slopes and continually growing.

In 2018, at the Jizzakh scientific experimental station, an orchard garden was set up on 0.50 hectares, with the use of new innovative technologies that preserved varieties of varieties in these areas every year in the Republic, more than 30,000 pieces of seedlings have been created for intensive orchards. As the methods of growing new varieties of apricots are being introduced to the production of new varieties, their area is expanded by 20-30 hectares per year, and the quality of apricots is increased. As a result, the export potential of agricultural production in the region and in the republic will increase.

In Jizzakh scientific experimental station, early spring 2018, the land was planted and the furrows were harvested and all the agrotechnical activities were well-watered and cleaned from the sand before sowing stratified seeds. Sprouting seedlings were cleaned of the weeds, and the loins were regularly softened. For the welding, the stems were made from the sapphire maternity garden of the Samarkand Scientific experimental station by selecting healthy varieties on the morphological features. On the basis of the morphological characteristic of the plant growing season (August, September), the apricot was tested and the buds were grafted to the seedlings to be welded and the worms were grafted to the seedlings.

It is well-preserved in botanical terms with relative and physiologically adapted welded feldspar.

Buds are processed in 3 ways: wooden, wooden and tube grafted. It is best to vaccinate the root. If it is grafted higher, wild boars may form in the walnut.

Bovine vaccination is recommended for the following procedure. The wanderer should work on the sun back. Duck buds were buried in 5 cm long buds. All of the cut-off area was tied with a 1 cm wide and 25-30 cm long film with a worm graft. After a week, buds were detected and reparative seedlings were recycled.

Agrotechnical activities were timely taken care of the seedlings. Dried apricots have been dried 3 times, 3 cultivated and 6 times irrigated for the successful growth and development of apricot seedlings. The seedlings are ready to be grown and sorted according to their standard requirements, length of seedlings, width of branches and roots system was implemented.

In early spring, the arachnid was irrigated and irrigated to irrigate the area planted in apricot.

After a week the soil was slightly softened to maintain moisture in the nursery.

In May, 1, June 1, July 2, August 1 and September 1, total nurseries were irrigated 6 times. In the middle of June, when the seedlings were growing, 90 kg of soil was fed to the hectare from nitrogen, which is a mineral fertilizer.

After two or three watering, the soil was softened three times and the weeds were cleaned from the weeds. 3 cultivated arrays and irrigation canals.

In the second half of April, nearly 100-120 g of nitrogen fertilizer was planted around each plant to grow young seedlings. The second time in June, the same amount of nitrogen fertilizer was left.

For the second time in July, vaccination work was carried out in the nurseries.

A second test was held on the vaccination of seedlings planted.

After a week, the rest of the seedlings were restored.

Agrotechnics activities were timely implemented in the care of nurseries.

In October-November, a series of sprouts between the young shoots and the seedlings were smashed, softened, and the weeds were started.

Early spring, 2018, seeds of apricots were sown and sown to 4-5 cm deep. Sprouted seedlings were mixed once.

3 times chopped 6 times watered. The duration and quantity of irrigation techniques differs slightly from those in the walnut tree planting. The soil moisture was maintained at 70-80% relative to the full wetness of the field. Before planting buds, seedlings were satisfied and watered. After the irrigation, the pine tree movements improved and the bark was well-matched.

In the study of planted apricots, the growth of corn was 91%.

Thanks to the timely implementation of agro-technical arrangements for planting seedlings, the seedlings were completely filled out.

In summary, the results of our experiments show that careful attention to a small beetle in the beginning of the enormous work, such as the expansion of the area of apricot varieties and the production of apricot fruits corresponding to world-class export standards, storage, processing, export of finished



products and development of ecotourism and there is boundless affection for the seedling that grows in color. Only then will we be able to use our land purposefully and wisely.

References

- “Strategy of Actions”, Tashkent, 2017.
- Lomakin E.N. (1977). Genofond abrikosa, zadachi i puti selektsionnoy raboty v Sredney Azii. - V kn: *Materialy nauchno-metodicheskogo soveshaniya po kulture abrikosa*. Tashkent.
- Mirzaev M.M. (2000). *Abrikos. Tashkent*.
- Mirzaev M. M., (2002). *Kultura abrikosa v Uzbekistane, Tashkent*.
- T.E.Ostonayulov, S.H.Nazieva, B.H.Gulomov. (2010). *Fundamentals of ornamentation Tashkent*.

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Risks assessment of two acaricides (fluvalinate and oxalic Acid) in *Apis mellifera intermissa* (Hymenoptera, Apidae): Acetylcholinesterase and glutathione S-transferase activities

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Abstract

The ectoparasitic mite *Varroa destructor* [1] (Acari, Varroidae) is one of the most serious pests of honey bees *Apis mellifera* L., (Hymenoptera, Apidae) worldwide. It has being linked with the death of millions of colonies and several acaricides are used by beekeepers to control *V. destructor*. The objective of the present study was to determine possible negative effects of two acaricides fluvalinate, a synthetic compound, and oxalic acid, a natural substance by measuring acetylcholinesterase (AChE) and glutathione S-transferases (GSTs) activities in newly emerged workers bees, nurses and foragers of *A. mellifera intermissa*. Two groups of five hives each were treated with these acaricides and one group was left as control. Data showed that fluvalinate led to increase GST activity and decrease AChE activity in emerged and nurse bees as compared to controls. In the forager bees, the enzymatic activities were similar in all groups of honey bees. However, oxalic acid has no significant effect on AChE and GST activities in the emerged, nurse and forager bees.

Keywords: *Apis mellifera intermissa*, *Varroa destructor*, Acaricides, Secondary effects, Acetylcholinesterase, Glutathione S-transferase.



A survey of necrophagous blowflies in the four different area of Kayseri, Turkey

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Abstract

Necrophagous insects are colonized cadavers immediately after death. Knowledge of the distribution, biology and behavior of necrophagous insects found at a crime scene can provide important trace about death. The most common application of insect evidence on body is the estimate the minimum time elapsed since death. The objective of this work was to to characterize the assemblage of Diptera, its richness, relative abundance in Kayseri Province, Turkey.

Four sampling sites were selected and in each site, collections were carried out with 8 traps baited with liver (150 g per trap) and chicken (150 g per trap) that were operated for two consecutive days from October 1, 2018 through 28, February 2019. To determine the diversity of species in two localities sample groups in our study, Shannon Wiener and Simpson Diversity Index was used

Diptera adult belonging to four families were captured 1794 species during this studies. *C. vicina*, *L. sericata*, *S. argyostoma*, Phora sp, Phronia sp, *Ch. albiceps*, were collected from the baited trap. A difference in species richness between the month was observed. Significant differences were found between all species that were seen between four sites and trap containing different animal tissue. *C.vicina* (78%) was found to be the most abundant species in all study sites. *Ch. albiceps* and *S. argyostoma*, were registered in lowest rate compared with other species. *Ch. albiceps* and *S. argyostoma* were collected from two different sites at October and November. *C. vicina* and Phora sp were sampled from all studies sites. *L. sericata*, *S. argyostoma*, and *Ch. albiceps* were recorded during from October to end of November. *L. sericata* was recorded first week of December at one study site

Keywords: Kayseri fauna, Diversity, Necrophagous Diptera, Baited trap, Turkey



Diversity of orchids in the region of El Tarf (extreme northeastern Algeria)

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Abstract

The knowledge of orchids in Algeria has made significant progress in recent years, but some areas, such as El Tarf, remain under-surveyed. For this purpose, a series of field surveys in search of orchids at the level of the said region has been carried out since 2012. The present study has proved to be very fruitful both in terms of the number of taxa recorded and the number of stations surveyed. 28 species / subspecies and 5 hybrids belonging to 11 genera (3 *Anacamptis*, 1 *Androrchis*, 2 *Dactylorhiza*, 1 *Himantoglossum*, 1 *Limodorum*, 2 *Neotinea*, 12 *Ophrys*, 1 *Orchis*, 1 *Platanthera*, 3 *Serapias* and 1 *Spiranthes*) were identified at the level of the study area and spread across 18 localities (El Kala, El Aioun, Souarekh, Bougous, Ramel Souk, Ain Assel, El Tarf, Zitouna, Ain Kerma, Bouhadjar, Oued Zitoun, Beni Salah, Bouteldja, Cheffia, Asfour, Besbes, Chihani and Berrihane). 6 species are early they were observed in the first half of January. The stations on the Algerian-Tunisian border have a very high number of species with a very large number of individuals per taxa. Some species have a wide distribution across the study area (*Ophrys bombyliflora*, *O. lutea* subsp. *lutea* and *Serapias parviflora*), while others are highly localized (*Androrchis patens*, *Himantoglossum robertianum*, *Orchis italica*, *Platanthera bifolia* subsp. *kuenkelei*). Of the species inventoried, 5 are protected by Algerian law and 5 species are endemic.

Keywords: Orchids, Biology of conservation, endemism, El Tarf, Algeria.



Investigation of thiol compounds in *Synechocystis* spp. isolates exposed to some heavy metals

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Abstract

The study aims to investigate the role of protein-bound, nonprotein and total thiols in metal resistance of *Synechocystis* spp. isolates exposed to Ni(II), Cr(IV) and Pb(II). Two *Synechocystis* spp. isolates (BASO403 and BASO404) were investigated with regard to their exposure to 15 ppm Ni(II), 5 ppm Cr(VI) and 100 ppm Pb(II) for metal toxicity and thiol production. Each isolate was effected by metals when compared with controls. Also the role of protein-bound, nonprotein and total thiols in metal resistance of *Synechocystis* spp. isolates exposed to Ni(II), Cr(IV) and Pb(II) was determined. *Synechocystis* spp. BASO403 and BASO404 exposed to Cr(VI) produce higher protein bound thiols when compared with control. In the present study, results showed that thiols might play a role in metal resistance by two *Synechocystis* spp. isolates.

Keywords: *Synechocystis* spp., Thiol compounds, Küçükçekmece Lagoon, Heavy metal resistance

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Anodic Stripping Voltammetry Detection of Pb(II) using a Modified Carbon Paste Electrode

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Abstract

A highly sensitive sensor based on a carbon paste electrode modified with chitosan reinforced by grafting thiourea through glutaraldehyde linkage was fabricated. In order to validate this developed sensor, the characteristics of modified electrode (CCts-TU-CPE) were investigated by several electrochemical techniques and the surface parameters were determined. Cyclic voltammetry analysis were realized in the presence of $[\text{Fe}(\text{CN})_6]^{3-/4-}$ and KCl as a redox probe and the effective surface area (A) was calculated.

Electrochemical impedance spectroscopy measurements indicated low interfacial charge transfer resistance of 718 Ω at the modified electrode. The effect of scan rate study indicates that the electrochemical system presents a quasi-reversible electron transfer reaction occurred with diffusion controlled process. The diffusion coefficient and standard rate constant of electron transfer were determined by chronoamperometry method. The SWV as a sensitive detection method was achieved by optimizing the chemical and instrumental parameters.

Application of the sensor was demonstrated by detecting Pb(II) in tap water.

Keywords: Lead determination, Chitosan, Thiourea, Carbon past electrode, Anodic stripping voltammetry



Benthic diatoms (Bacillariophyceae) of the South Bay, Livingston Island, Antarctica

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Abstract

Despite the long history of diatom research in Antarctica, there seems to be a considerable lack of knowledge on the marine benthic diatom flora of the region. During the 27th Bulgarian Antarctic Expedition (2018-2019) samples for marine benthic diatoms were taken from several localities across the South Bay, Livingston Island, the South Shetland Islands, Antarctica. Several types of samples were collected: (1) the diatom biofilm obtained on artificial substrates (Plexiglass© tiles and from the synthetic ropes, holding the tiles), (2) natural epilithic diatom communities on always submerged boulders in the coastal waters of the bay, and (3) the diatom biofilm covering the bottom of small puddles on coastal rocks. One sample for diatoms of soft bottom sediments was also taken. Studies were performed using light microscopy (LM), and where possible, scanning electron microscopy (SEM). A quite diverse and rich diatom flora was found: a total of 127 taxa were recognized in the samples, among which the genera *Cocconeis* and *Navicula sensu stricto* dominated in terms of species richness with 21 and 17 taxa, respectively, followed by *Nitzschia* and *Amphora sensu lato* (8 taxa each). Cluster analysis based on Bray-Curtis similarity (Primer v6 software) showed that the artificial substrates used for our sampling host a similar flora to that of the natural epilithon, whereas the small puddles on the coastal rocks form a separate entity, even if only species presence/absence data are taken into account. During the study almost 30% of the taxa remained unidentified to species level, and for several others the generic affiliation is unknown at present, which result points well the necessity for further research on the Antarctic marine benthic diatoms. The poster presents and discusses the main characteristics and diatom diversity of the different groups of samples, as defined by the cluster analysis, and shows some rarely reported and interesting (and presumably new) taxa.

Keywords: diatoms, diversity, marine benthos, epilithon, artificial substrates, Antarctica



A new record for Turkish biting midges (Diptera, Ceratopogonidae): *Culicoides clastrieri* Callot, Kremer & Deduit, 1962

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Abstract

The female biting midges of the genus *Culicoides* (Diptera: Ceratopogonidae) feed on blood sucking. It is one of the focal points of medical and veterinary studies due to their vectors. Therefore, many studies on this genus are carried out in Turkey and the number of species identified for Turkish fauna is increasing day by day. One of the areas with suitable breeding and feeding habitats for the biting midges is the Sarikum Nature Conservation Area of Sinop Province. In this area, sampling was performed using CDC miniature light trap between May and November 2017. One of the species identified in the study is *Culicoides clastrieri* Callot, Kremer & Deduit, 1962. A female of this species was caught in June and its morphological characteristics were determined. Thus this species was reported from Turkey for the first time.

Keywords: Biting midges, *Culicoides*, Sarikum, Fauna, Sinop, Turkey

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Preliminary data on the diversity pattern of waterbirds of Chott El-Hodna (Central High Plateaux-Algeria)

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Abstract

In this pioneering work on the aquatic avifauna of Chott El-Hodna (Central High Plateaux), we present results obtained through monthly companies of waterbirds counts started from September 2007 to September 2009. On this wetland of international importance under Ramsar convention, a total of 39 species of water birds representing 12 families have been recorded. The family of ducks is the most represented by 10 species. Amongst of all species, 20 of them are wintering species, 12 are visitors, 06 are resident breeder species as well as the Ruddy Shelduck *Tadorna furruginea* and Black-winged Stilt *Himantopus himantopus* etc. Only one species has breeder- migrant status as well as the white stork *Ciconia ciconia*. However, 11 species are protected under Algerian law, which one species is listed in (VU) Category of Red List of endangered species (Teal marbled *Marmaronetta angustirostris*) by the International Union for Conservation of Nature (IUCN).

Keywords: Waterbirds, Chott El Hodna, Status, diversity, Algeria

Introduction

Algeria contains a wide variety of wetlands which are important staging posts and wintering grounds for birds migration in the Palearctic (Stevenson et al. 1988; Coulthard 2001; Boulekhssaim et al.2006).

The bird fauna of Algeria is relatively well known, due to data collected by dedicated ornithologists over the past two centuries (Heim de Balsac & Mayaud 1962, Isenmann & Moali 2000, Boumezbeur 2002). These early works are based on dispatched observations recorded intermittently in few wetlands. High Plateaux, especially those in the center contain high diversity of birds remains poorly known, where the only study was carried out by Jacob & Jacob (1980) in Boughzoul Lake.

Chott El-Hodna, with its large surface, its strategic location at the center of the country and its biodiversity richness, was classified as a wetland of international importance under the Ramsar convention in 2001.

In order to know the importance of the Chott for waterbirds, who has never benefit an ornithological study, we present preliminary data of monthly companies of waterbirds surveys that have been made regularly from September 2007 to September 2009. This work aims to:

- Determine the ornithological value of this site, and it's nationally and internationally importance.
- Determine the status of species used this wetland.

Material and Methods

Chott El-Hodna (35 ° 18 ' / 35 ° 32' N 4 ° 15 ' / 5 ° 06') with more 362,000 ha, located in the semi-arid Central High Plateaux (CHP) of Algeria. The study area has a semi-arid climate, with an annual mean temperature of 25 °C and an average annual rainfall of less than 400mm. The landscape is dominated by steppe vegetation. This salt lake is part of a series of salt pans scattered in the middle part of country,

which are developed where the waters converge from the Saharan Atlas mountains in the South and the Tell Atlas mountains to the North. It is wedged between two mountains formations, hydrologically is a closed Hadna basin over 26.000 km², extending 220 km of long and 70 km of wide (Fig 1).

The Chott straddles two wilayas: M'sila (1000 Km²) and Batna (100 km²), it is isolated from the Mediterranean Sea from 100 to 150 km of mountain ranges. This salt pan occupy the center of the bowl of Hodna, it is located about 40 km from M'sila City (Ladgham Chicouche & Zerguine, 2000), it was selected as Important Bird Area (IBA) and classified as wetland of international importance under the Ramsar convention in 2001 (Coulthard 2001). The Chott extends over 77 km long and 19 km wide. Where flooded part never exceeds 80.000 ha, it feeds mainly by at least 22 major oueds, with a further source of fresh water (Ladgham Chicouche & Zerguine ,2000). The importance of Chott El-Hodna in the biodiversity conservation can be summarized by the presence of some endemic flora species, as representative of the Mediterranean part, this flora is represented by 550 taxa identified in the steppe communities, forest and pre-forest (Kaabeche 1990).

With their different habitats, the Chott is the natural area of great importance for animal species (Cuvier's Gazelle *Gazella cuvieri*, Houbara Bustard *Chlamydotis undulata*), endangered species listed by the International Union for Conservation of Nature (Ladgham Chicouche & Zerguine, 2000).

The main objective of our study is to identify and assess waterfowl who attended the site and to determine their phenological status to show the role of Chott El-Hodna in the conservation of biodiversity and particularly waterbirds. The study of waterbirds phenology was undertaken through monthly companies of birds count from September 2007 to September 2009 using a telescope KONUSPOT (20 × 60). The surveys were conducted at several stations around the wetland, in the order to obtain consistent data.

We used individual count when the numbers of birds present were small. When more than 200 birds were present, total numbers were estimated by dividing the flock into small equal blocks (50–200 birds according to flock size) and counting the number of blocks (Blondel 1975). This last method is the most used in the winter counts of waterfowl (Lamotte & Bourliere, 1969)

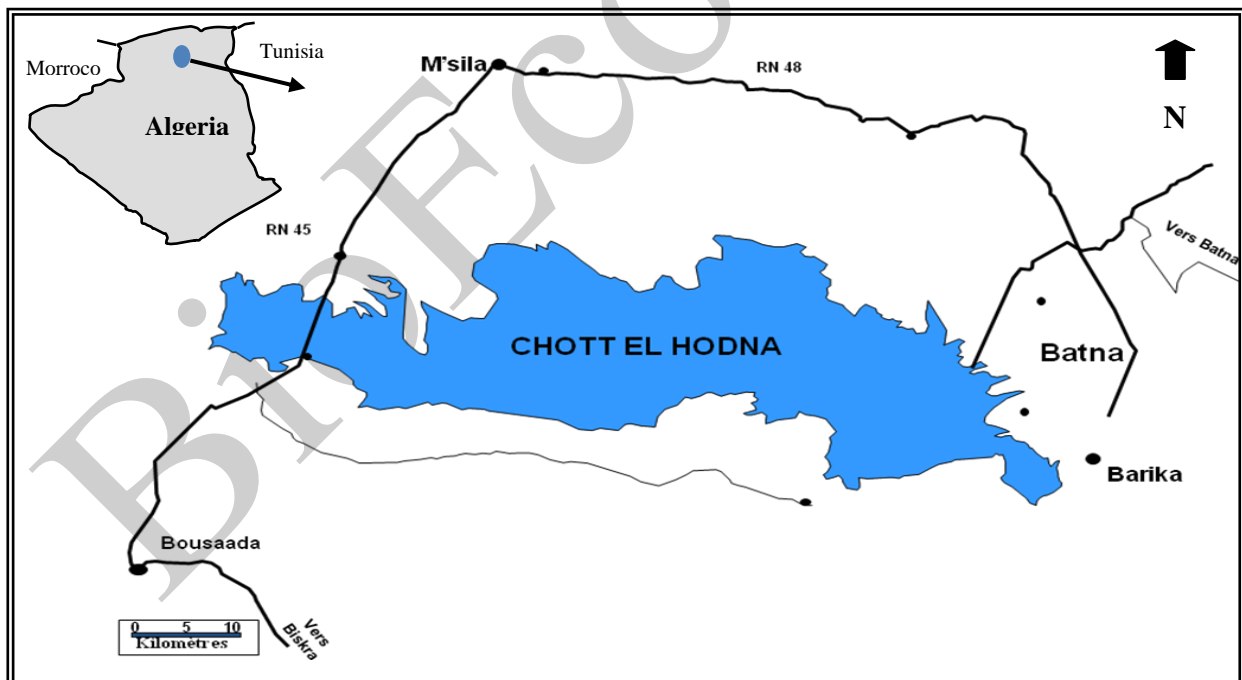


Figure 1. Geographic situation of study area.

Results

Under this item we present assessed species regrouped within families and their phonological status and census.

Ardeidae

Cattle egret *Bubulcus ibis*- Resident Breeder species- Observed most of the year in the middle or in the outskirts of the site. Generally, their nests are made up of *Eucalyptus sp* trees in monospecific colony



located around the wetland. This species use the site border areas for resting and foraging. The highest number was observed during May and June (1000 individuals).

Grey Heron *Ardea cinerea*- Wintering species-(October-May): This wader observed through all the wintering period. They are generally solitary and territorial, and they occupy the satellite place of the Chott and water outfalls. Particularly at Oued M'sila just upstream of the K'sob dam where there are fish loosens, a maximum of 52 birds were found on 24 February 2008.

Little Egret *Egretta garzetta*- Wintering species-(October-March): Observed through the wintering period with low numbers varied between 20 and 30 individuals. A maximum of 72 birds were recorded on 6 March 2008. This is probably due to a migrating passage from another population by this site.

Great Egret *Ardea alba*-Migrant species- It was observed two or three times on this site, mainly during periods of transition. 11 birds were reported on 10 December 2007 in the outskirts near the phragmites of the Chott.

Ciconiidae

White Stork *Ciconia ciconia*-Migrant Breeder- Hundred of nests are placed on electrical post and dead trunks of palm trees in the bordering villages of the Chott and in M'sila's down-town. There was a remarkable increase in the installation of new nests during latest years. They were regularly observed in the wetland to feeding, from January till August. The maximum of 157 individuals was recorded in the site on 4 September 2009.

Phoenicopteridae

Greater Flamingo *Phoenicopus roseus*- Wintering species- This characteristic species of salt wetlands, are regularly present early in September until the end of May with high numbers, where a maximum of 2800 birds were recorded in March 2008. Observations of chicks were reported by local population in 2004 or earlier. Egg fragments witnessed confirmed the successful breeding of this species in the islets within Chott.

Anatidae

Eurasian Wigeon *Anas penelope*-Wintering species- These ducks were present regularly during the period from October to March with fluctuating abundance. A maximum of 440 individuals were observed in February 2008. It was particularly in the southern part of the Chott near to the phragmites.

Gadwall *Anas strepera*-Migrant species- These ducks were observed two or three times through the study period principally during migration periods in September and February (150 birds on 24 February 2008). It seems that the Gadwall uses the Chott as a staging area before or after crossing the Sahara desert (long-distance migration).

Northern Pintail *Anas acuta*-Migrant species- These ducks were observed two times during all study periods. This may be explained that this species used the site as stopover in pre and post breeding journey. A maximum of 142 individuals were observed on 11 March 2008.

Mallard *Anas platyrhynchos*-Wintering species- This cosmopolite bird, stay generally over six months (October-March) through wintering period in Chott El-Hodna. Maximum of 360 birds were recorded in January 2009.

Shoveler *Anas clypeata*-Common Wintering species- These ducks were observed regularly during winter in the Chott from September to March. The maximum of 1640 birds were recorded on 19 December 2008.

Common Teal *Anas crecca*-Wintering species- They were observed in Chott El-Hodna as early as September with a considerable number especially during the wintering season 2008/2009. A maximum of 2250 individuals were counted in January 2009 and 1850 individuals in February 2009.

Marbled Teal *Marmaronetta angustirostris*-Wintering species- They were present in the Chott during winter with limited number (30-40 individuals), with the exception of 2008/2009 winter season, where the maximum of 88 individuals were observed on 9 November 2008.

Ruddy Shelduck *Tadorna ferruginea*-Resident Breeder species- They were present all the year, with a maximum of 640 birds in February 2008. Two populations were distinguished, a wintering population and a breeding population. The breeding population reached about 50 breeding pairs (11 June 2008), and one pair with seven sub-adults was observed near Barika (eastern part of the Chott) on 17 June 2009.

Common Shelduck *Tadorna tadorna*-Wintering species- They were observed regularly in the Chott from September to March with remarkable numbers, especially in the South part of the wetland with other ducks. The maximum of 2750 was noted in March 2008.

Common Pochard *Aythya ferina* -Migrant species- This species was observed twice particularly during post-breeding period (November 2007) with a maximum of 290 individuals.



Accipitridae

Western Marsh-harrier *Circus aeruginosus*-Wintering species- This species was present in Chott El-Hodna, especially in the Reed in southern part. It was observed throughout the wintering period from October to April, with low numbers. A maximum of 22 individuals were observed in October 2007.

Egyptian vulture *Neophron percnopterus*-Migrant species- This species was observed in three distinct times; 17, 30 and 24 individuals in February 2009, March 2009 and October 2007 respectively. It prefers the western edge of the Chott near the waste discharge in the municipality of Chellal.

Rallidae

Common Coot *Fulica atra*-Wintering species- It colonizes the Chott during the winter period from September to March. They were observed in limited numbers. A maximum of 89 individuals were recorded on 19 December 2008. The coot occupies mostly the Phragmites of khobana (Southern part of the site) with Common Moorhen.

Common Moorhen *Gallinula chloropus*-Resident Breeder species- Maximal number estimated was 87 individuals during the winter period (January 2008). However, 12 breeding pairs were observed during the breeding period in 2008 in the boundary waters attached to the site containing the Phragmites. Egg fragments and nests with eggs were found in the vegetation which confirmed that breeding was successful for this species.

Gruidae

Common Crane *Grus grus*-Wintering species- It winters regularly for several years, and its number has increased continuously from the end of September by the successive arrivals of European populations. This reaches a maximum of 480 individuals during January. This bird seems to prefer the high plains and is highly targeted by hunters (Houhamdi et al, 2008). It is often observed in the cereal culture bordering the Chott from the North part, mainly in feeding activity.

Recurvirostridae

Black-winged Stilt *Himantopus himantopus*-Resident Breeder species- was observed throughout the year with fluctuating numbers (Maximum of 274 individuals were observed on April 22, 2008 and more than 35 breeding pairs on 2 June 2009 in the southern part of the Chott). Nests of 3 to 4 eggs were found by local people in the southern edge of the Chott.)

Avocet *Recurvirostra avosetta*-Resident Breeder species- This sedentary species was present through the year in the Chott, especially in shallow water depth places. A maximum of 310 birds were recorded in March 2009. About twenty breeding pairs were observed during the months of June and July in the Chott. Eggs were found in the southern shore of the Chott next to Oued M'cif on 12 June 2008 and three chicks were found on 25 June 2008. This confirmed that breeding was successful.

Charadriidae

Little Ringed Plover *Charadrius dubius*-Migrant species- Two observations were recorded for this species with a maximum of 1950 individuals noted on 18 January 2009.

Kentish Plover *Charadrius alexandrinus*-Resident Breeder species- This species was represented by two populations. Wintering population and sedentary population were present through the year with fluctuating numbers. A maximum of 2200 individuals were noted on 18 January 2009. The sedentary status was confirmed by the presence of more than 30 breeding pairs during May and June in both 2008 and 2009. Nests of two and three eggs were found in the southern bordering of the Chott during the same period.

Ringed Plover *Charadrius hiaticula*-Migrant species- This wader has the same status as the Little Ringed Plover *Charadrius dubius*. It has been reported only once, on 9 November 2008 with about 325 individuals.

Northern Lapwing *Vanellus vanellus*-Migrant species- This species was observed three times in the Chott during two specific months (October and December, with a maximum of six birds on 19 December 2008) during the two years study period.

Scolopacidae

This family was represented by nine species which is composed of five Migrant species and four wintering species.

Migrant species include Common Snipe *Gallinago gallinago*, a maximum of 221 individuals were noted on 22 April 2008; Dunlin *Calidris alpina*, a maximum of 32 individuals were observed on 12 November 2007; Sandpiper *Tringa stagnatilis*, a maximum of 93 individuals were reported on 10 December 2007; Common Redshank *Tringa totanus* were up to 127 birds marked on 18 January 2009 and 38 individuals of



Black-tailed Godwit *Limosa limosa* were observed on 18 January 2009. These migrant species were mainly observed once or twice during the study period especially during their post-breeding passage. The four wintering species present were Spotted Redshank *Tringa erythropus*, a maximum of 335 individuals were observed on 10 December 2007; Common Greenshank *Tringa nebularia* were observed on 9 February 2009 (200 birds); Little Stint *Calidris minuta*, a maximum of 97 individuals were observed on 6 March 2008 and a maximum of 125 individuals of Common Sandpiper *Actitis hypoleucos* were observed in November 2007. Indeed, some species of these waders were represented by two different populations: a wintering population and migrant population.

Laridae

Black-headed Gull *Chroicocephalus ridibundus*-Wintering species- This species was present throughout the wintering period but were few in number (a maximum of 17 birds were seen on 18 January 2009).

Little Gull *Larus genei*-Wintering species- It was present during winter. The maximum of 18 individuals were marked on 10 December 2007.

Sternidae

Whiskered Tern *Chlidonias hybridus*-Migrant species- This occasional visitor was observed two times in the Chott through the period of our study, the maximum of 02 individuals were observed in April 2009.

Discussion

Chott El-Hodna wetland by this exceptional biodiversity remains unexplored until now. During the period from September 2007 to September 2009, approximately 39 water birds species representing 12 families were recorded in this wetland. These species represent different phonologic status: Twenty wintering species (51%), twelve migrant species (31%), six resident breeder species (15%) and one migratory breeder species (3%). However, some species have two different statuses, may be due to the existence of two distinct populations that use the site. The family of Anatidae is the most represented in terms of richness and numbers by ten species and a maximum exceeding 8000 individuals was marked during January and February 2008 with all species combined. Other families are poorly represented, except that of Scolopacidae with nine species after that of Anatidae.

For some breeding species, their breeding was confirmed as: Ruddy Shelduck *Tadorna ferruginea* that was never reported in the Chott. This species was previously observed in winter by Jacob & Jacob (1980) at neighbor site (Lake of Boughzoul) with a small number (Ledant 1981, Jacob & Jacob, 1980). Among all recorded species, eleven species are protected under Algerian law pursuant to Decree N°. 83-509 of August 20, 1983 and the Order of January 15, 1995 completing the list of non-domestic protected animal species, Marbled Teal *Marmaronetta angustirostris* species of greatest conservation listed as Endangered Species in the category (VU) of Red List by International Union for Conservation of Nature (BirdLife International 2004). The latter species is present with a relatively high number (88 individuals) November 9, 2008; it has never previously been cited in the Chott El-Hodna. Indeed, it is important to note that attendance of this ecosystem by aquatic birds depends mainly on its impoundment. At the end of the study, the Chott El-Hodna one hand seems to play a great role in the wintering and breeding of waterfowl and also serve as stopover site for migrant species during their trans-Saharan migration journeys.

Acknowledgements

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References

- Coulthard, N. D. (2001). Algeria. In Fishpool, L. D. C. & Evans, M. I. (eds.) *Important Bird Areas in Africa and Associated Islands: Priority Sites for Conservation*. Newbury: Pisces Publications & Cambridge, UK: BirdLife International.
- Boulekhsaim, M., Houhamdi, M., Saheb, M., Samraoui-Chenafi, F., & Samraoui, B.(2006) Breeding and banding of Greater flamingo *Phoenicopterus roseus* in Algeria. *Flamingo*, 14: 21-24.
- Steavenson, A.C., Skinner, J., Hollis, G.F.& Smart, M. (1988). El Kala national park and environs, Algeria. An ecological evaluation. *Environmental conservation* 15: 335-348.
- Heim de Balsac, H. & Mayaud, N. (1962). *Les oiseaux du nord ouest de l'Afrique: distribution géographique, écologie, migration, reproduction*. Le Chevalier, Paris.



- Isenmann, P. & Moali, A. (2000). *Oiseaux d'Algérie / Birds of Algeria*. Paris : Société d'Etudes Ornithologiques de France.
- Boumezbeur, A. (2002). Atlas des 26 zones humides Algérienne d'importance internationale. 89p.
- Ladgham Chicouche, A. & Zerguine, D. (2000). Projet d'étude classement de la zone humide (Chott El-Hodna) wilaya de M'sila en zone humide d'importance internationale (Ramsar)., 23p
- Kaabeche, M. (1990). Les groupements végétaux de la région de Boussaâda (Algérie). Essai de synthèse sur la végétation steppique du Maghreb. *Thèse de doctorat. Université Paris Sud*, centre d'Orsay. 93 p
- Blondel ,J. (1975) Analyse des peuplements d'oiseaux d'eau. Elément d'un diagnostic écologique. I: La méthode des échantillonnages fréquentiels progressifs (E.F.P).*Terre et Vie*, 29: 533-589.
- Lamotte, J. & Bourliere, A. (1969). Problèmes d'écologie: l'échantillonnage des peuplements animaux des milieux terrestres. *Massons*, 151p.
- Houhamdi, M., Hafid, H., Seddik, S., Bouzegag, A., Nouidjem, Y., Bensaci, E., Maazi, M.C. & Saheb, M. (2008). Ecologie des Grues cendrées (*Grus grus*) dans le complexe de zones humides des hautes plaines de l'Est de l'Algérie. *Aves*, 45(2) : 93/103.
- Ledant, J. P., Jacob, J. P., Jacob, P., Malher, F., Ochando, B. & Roche, J. (1981). Mise à jour de l'avifaune Algérienne. *Le Gerfaut* 71 ; 295 – 398.
- Jacob, J. P. & Jacob, A. (1980). Nouvelles données sur l'avifaune du lac de Boughzoul (Algérie). *Aves*, 16: 59-82.
- BirdLife International. *Threatened Birds of the World 2004*. CD-ROM. Cambridge, UK



Preimaginal exposure to azadirachtin affects food selection and food intake in adults of *Drosophila melanogaster* (Diptera : Drosophilidae)

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Abstract

Plants with pesticidal properties have been investigated for decades as alternatives to synthetics for developing sustainable agricultural practices and promote human and environmental safety. Azadirachtin, a tetranortriterpenoid, is the most effective compound produced as a secondary metabolite of the neem tree, is exceptional in having a broad range of bioactivity including toxicity, growth, development and reproduction effects, repellency and antifeedancy. If considerable progress on the physiological and biological activities and agricultural application of azadirachtin has been achieved, its exact mechanism of action remains uncertain. In this study, we aimed at assessing the lethal and sublethal behavioral and physiological effects of azadirachtin on *Drosophila melanogaster* Meigen, 1830 (Diptera: Drosophilidae) as biological model. Azadirachtin was applied topically at two doses LD₂₅ (0.28 µg) and LD₅₀ (0.67 µg) on early third instar larvae. Results showed that flies preferentially ingested control medium rather than azadirachtin-treated medium. Pre-imaginal exposure (L3) to azadirachtin increased aversion to this substance suggesting a memorability of the learned avoidance. In addition, all tested flies revealed a clear preference for solvent odour rather than azadirachtin odour. Moreover, azadirachtin treatment decreased significantly the amount of food intake in the adults of both sexes. These results may provide some evidence of a long term antifeedancy and delayed effects through developmental stage which may reinforce the insecticidal activity of this bioinsecticide.

Keywords: Azadirachtin, *Drosophila melanogaster*, Feeding behavior, olfactory response, Food intake



Pre-imaginal exposure to azadirachtin affect feeding in *Drosophila melanogaster*.

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Abstract

Botanical insecticides are a promising alternative to reduce the harmful effects of synthetic chemicals. Among the plant derived product, azadirachtin, a neem-based insecticide, is exceptional in having a broad range of bioactivity including toxicity, repellency and antifeedancy but its mechanism of action need to be clarified.

In this study, we aimed at assessing the lethal and sublethal effects of azadirachtin on feeding behavioral of *Drosophila melanogaster* Meigen, 1830 (Diptera: Drosophilidae) as biological model. Azadirachtin was applied topically on early third instar larvae at two doses LD25 (0.28µg) and LD50 (0.67µg) of immature stage. Series of control were done in parallel using acetone. We monitored the feeding activities of treated flies provided access to liquid containing solutions of sugar and bitter compounds (azadirachtin and caffeine), within capillary feeders (MultiCAFE) by extending a system proposed by Ja et al., 2007. No-choice condition of capillary feeding assay showed that treated flies consume less of azadirachtin than control flies in both sexes. Increasing concentrations of sugar enhance azadirachtin consumption in all tested series (controls and treated).

Results of binary choice between sugar and azadirachtin capillary assays showed that treated and control flies consume only sugar. These results may reflect interference of azadirachtin with regulation of feeding and provide some evidence of a long term antifeedancy which may reinforce the insecticidal activity of this bioinsecticide.

Keywords: Azadirachtin, Feeding behavior, *D. melanogaster*.



Fixed coastal dunes with *Alyssum borzaeanum* Nyár. in the Danube Delta Biosphere Reserve (Romania) – floristic particularities, conservation status, future tendencies and vulnerabilities

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Abstract

Fixed coastal dunes with herbaceous vegetation - grey dunes (2130*) are one of the most threatened coastal habitats in Europe, assessed as endangered in the European Red List of habitats due to many pressures and threats, mainly anthropogenic. In Romania, grey dunes are represented by fixed and semi-fixed dunes colonised by more or less closed perennial grasslands, composed by herbaceous plants, mosses and lichens. Coastal grasslands with *Alyssum borzaeanum* are typical for the habitat 2130* on the western Black Sea shore and they have high conservation value mainly because very limited and fragmented distribution of the euxinic plant *Alyssum borzaeanum* in Romania, Northern Bulgaria, Ukraine and North-Western Turkey. Fixed coastal dunes with *Alyssum borzaeanum* occur in the Danube Delta Biosphere Reserve, on Lupilor sandbank, on Saele (Istria) sandbank and in the protected area "Marine sand dunes of Agigea" on the southern coast of Romania. The largest surfaces with *Alyssum borzaeanum* there are in the western zone of Lupilor sandbank (Wolves sandbank), out of the strictly protected area, on the sand strips formed over than 2000 years ago in the place of the ancient Halmyris Bay of the Black Sea (ancient coast of the Black Sea). Here, vegetation has particular features, structure and floristical composition because around the fixed dunes there are humid dune slacks with mesophytic plant communities which belong to the habitat type 2190 according to the Annex I of the Directive 92/43/EEC. Floristic particularities, conservation status, future tendencies, vulnerabilities of the fixed coastal dunes with *Alyssum borzaeanum* on Lupilor sandbank and proposals for improving of the conservation measures will be approached in the article.

Keywords: Fixed coastal dunes, *Alyssum borzaeanum*, Lupilor sandbank, Black Sea coast, Romania



Diurnal time budget of wintering Pochard *Aythya ferina* (Anatidae) at Lac des Oiseaux (Ramsar site, Northeast Algeria)

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Abstract

The present study on the ecology of the Ferruginous Common Pochard *Aythya ferina* has been carried out at Lake of birds "Lac des oiseaux" or "Garaet Ettouyou", located in a humid zone of northeastern Algerian and which takes its name from rich birds. During the 2011/2012, 2012/2013 and 2013/2014 wintering seasons, he played a key role in maintaining the populations of the Fuligule milouin, *Aythya ferina*, which he used throughout the season. Indeed, this species has been composed of several populations, the main one is wintering and the others use the water only during their passage and their transit.

These waterfowl mostly used the open and deep areas during the entire wintering season, thus showing the very fierce nature of these Anatidae, which are often observed in the company of other species of ducks.

The monthly monitoring of the population of this Fuligule has shown that the maximum number was recorded during the three wintering seasons with 790 individuals during the month of November during the 2011/2012 season, 800 individuals during the month of November during the 2012/2013 season and finally 900 individuals during the month of November too, during the 2013/2014 season.

The study of diurnal activity rhythms was conducted once a fortnight using the FOCUS method during these seasons and revealed the role played by the ecosystem "Lake of the Birds" for this aquatic avifauna (winning ground). The balance of activity rhythms is dominated by diet (52%), followed by swimming (20.66%), plumage maintenance or grooming (19%), theft (4.33%) and finally sleep (4%).

Keywords: Wintering seasons, Lake of birds, Fuligule milouin, *Aythya ferina*, Anatidae, number of individuals, time budget, Algeria.



Epidemiological characteristics of bird tumor diseases in relation to human oncology

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Abstract

The purpose of this study is to present a retrospective of our work on the tumoral diseases of birds and to engage perspectives related to human oncology. The Rous Sarcoma Virus causes sarcomas in birds, it was the first oncovirus discovered in 1911 The most common cancers in women are those of the breast and uterus while prostate cancer is the most reported in man. This represents a certain analogy with the bird data. As in young birds, the child oncology before sexual maturity results in tumors localized in other tissues such as the brain, bones, eyes or body defense.

Keywords: Oncology, Birds, Human, Analogy.



Risk assessment of some heavy metals in mussels (*Mytilus galloprovincialis*) for human health

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Abstract

Concentrations of six heavy metals (Cu, Fe, Mn, Zn, Cd, Hg) were determined in mussels (*Mytilus galloprovincialis*) that are seasonally collected in two mussel farms in Boka Kotorska Bay, Montenegro. The purpose of the present study was to analyze the concentrations of metals and to evaluate the risk for human health from the presence of the six heavy metals. The average concentrations of the heavy metals found in mussels samples were 7.9 mg/kg for Cu, 169 mg/kg for Fe, 9.5 mg/kg for Mn, 140 mg/kg for Zn, 1.87 mg/kg for Cd and 0.131 mg/kg for Hg. In terms of the obtained metals concentrations in mussels, permissible limits set by EC and USFDA, as well as provisional tolerable weekly intakes prescribed by the JECFA, concentrations of heavy metals in the mussels analyzed were below acceptable levels for human consumption, except Cd concentrations which were recognized as the limiting factor for the consumption of mussels.

Keywords: Mussels, heavy metals, human consumption, Boka Kotorska Bay, Montenegro



DNA damage in blood cells of six marine fish species as biomarker of pollution in the Boka Kotorska Bay

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Abstract

In this study we carried out the assessment of DNA damage in erythrocytes of six marine fish species as the indicator of pollution-related genotoxicity in the Boka Kotorska Bay (Montenegro). Fish specimens: red mullet (*Mullus barbatus*), common pandora (*Pagellus erythrinus*), comber (*Serranus cabrilla*), picarel (*Spicara smaris*), annular seabream (*Diplodus annularis*) and Atlantic horse mackerel (*Trachurus trachurus*) were sampled by trawling in haul between two positions (N42 28.807 E18 42.039 and N42 28.556 E18 44.463) within a bay. Comet assay was used for the analysis of genotoxicity in fish blood samples. There was no significant difference between fish species in means of cell viability. Genotoxicity parameters (tail intensity – TI% and heavily damaged cells "hedgehogs" – HH%) indicated the lowest values in *D. annularis* specimens. The highest TI% value was observed in *T. trachurus*, while the highest HH% was recorded within a group of *S. cabrilla*. These were the first data on fish genotoxicity in the Boka Kotorska Bay and it will represent starting point for the further research related to molecular biomarkers in fish from this area.

Keywords: DNA damage, blood cells, marine fish, Boka Kotorska Bay



Invasive alien plant species of EU concern in Romania

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Abstract

Considering the requirements of the EU Regulation 1143/2014, an assessment of alien plants from Romania was conducted. Thus, available data about the presence on the Romanian territory, the distribution, invasiveness, pathways of introduction and known impact on habitats, ecosystem services, economy and health was analysed. We found that of 36 plant species of European Union concern, four are already established in Romania and they are widespread at least locally or regionally: *Ailanthus altissima* (449 settlements), *Asclepias syriaca* (93 settlements), *Elodea nuttallii* (70 settlements) and *Impatiens glandulifera* (299 settlements). For *Humulus scandens* there are also some reports, but its presence and status require confirmation. The same situation is for *Cabomba caroliniana*, *Heracleum sosnowsky* and *Ludwigia peploides*. For the last one, it was reported once on social media. Most of them are intentional introductions for ornamental purposes. Regarding the invasiveness, given the geographical origin and history of invasion in warmer climate regions (tropical, subtropical), many of the species listed as being of the EU concern do not currently constitute a real threat to Romania. Data about impact of alien plant species and their management in Romania are scattered or completely missing. Coordinated institutional efforts are needed to increase the efficiency of the alien species management at national and local level. These include the enhancing of the legislation and the institutions capacity, increasing the interest of science for this topic and promoting real measures to mitigate, to control and to remove alien plants.

Keywords: invasive alien plant species, distribution, European Union list, Romania



Wind turbine platforms: refuges for flora conservation in agricultural lands?

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Abstract

While most of the studies show how wind farms cause loss of flora diversity, especially when it comes to their construction in protected natural habitats, in our study we investigated the situation in unprotected areas dominated by agricultural land. The study was conducted in a wind farm located in agricultural lands, at about 2 km distance from the Natura 2000 site ROSCI0060 Dealurile Agighiolului, Dobrogea, Romania. Six technological platforms, each with a surface area of 0.2 ha, were selected as sample areas. The total survey area covered about 1.2 ha. The inventory of plants on platforms represents about 25% of the flora of ROSCI0060 Dealurile Agighiolului (1433 ha). Although ruderal and segetal plants are dominant, there are also numerous species of steppic grassland, which is the most widespread type of habitat in the neighbouring Natura 2000 site. Also, some rare plants such as *Astragalus ponticus* Pall. were observed. This species has an isolated presence in the site, but on the platform, it shows a large and constantly expanding population. Our results support the idea that in the case of agricultural lands with homogeneous vegetation, the turbine platforms offer a potential refuge for the dynamics of a high diversity flora, including rare plants.

Keywords: wind farms, plant diversity, agricultural land, refuges, Dobrogea, Romania



Monthly variation in meat quality and shell component index of three clam species (Bivalvia-Veneridae) from Turkey

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Abstract

The clam species, striped Venus (*Chamelea gallina*, Linnaeus 1758), grooved carpet shell (*Ruditapes decussatus* Linnaeus 1758) and Japanese carpet shell (*Ruditapes philippinarum*, Adams and Reeve 1850) are commercially very valuable because of its high commercial interest. These species have high consumption rates of molluscs species in the world. The condition index and meat yield are used a rapid measure of healthy and ecophysiological state and also to determine the harvesting season in commercially mollusc species, especially bivalves. It is likewise a very practical tool used for determining gametogenetic activities and chemical composition. Shell component index also helps to estimate the annual cycle of animal condition or reproductive cycle.

This study was carried out in two stations where striped Venus were collected from Kocaeli-Kefken, grooved carpet shell and Japanese carpet shell were collected from Bandırma-Balıkesir between November 2013 and December 2014. The meat yield, condition index and shell component index were calculated for all sampled individuals by monthly. Environmental parameters were monitored each sampling time. Meat yield, condition index and shell component index of all species were found a relationship between each other ($p \leq 0.05$). The highest condition index and meat yield were observed for Striped Venus in June, for grooved carpet shell in December and for Japanese carpet shell April and June. Maximum shell component index was determined for both carpet shell clam in October and for striped Venus in August.

Keywords: Meat yield, Condition index, Shell component index, *Chamelea gallina*, *Ruditapes decussatus*, *Ruditapes philippinarum*



Evaluation of *Chamellea gallina* (Linnaeus, 1758) on Total Carotenoid Amounts on Black Sea Coast in Turkey

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Abstract

Nowadays, it is known that the future of many foods is under threat due to global warming, increasing population, industrialization and uncontrolled wastes. This threat is increasing every year. Therefore, the value of seafood is gradually increasing. Although the production of culture marine and freshwater fish is intensely produced in Turkey, the production of economic bivalve species is quite low, compared to fish production. In aquaculture, it is feed costs on average 60-65% of the expenses. Bivalve mollusks are organisms that feed by filtering water. Therefore, bivalve will emerge as a low-cost and valuable food source. It is known that caratoneoid compounds are natural antioxidants which are soluble in fat and commonly found in many food products. In this study, it was investigated total carotenoid amounts of *Chamelea gallina* (Linnaeus 1758) monthly. The Samples were collected from Kefken Region of the Black Sea in Turkey. Total carotenoids were compared in the samples at different months. Firstly, the samples were dried with Freeze-dryer and then homogenized. The extraction was performed with acetone to determine total carotenoids. It was extracted with acetone on the dried samples. Total carotenoids were determined using UV spectrophotometer. According to the results, it was determined that the total amount of carotenoids in *C. gallina* varied according to the months ($p \leq 0.05$). The lowest total amount of carotenoid was determined in December. The highest amount was determined in August. It was found that the total carotenoids of *C. gallina* were affected by season and nutrition resources.

Keywords: *Chamelea gallina*, Carotenoids, Spectrophotometer



A new record of *Forcipomyia glauca* Macfie, 1934 (Diptera: Ceratopogonidae) from Sinop (Turkey)

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Abstract

Forcipomyia Meigen, 1918 is the second largest genus in terms of number of species of Ceratopogonidae family. It has 1154 extant species and a wide distribution in the World. *Forcipomyia* larvae are found in aquatic, semi-aquatic or moist terrestrial habitats. The majority of adults of this genus are fed with nectar and are pollinators. Some of the females of *Forcipomyia* are parasites of vertebrates, large insects and arachnids. Numerous studies have been conducted on *Forcipomyia* in the World. But there are few studies on this genus in Turkey. This study was carried out in Akliman District of Sinop Province. Sampling was performed using CDC miniature light trap from May to November 2014 and from June to November 2015. One of the species identified in the study is *Forcipomyia glauca* Macfie, 1934. Two males of this species were caught in August and September 2015. Morphological characteristics of these samples were determined. Thus *F. glauca* was reported from Sinop for the first time and the second time from Turkey.

Keywords: Biting midges, Ceratopogonidae, *Forcipomyia*, Akliman, Sinop, Turkey



Computation of lethal doses by the methods of Lietchifield and Wilcoxon of total alkaloids of *Ruta montana* for toxicological classification and the evaluation of sex sensitivity in rats

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Abstract

Ruta montana is widely used in traditional medicine and pharmacology. The evaluation of the toxic properties of *Ruta montana* is crucial to reduce the impact of these conditions. Therefore, in this study, the toxicity of the total alkaloids of *Ruta montana* was studied in male and female rats. Determining the correct lethal dose is important for the toxicological classification of total alkaloids of *Ruta montana*. In an experimental model, 60 rats of each sex obtained from the Pasteur Institute of Algiers were used. After acclimation for 30 days under the conditions of the animal house, the rats were divided into groups of 6 including a control group. The animals received 100 mg / kg, 400 mg / kg, 500 mg / kg, 600 mg / kg and 900 mg / kg total alkaloids of *Ruta montana* and the control group received physiological saline. The results obtained by Leitchfield and Wilcoxon's Probit calculation show that the LD₅₀ values are respectively 398.1 mg / kg and 530.88 mg / kg respectively in female and male rats. The two curves of the two LD₅₀s are parallel. And that the alkaloids of *Ruta montana* have the same metabolism in both sexes. We conclude that the total alkaloids of *Ruta montana* had a significant effect on female rats. And we classify the alkaloids *Ruta montana* in the category of moderately dangerous products according to the classification of Hodge and Sterner (1943) and Loomis and Hayes (1996).

Keywords: *Ruta montana*, alkaloids, lethal doses, rat, toxicological classification, sex sensitivity.



Antihemolytic activity and total phenolic content of polyphenolic fenugreek seed extract

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Abstract

In recent years, much research has been directed towards the enhancement of traditional medicine in order to verify the safety and efficacy of medicinal plants and establish scientific rules for the use of these plants. In this context fits our work aims to verify the Antihemolytic activity of polyphenolic fenugreek seed extract. Total phenolic content of the extracts were performed using Folin-Ciocalteu reagent and gallic acid as standard. As a result of the present study, polyphenolic extracts exhibited significant antihemolytic activity. The phytochemical screening reveals the presence of polyphenols in the crude extract.

Keywords: Fenugreek seeds, total phenolic content, antihemolytic activity.



Breeding of a species of necrophagous insects (*Lucilia sericata*) and its use for agricultural purposes

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Abstract

Insects occupy a prominent place in the ecosystem. They clean, recycle and fertilize the soil and are indispensable in the food chain, being the main source of food for many animal species.

Our study, whose main objective is the use of dried and powdered insects, as a natural fertilizer and pesticide, is to breed a species of necrophagous flies (*Lucilia sericata*) until they are killed in a healthy and controlled environment. The dried maggots are then ground to produce a flour that will be added to 2 species of cereals: oats (*Avena sativa*) and two varieties (BOUSSELAM and WAHA) of durum wheat (*Triticum turgidum*), as natural fertilizers to test a number of agronomic and morphological parameters of which we will mention only the results of four of them in this presentation namely the number of tillers per plant (Nt / pt), height of the main stem (Htp), Numbers of ears / plant (Népi / pt) and the number of grains / ear (Ngr / ear). The experiment was conducted in the laboratory in pots, 4 per variety; 3 treatments (repetitions) and one control for each variety.

The results obtained after daily monitoring, showed that the insect-based flour added to the plants, improves their production potential, namely the yield of biomass and the grain yield as well as certain components of the yield but the oats given the best averages for the last three parameters studied (http, Népi / pt and Ngr / epi) compared to the control and between the two durum varieties, Bousselem outweighs waha in terms of grain production and biomass (respectively 13% and 17.6% more compared to the control).

Keywords: Scavenger flies, breeding, fertilizer, grain yield, biomass yield



Role of Biological Control Agents in Integrated Pest Management Approaches

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Abstract

Based on the overwhelmingly positive features of biological control, it is the prime candidate for reducing dependency on chemical pesticides. Public demand for finding solutions, is the main driving force in the rapid developments in the various strategies of utilizing natural enemies. Despite its documented applications and systematic development efforts for longer than 50 years, biological control still remains a grossly underexploited method of pest management. It is critical to recognize that farmers have the principal aim of making a profit. This objective may be tempered by seeking to maximize farm sustainability as well as reducing risk. Nowadays Climate change is perhaps the biggest single problem facing Europe and the rest of the world at the start of the 21st century. Hotter and drier conditions in the south will promote insect infestations. The UN Food and Agriculture Organization (FAO) predicts wide ranging effects of global warming, more unpredictable farming conditions, and an increase of pests and diseases as threats to agriculture production. At present the biological control as a pest control technology is becoming more desirable and has important place in bio-protection and in Food safety strategy. Biological formulations on basis of entomopathogens (microorganisms such as microsporidia, fungi, bacteria, viruses, and nematodes) are as one of the effective means for the protected of agricultural and forest plants from the harmful insects and successfully were used in practices. The effect of the bioformulations obtained in the laboratory has been approved in Georgia as means of pest control of 17 species of agricultural crops and forest plants: e.g. the *Leptinotarsa decemlineata*, *Pieris brassicae*, *Agriotes lineatus*, *Hyphanthria cunea*, *Ocnertia dispar*, e.t.c. It has been estimated that insect death rate caused by spraying was 68-89%. So, biological control is a key component of a 'systems approach' to integrated pest management.

Keywords: *Leptinotarsa decemlineata*, *Pieris brassicae*, *Agriotes lineatus*, *Hyphanthria cunea* e.t.c.



Contribution to the study of the toxicity of a pesticide (chlorpyrifos-ethyl) on freshwater ciliated protists "*Paramecium sp.*"

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Abstract

In order to evaluate the toxicity of "Chlorpyrifos-ethyl" a phytosanitary product used in many countries, belonging to the chemical family of organophosphorus organochlorines, we have done a research work on a cellular model in this case a protist ciliate of freshwater "*Paramecium sp.*" for its use in the fight against the pollution of aquatic environments since it is considered as a bio-indicator.

The effects of Chlorpyrifos-ethyl on the paramecies were evaluated on one hand, on growth by monitoring growth kinetics and calculating the percentage response of treated microorganisms to controls showing a dose-dependent inhibition of growth of these organisms in the presence of the insecticide tested. On the other hand, on the total proteins contents as well as on some biomarkers (glutathione and catalase activity).

The toxicity of Mancozeb shows an action on the physiological and biochemical parameters studied; a metabolic modifications have been indicated by an increase in the total protein level, a stimulation of the activity of the enzymes involved in detoxification, particularly catalase as well as disturbances in the biomarker rate (Glutathione) in cells treated with the highest concentrations compared to controls.

Our results have suggested that the tested xenobiotic is cytotoxic and induces the formation of free radicals.

Following the oxidative stress caused, the paramécies developed a cellular defense through the induction of the antioxidant detoxification enzyme (Catalase).

Keywords: Chlorpyrifos-ethyl, pesticide, protistes, growth, biomarkers, toxicity.



A Study of the Toxicity of Toluene to a few Reproductive Parameters in male Wistar Rats

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Abstract

Many studies have demonstrated the toxic effect of organic solvents on human and animal health because of their ability to cause multiple damage to most organ functions. In this context, the present work aims to evaluate the harmful effects of toluene, an organic solvent, on some fertility and hematological parameters of male wistar rats. Fourty adult male rats were divided into the control group (C), the positive control group (H) received corn oil, the group (D1) treated with toluene (275 mg/kg bw), and the group (D2) treated with toluene (550 mg/kg bw). The obtained results showed that toluene treatment induced a highly significant reduction in body weight from the 4th week, which became very highly significant at the end of the 6th week. The study of organ weights indicated no change in epididymal weights and a very highly significant decrease in testicular weight in the treated groups. It also seems that toluene treatment, especially in the high dose, has affected sperm production, resulting in a very highly significant decrease in the concentration, motility and vitality of spermatozoa.

Keywords: Toluene, Rats, Testicle, Fertility parameters, Toxicity.



Responses of antioxidants in *Flavoparmelia caperata* (L.) Hale to the atmospheric pollution air at two urban and semi-urban areas in the region of Annaba (East of Algeria)

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Abstract

The purpose of this study was to identify, in the lichen *Flavoparmelia caperata* (L.) Hale, antioxidants that may provide indications of stress of air pollution. *Flavoparmeliacaperata* (L.) Hale was transplanted from its natural habitat relatively unpolluted (forest of Bougous) in two polluted areas: urban and semi-urban, for a maximum period of 4 months.

The first signs of stress were detected by the increase in the contents of proteins in a significant way in space thereafter, by the increase very highly significant in the activity of the enzymes Ascorbate peroxidase (APX) and Guaiacol-peroxidase (GPX) in space, on the other hand Catalase (CAT) presents only significant activity in space. We noted a clear increase in these parameters in the transplants of *Flavoparmelia caperata* (L.) Hale on the level of the urban area compared to the semi urban area. On the other hand, the content of protein and the activity of different enzymes is very low at the control region (forest of Bougous).

There are few publications dealing with the interaction of metallic and gaseous pollutants, while they may be present together on the same site (urban or industrial) and thus act in concert on the physiology of lichens. Indeed, our results reflect very well this phenomenon (interaction lead and gaseous pollutants such as the NOx) through increased levels of proteins that normally under the effect of stress will increase their catabolism.

Keywords : Atmospheric pollution, enzymes, lichen, protein., stress, transplantation



Impact of Air Pollution on Lichenic Diversity in the Annaba Region (Eastern Algeria)

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Abstract

The use of lichens as indicators of the environment is no longer to be demonstrated because these organisms contain particular properties. They are plants which present no leaf, rod, or root only a thallus, and are therefore excellent accumulators of the elements contained in the air. As a result, we have used these plants as biological indicators of air pollution in the Annaba region (East of Algeria) and part of El Tarf (Ben Mhidi district). From this, we carried out an inventory of 59 lichenic species, with an apparent dominance of the crustaceans and a presence of some toxitolerant species. Among these resistant and accumulating species: *Xanthoria parietina*, *Xanthoria polycarpa*, *Pheophyscia orbicularis*, *physcia adscendens* considered as nitrophyll species and *Hypogymna physode*, the latter is resistant to oxides of sulfur.

Keywords: Lichen, Atmospheric pollution, bio indication, urban pollution, inventory, nitrophilic lichens.



Responses of antioxidant defense systems at differential chromium tolerance of wheat (*Triticum aestivum* L.)

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Abstract

The effects of hexavalent chromium on proline, electrolyte leakage and relative water contents, oxidative stress and antioxidant enzymes were studied in wheat seedlings. The results revealed that the chromium application increased proline, electrolyte leakage and relative water contents. Chromium toxicity was responsible for the increase of lipid peroxidation and hydrogen peroxide. Under chromium stress, the activities of antioxidant enzymes including catalase (CAT) and peroxidase (POD) were increased in plant tissues. These results suggested that the induction of various enzymes is part of a general defense strategy to cope with the overproduction of reactive oxygen. However, the antioxidant enzymes were to be susceptible to chromium resulting in a decline in their catalytic activities. This decline in antioxidant efficiency is an important factor in generating oxidative stress in plants under chromium stress.

Keywords: Chromium, wheat, oxidative stress, reactive oxygen species, antioxidant enzymes, tolerance.



Cadmium stress induced changes in antioxidant enzymes, lipid peroxidation and hydrogen peroxide contents in barley seedlings

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Abstract

Cadmium pollution is a problem of increasing significance for ecological, nutritional and environmental reasons. Different plant species and varieties show a wide range of plasticity in Cadmium tolerance, from a high degree of sensitivity to the hyper-accumulating phenotype of some tolerant plants. Plants adopt various defense strategies to avoid cadmium toxicity. The present study was undertaken to assess and investigate the antioxidant responses of barley (*Hordeum vulgare* L.) to cadmium treatment. Seedlings of barley were grown in increasing concentrations of CdCl₂ ranging from 25-100µM, for up to 14 days in a hydroponic system. The results showed that CdCl₂ reduced pigment content and caused oxidative damage as characterized by increased total soluble protein, malondialdehyde (MDA) and Hydrogen peroxide (H₂O₂) contents. Under cadmium stress, the activities of antioxidative enzymes, including ascorbate peroxidase (APX), peroxidase (POD) and catalase (CAT) were considerably increased in plant tissues. The present results allow us to conclude that the barley plants showed a negative response to cadmium toxicity. The physiological and biochemical process in plants was significantly affected by stress of CdCl₂. Barley plants activated antioxidant enzymes to diminish the reactive oxygen species (ROS) to deal with the cadmium induced oxidative stress.

Keywords: antioxidant enzyme, cadmium, *Hordeum vulgare*, oxidative stress, reactive oxygen species, tolerance.



Application of Local Entomopathogenic Nematodes and Fungi Against *Curculio nucum* (Coleoptera: Curculionidae)

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Abstract

The development and usage of biological control methods are based on the using of entomopathogenic microorganisms (fungus, bacteria, viruses, nematodes, etc.) associated with insects, as an alternative method of combating against pest insects by chemical pesticides.

The study showed, the results of experiments conducted in laboratory and field conditions against *Curculio nucum* (Coleoptera: Curculionidae) using local entomopathogenic nematodes (*Steinernema borjomiense*, *S. thesami*, *S. tbilisiensis*, *Steinernema* sp.) and entomopathogenic fungi *Isaria fumosorosea* "strain" (ARSEF access no. 10244).

The species of these Nematodes and fungi were used at first time against the hazelnut's pest *Curculio nucum*. The experiments were carried out using the nematodes and fungi separately and in combination with various doses of suspensions (100, 50, 25 IJs / nematode 1 insect). Laboratory tests have shown that from various doses of suspension against pests the most effective suspension is a dose of 100 nematodes against one insect. From nematodes used against insect pests, *S. borjomiense* and *Steinernema* sp. showed the highest effect. After 96 hours, 100% pest mortality was achieved. Regarding the separate use of *I. fumosorosea*, it was less effective against *C. nucum* (died 38.5% of imago and 43.2% of larvae). Against harmful insects, a much higher effect was received after usage nematodes and fungi in combination preparations in laboratory and field conditions. In the laboratory condition using of combining suspension showed the 100% mortality of harmful insects (as imago, so larvae). This result was registered after 72 hours.

The usage of *S. borjomiense*, *Steinernema* sp. suspension with a higher dosage (2000 nematode in 1 ml of water) against a pest in field condition showed that imago has died 78.4%, and larvae 66.7%.

The usage of combined suspension (nematode + fungi) showed that the pest mortality rate was higher; In this case, the imago mortality 85.9% and 78.2% larvae were obtained.

Keywords: Biocontrol, Entomopathogenic Nematodes. Pathogenic fungi, *Curculio nucum*, *Isaria fumosorosea*.



Histopathological study of organs of rats treated with insecticide

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Abstract

The Chlorpyrifos is an insecticide widely used in agriculture. This work aims to evaluate the effects of this insecticide of the organophosphorus family, on histological parameters of some organs of mammals. The study was performed on male Wistar rats divided into 3 groups; the control and two groups treated at a rate of 0.00185 and 0.00286 mg / ml chlorpyrifos / kg per diet for 6 weeks. The histological study of the liver revealed a dilatation of the lumen of the centrilobular vein and swelling of the tissue resulting in a loss of trabecular architecture. Regarding reproduction, a reduction in the light of the seminiferous tubes and disappearance of the space between the different cells of spermatogenesis with more severe disorganization of the epithelial architecture, leading a decrease in the sperm count and degeneration of testicular tissue. To conclude, the reproductive profile was the most affected by chlorpyrifos.

Keywords: Chlorpyrifos, histological study, spermatozoa, rat



Toxicological Impact of Food Additives Incorporated in Beverages Purchased by Children in the Algerian Market

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Abstract

Nowadays, the use of food additives has become controversially questioned of late growth, hypersensitivity and allergic reactions, immune system and intestinal disorder, as well as genotoxic and carcinogenic effects. In order to answer all those questions, we first tried to approach food safety through a survey about food additives incorporated into the local and imported milk drinks, juice and soft drinks found in the Algerian market.

The survey was carried out at different sale sites within the city of Annaba (Northeast of Algeria); the additives were inventoried then classified according to their category and degree of toxicity (*codex alimentarius*). At the same time, another survey on 600 children was conducted to study the drinking habits of those beverages. The results show the presence of a massive number of carcinogenic additives, highly toxic (SIN 102, SIN 110 and SIN466), doubtful (SIN160a, SIN120 and SIN202) in the imported beverages for a risky use of toxic additives (SIN104, SIN124, SIN150d), moderately toxic (SIN160 ai and SIN306) and slightly/not toxic (SIN412, SIN415 and SIN414) in the local beverages. For these young consumers, the results of the survey show highly consumption of these two type of beverages (very frequent, daily and repeated).

For children, the results of the survey showed a very high consumption of both types of drinks by Algerian's children. In addition, many of them suffer from hyperactivity (37%), food allergies (28%), obesity (22%) and gastro-intestinal disorders (19%), confirming the gravity of the situation.

This age group is very delicate and vulnerable; it would be advisable to sensitize the parents, school staff including school health staffs to reduce the consumption of those beverages and choose those that are naturel or homemade ones. Moreover, contact the control, hygiene and food safety services in order to avoid the exceeding of the daily allowable doses, especially in products heavily consumed by children.

To deal with this plague of toxicity, we advise consumers to become aware when buying food by checking the labels of these products. Thus, we encourage the agro-food industries to reserve sufficient space for the list of ingredients on the packaging which it should be readable and especially easily spotted by buyers.

Keywords: Food additives, survey, drinks, health risk, children



Biomonitoring of the northeastern coast of Algeria: Antioxidant defense in a gastropod mollusk

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Abstract

The aim of our study was to evaluate, in the digestive gland of a mollusk gastropod *Stramonita haemastoma*, the response of a biomarker associated with environmental pollution. Specific activity of Catalase (CAT) was measured in this species during 2013-2014. Seasonal collection of samples was performed at three sites. The results obtained show seasonal and inter-site variations of the CAT activity. This study, which is the first in *S. haemastoma* at the regional level, shows that the biomarker measured is sensitive and inducible parameter making it possible to qualify the state of health of the organism and the overall quality of the sites studied. This species could be used in biomonitoring programs.

Keywords: *Stramonita haemastoma*, Catalase, Biomonitoring, Biomarker, Coast of Algeria.



Evaluation of the Health State of the Gulf of Annaba (Algeria) through the Bivalve Mollusc *Donax trunculus*

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Abstract

Marine organisms are the main vectors that can create changes at any time in ecosystems. Molluscs, especially bivalves, are biological models that are widely used in ecotoxicology as bioindicators of pollution because of their ability to bioaccumulate. *Donax trunculus* is an edible Bivalve Mollusc that is very abundant in the Gulf of Annaba. The site of Sidi Salem is considered as polluted because it receives through the Seybouse river , waste urban and port, in addition to the rejections of the FERTIAL industrial complex specialized in the production of phytosanitary products and fertilizers. The present study on the *Donax trunculus* population of Sidi Salems' beach is part of a dynamic ecology monitoring of the beaches of the Algerian coast. A random sample of 936 individuals of this species was conducted for a period of 4 months (January to April, 2018) at the study site (the beach of Sidi Salem). A biometric study; biomass; the relative growth and physico-chemical parameters of the environment were studied. The results obtained show a distribution of classes of different size between 4 months with a maximum size of 32 mm and a minimum size of 12 mm indicating better growth of individuals, with low recruitment in January. The determination of the sex ratio shows that the population is male with a percentage of 63% during the study period. Also, there was an increase of the dry weight of the samples taken in February compared to January, followed a significant decrease in March. The study of relative growth shows a significant, weak and positive relationship between height and weight, thus reflecting a growth in allometric reduction, for which the size grows faster than the weight.

Keywords: *Donax trunculus*, Bio surveillance, Relative growth, Biometrics, Biomass.



Variation in the biochemical composition of gonads in *Patella caerulea* (Gastropoda, Prosobranchia)

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Abstract

The present work aims to know the effect of pollution on the biochemical composition of the gonads and the reproduction of *Patella caerulea* in the East-Algerian coast. These gastropods colonizing the mid-littoral stage are considered in many studies as excellent indicators of marine coastal pollution. In this study carbohydrate, lipid and protein levels were measured in *Patella caerulea* gonads. The samples were collected during the spring 2018 (sexual activity period) at two stations: El-Kala, far from sources of pollution and Toche considered as polluted station, at the East-Algerian coast. The estimation of the energy reserves shows a very highly significant decrease in the carbohydrates and lipids of the individuals of the Toche station ($\text{♂} : 1,05 \pm 0,01$; $\text{♀} : 1,29 \pm 0,20$ and $\text{♂} : 1,60 \pm 0,32$; $\text{♀} : 1,28 \pm 0,20$ respectively) in comparison with the individuals of El-Kala ($\text{♂} : 2,75 \pm 0,14$; $\text{♀} : 3,67 \pm 0,22$ and $\text{♂} : 2,13 \pm 0,39$; $\text{♀} : 1,49 \pm 0,32$ respectively) . however the evaluation of protein levels reveals that El-Kala's limpets have the lowest values ($\text{♂} : 2,09 \pm 0,21$; $\text{♀} : 2,89 \pm 0,34$) compared to those of Toche ($\text{♂} : 3,52 \pm 0,32$; $\text{♀} : 4,61 \pm 0,24$). This variation would be related to the gametogenesis and reproduction of *Patella caerulea* on the one hand, and the different urban and industrial discharges that the Gulf of Annaba receives on the other hand.

Keywords: Reproduction, Carbohydrates, Lipids, Proteins, *Patella caerulea*, East-Algerian coast.



Assessment of the potential side-effects of novaluron (insect growth disruptor) on moulting hormone profile, cuticle secretion and chitin contents on the shrimp *Palaemon adspersus*.

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Abstract

The leaching of a large amount of pollutants derived from agricultural and domestic activities (fertilizers, pesticides, and detergents) might contaminate especially the aquatic environments affecting several non-target aquatic organisms such as crustacean species. The current study aimed to evaluate under laboratory conditions the potential side-effects of novaluron (20% Wettable Powder), a potent benzoylurea derivative insecticide on mosquito larvae, against a non-target shrimp, *{Palaemon adspersus}* Rathke, 1837 (Decapoda, Palaemonidae). This species is abundant in the lagoon El-Mellah (Northeast Algeria) and a relatively important species for the local fishery industry. The compound was tested at two concentrations (0.91 mg/L and 4.30 mg/L) corresponding respectively to the LC₅₀ and LC₉₀ determined against fourth-instar larvae of *{Culiseta longiareolata}* (Diptera, Culicidae). The newly ecdysed adult shrimps were exposed for 15 days, i.e. stage A until D during a moult cycle. Under normal conditions, changes in hemolymphatic ecdysteroid concentrations during the molting cycle presented a peak at stage D, just before the ecdysis while in the treated series, we note an increase in hemolymphatic ecdysteroid concentrations at stages C and D and an absence of the peak as compared to the controls. Histological observations of integuments revealed that novaluron caused a significant reduction in thickness of the new cuticle at its LC₅₀ and an inhibition of the new cuticle secretion at its LC₅₀. The determination of chitin amounts, showed that exposure of shrimps to novaluron resulted in a significant decrease of values at all molting stages with a dose-response manner in comparison to controls. Thus, the overall data confirm the primary mode of action of novaluron on chitin. This insecticide can present secondary effects on this non-target shrimp species commercially important for the local economy.

Keywords Toxicology, Novaluron, *Palaemon adspersus*, Ecdysteroids, Cuticle, Chitin



Biomonitoring Working Party Index (Bmwp) for the Bioassessment of the Water Quality of Lake Tonga (Northeast Algeria)

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Abstract

The responses of biological communities, or of the individual organisms, can be monitored in a variety of ways to indicate effects on the ecosystem. The Biological Monitoring Working Party (BMWP) is among the most used bio-assessment indices for aquatic ecosystems quality assessment, which assigns scores to each macro-invertebrate taxa according to their sensitivity to pollution. This study was carried out between march 2017 to February 2018 in Lake Tonga. The BMWP Score System revealed that the Lake was a Class III with a score of 60 points, indicating fair biological water quality.

Keywords: BMWP, Bio-assessment indices, Aquatic ecosystems, macro-invertebrate, Lake Tonga.



Measure of environmental stress biomarkers in the shrimp *Palaemon adspersus* from the El-Kala lakes and Annaba gulf (Algeria): spatial and temporal variations

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Abstract

The objective of this study was to investigate the impact of anthropogenic activities on the water quality in two regions of eastern Algeria: El-Kala lakes and Annaba gulf using the shrimp *Palaemon adspersus* (Crustacea, Decapoda) as a bioindicator. For this, physicochemical data (pH, salinity and temperature) were collected, an inventory of Crustacea species associated with *P. adspersus* shrimp was established and the biometric parameters were determined, then the activities of glutathione S-transferase (GST) and acetylcholinesterase (AChE), biomarkers were measured in shrimps. Four sampling sites were chosen El-Kala lakes (El-Mellah lagoon: site 1, Obeira Lake: site 2, Tanga Lake: site 3) and Annaba gulf (Sidi Salem: site 4). The study was conducted for autumn of two consecutive years (i.e. 2018 and 2019). The results of the inventory reveal the existence of two isopod species: *Idotea* sp1 and *Idotea* sp2 (Rathke, 1837), and a crab species *Carcinus aestuarii* (Linné 1772) and a single species shrimp *P. adspersus*, which was the subject of our biometric and enzymatic study. The El Mellah lagoon sites have more species than the other sites. The biometric study of *P. adspersus* reveals significant variations in weight and linear parameters. The GST and AChE activities were found to vary between sites and by year. The results showed a significant induction in GST and also a significant inhibition in AChE activities in individuals from the sites 2, 3 and 4 compared to those of the site 1. This reflects the water quality of the sites studied and indicates that the site of Sidi Salem is considered the site most affected by various sources of pollution.

Keywords: Pollution, Biomonitoring, Lagoon El Mellah, Crustacea, *Palaemon adspersus*, Glutathione S-transferase, Acetylcholinesterase.



Effect of salinity stress on root development of *Phoenix dactylifera L.* seedlings

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Abstract

The date palm is an essential element of oasis ecosystems. It plays a very important role in the balance of these ecosystems. It ensures, on the one hand, the protection of the underlying crops by creating a microclimate, and on the other hand, it participates in the fight against silting up, due to its fasciculated root system. The salty groundwater rise, and the salinity of irrigation water are the main obstacles limiting plant development. The objective of this work is to describe the effect of salinity in irrigation water (at 0, 100 and 200 mM of sodium chloride) on the development and root growth of date palm seedlings. Two parallel experiments were conducted in rhizotron: dynamic and static analysis. Architectural traits were used to describe the structure and development of the root system. Root elongation was measured regularly on seedlings grown from seed (0 to 6 months). The branching, length and diameter measurements of roots were made at sample excavation. 3D simulation DigR software (©CIRAD, Montpellier, France) illustrating the establishment of different types of root axes evolves over time and depends on the root category. The results of architectural analysis show the presence of seven different morphological types of roots. The establishment of root types is progressive with time (ontogeny). The branching is significantly influenced by salinity, but the growth rate did not reveal a large difference between the 3 concentrations. At the 0 and 100 mM of sodium chloride, root types have distinct characteristics and are spread over three different topological orders (primary, secondary and tertiary). But at 200 mM, root types are spread over two topological Orders (primary and secondary).

Keywords: Salinity, Root growth, *Phoenix dactylifera*, Ramification, Architecture



Enzymatic biomarkers measurement in adult females of a freshwater fish *Gambusia affinis* exposed to thiamethoxam during the reproduction season.

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Abstract

In Algeria the use of pesticides is increasing with the development of agriculture aiming at a better yield by protecting the crops from the pests but are also used in the fight against various zoonoses such as leishmaniasis or malaria. Neonicotinoids are insecticides widely used in agriculture to control pests, but can also affect other non-target species. The purpose of this study is to evaluate the side effects of a neonicotinoid insecticide, thiamethoxam (active ingredient of Actara® 25 WG) administered in the water of a non-target organism, *Gambusia affinis* at concentrations of 10, 20 and 40 mg/l, on the activity of two biomarker enzymes glutathione S-transferase in the liver and acetylcholinesterase in the brain of adult females. The product is added to the rearing water of fish at concentrations of 10, 20 and 40 mg/l corresponding to concentrations lower than those used in culture (ranging from 200 to 1,000 mg/l of active ingredient), the females are exposed for 28 days, the brain and liver are collected at different exposure times (0, 1, 7, 14, 21 and 28 days) to measure GST and AChE. The results show a highly significant variation in the activity of biomarkers including a very highly significant increase in the activity of GST from the 14th day of treatment, which is maintained until the end of the experiment which reveals the induction of GST and its role in the detoxification of the insecticide. In addition, a highly significant reduction in the activity of acetylcholinesterase after 24 hours of exposure is observed, which indicates an inhibition of its activity by the insecticide and confirms its neurotoxicity. Finally, early inhibition of AChE activity, which will be followed by induction of GST, indicates a significant response of adult females to this insecticide. All of these results suggest that thiamethoxam has a toxic effect on *G. affinis*.

Keywords: Neonicotinoids, Thiamethoxam, Biomarkers, *Gambusia affinis*, Glutathione S-transferase, Acetylcholinesterase, reproduction season.



The use of Macroinvertebrate Biotic indices BMWP, ASPT and SWRC for evaluation of the water quality in rivers in Kosovo

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Abstract

The aim of this study is to analyze sensitivity of macroinvertebrate groups in different pollution sources in water bodies in order to evaluate the water quality of the rivers in Kosovo. Up to recently, the saprobity indices were the most used for this purpose. In this research different indices based on macroinvertebrate groups presented in the water course of the River Lepenci, are used. The macroinvertebrates are sampled in 8 sampling stations along the river course. The measurement of physical and chemical water parameters was conducted in parallel.

Based on the BMWP (Biological Monitoring Working Party) and ASPT (Average Score Per Taxon) data, it is concluded that the water quality is high in source area of the river, where no or minimum impact exists; it decreases in the stations in middle stream of the river, located in populated areas, where as a result of antropogenic activities pollutants from waste waters, industry and agriculture discharge in the river changing the physical and chemical parameters of water and its quality. Further, downstream of the river, due to auto- purification ability of the water bodies, the quality slightly increases becoming moderate.

SWRC index (Stround Water Research Center – Biotic Index) is used to evaluate the organic pollution in water of river Lepenci. Based on observed and average values of SWRC, it is concluded that even in the source area, the river water according to Ecological Quality Ratios (EQR-s) is of second (II) class quality, in the middle stream it decreases significantly and is of fourth class (IV), whereas downstream it becomes of third class (III)-moderate. Our results show that the use of different macroinvertebrate quality indices gives a clear picture of the impact of diverse pollutants in water quality of the rivers.

Keywords: BMWP, ASPT, SWRC, sensitivity, River Lepenci, macroinvertebrates



Water Quality Classification Using Macrophytes as Biological Indicator in the Basin of Lepenci River Kosovo

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Abstract

Macrophytes represent one part of the biological quality element defined by the European Water Framework Directive (WFD) as 'macrophytes and phytobenthos'. The aim of the study was to estimate the reliability of ecological status classification with the use of macrophytes for lowland rivers with different habitat conditions, corresponding to the requirements of the WFD. The research was conducted in eight localities in the Lepenci River Basin. The classification of water quality is based on the Ecological Quality Ratios (EQRs) which is proposed for the purpose of macrophyte-based classification for the WFD. For deriving the ecological quality ratio we calculate the indices River Macrophyte Nutrient Index (RMNI); River Macrophyte Hydraulic Index (RMHI); Number of macrophytes taxa which are not helophytes (NTAXA) and the Number of functional groups of macrophyte taxa which are not helophytes (NFG). For the Calculation of the ecological quality ratio (EQR) for each parameter we have these sets of results: RMNI in location (SP1-0, SP2-0, SP3-0, SP4-2.87, SP5-8.65, SP6-7.56, SP7-6.41, SP8-7.0). EQR_{RMNI} (SP4-1, SP5-0.37, SP6-0.66, SP7-0.97, SP8-0.82). RMHI (SP1-0, SP2-0, SP3-0, SP4-3.11, SP5-8.11, SP6-8.74, SP7-6.90, SP8-7.15). EQR_{RMHI} (SP5-0.6, SP6-0.39, SP7-0.98, SP8-0.90). The number of macrophyte species is in positive correlation with the nutrients in water that are rich in nitrogen and phosphorus as a result of various organic pollutants, such as wastewater from households and manure which are discharged near the river in these areas by different farmers. Based on the River Macrophyte Hydraulic Index (RMHI), the highest values of this index appear at SP6-Gërlicë Station with a value of 8.74 as this station is the most polluted site and has a slower flow, and these types of plants are associated with low velocity which depends on the velocity of the water flow. The largest number of macrophyte species that were not heliophytes is recorded in SP8-Hani i Elezit. The distribution of macrophytes is closely related to the presence of water pollution, from which they provide nutrients that enable them to grow favorably, therefore the medium and lower station which have had greater contamination have had a greater number of species.

Keywords: Macrophytes, WFD, EQRs, RMNI, RMHI



Toxicity of azadirachtin against Mediterranean flour moth, *Ephestia kuehniella* Zeller

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Abstract

Insect pests, considered as one of the major problems in agriculture, can also be vectors of pathogens and pose a threat to animals, including humans. Thus, in the context of sustainable development, non-polluting pesticides have been marketed by pharmaceutical and phytosanitary firms. Among these molecules, biodegradable and low environmental impact azadirachtin. Therefore, the objectives of the present study were to determine the lethal parameters of azadirachtin, applied topically alone on *Ephestia kuehniella* Zeller, larvae of *E. kuehniella* were cultured in the laboratory on wheat flour at 27°C and 80% relative humidity. The product was dissolved in acetone and topically applied (1 µl per insect) on newly ecdysed pupae (<6 h old). Control insects were treated with acetone alone (1 µl). Five doses (0.5, 1, 1.5, 2.5 and 3.5 µg) were tested (three replicates per dose were done each consisting of 30 insects). The inhibition percentages of adult emergence were corrected in accordance with Abbott (1925). The inhibition doses (ID) ID25 and ID50 (doses causing inhibition of adult emergence in 25% and 50% of the treated insects, respectively) were determined together with their corresponding 95% fiducial limits (95%FL) and the Hill slope.

Keywords: Toxicity, Biopesticide, *Ephestia kuehniella*,



Effects of inhibitor of the angiotensin converting enzyme on the quality and quantity of cuticular proteins of the Mediterranean flour moth, *Ephestia kuehniella* Zeller

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Abstract

The large number of protease genes in animal genomes reflects the widespread importance of proteolysis to animal physiology and development. Few works were carried out on the localization and role of certain members of the metallopeptidases family to which the enzyme of conversion of angiotensin (ACE) belongs. This enzyme is a zinc metallopeptidase anchored to the cell surface and whose role is to cleave a peptide angiotensin I to produce a vasoconstrictor, angiotensin II. Studies have shown the presence of ACE in insects and its role in the inhibition of molting hormones (ecdysteroids), which play an important role in the development and reproduction. This study consists in evaluating the consequences of the inhibition of this enzyme in the tegument of *Ephestia kuehniella*, larvae of *E. kuehniella* were cultured in the laboratory on wheat flour at 27°C and 80% relative humidity. The compound is diluted in acetone and applied topically to newly emerged pupae (10µg/pupa) on newly emerged females. The effects of this molecule was studied, on the biochemistry of tegument quantitative and qualitative analysis of the cuticular proteins. Captopril reduces significantly quantity of ovarian proteins and nucleic acid. The electrophoresis profile reveals the absence of tree bands at the treated series.

Keywords: *Ephestia kuehniella*, Drug, Captopril, Proteins, tegument



Mineral response of *Atriplex halimus* L. under the effect of lead nitrate

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Abstract

Our ecosystems are exposed to many sources of pollution. The main of this study is to examine the response of a halophile species *Atriplex halimus* L. under lead stress in the context of phytoremediation. Seeds of this species are sown in a controlled greenhouse in a mixture of peat and sand. They are watered from germination with increasing concentrations of lead nitrate 00, 1000, 3000, 5000 and 7000 ppm every two days for 100 days. Watering is done for 100 days using alternating distilled water, nutrient solution and lead treatment. The study of the foliar and root mineral response consists of analyzing: lead, potassium and calcium content.

Lead nitrate induces a slight accumulation of lead in leaves and roots for this species. For calcium, the plant has blocked the return of this mineral by reducing its content in the root. On the other hand, an increase in the potassium content is observed in leaves under this metal.

It is concluded that this plant exposed to lead stress has not accumulated significant levels of lead, and therefore it can not possibly decrease lead pollution in the polluted soil.

Keywords: *Atriplex halimus* L., lead nitrate, calcium, potassium, lead.



Assessment of water quality of Karaören Pond (Çankırı,Turkey) using water quality index and multivariate statistical analyses

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Abstract

This study was carried out to determine water quality of Karaören Pond using water quality index and multivariate analyses. Turkey's Ministry of Forestry and Water Affairs Surface Water Quality Regulations (SWQR) were used in calculating the water quality index. For this reason, 28 water quality variables (Water temperature, salinity, total suspended solid matter dissolved oxygen, pH, chlorinity, electrical conductivity, COD, BOD, total hardness, NO_3^- -N, NH_4^+ -N, total alkalinity, PO_4^{3-} -P, SO_3^{2-} , SO_4^{2-} , Cl, Ca, Mg, Na, K, Fe, Pb, Cd, Zn, Ni, Cu, and Hg) were measured monthly at four stations for one year. WQI values in the pond were found to be between 7.89 and 68.97. Accordingly, water quality shows fluctuation between "good" and "very good" levels. In accordance with monthly average of water quality index, while the values were relatively high in the autumn the early winter, fell to minimum in February and reached maximum in June. Factor analysis results showed that pH, temperature, electrical conductivity, solid suspended matter, chemical demand, biochemical oxygen demand, SO_4 , SO_3 , Ca, NH_4 -N, Ni and the DO are the main parameters responsible for the changes in the ecosystem.

Keywords: Karaören Pond, Water quality, Water quality index, Turkey



Biopesticides in Algeria

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Abstract

The excessive use of chemical pesticides in recent years has highlighted the value of alternative approaches to sustainable development of agriculture, the use of natural products. Biopesticides are used by farmers and peasants, to eliminate parasites and competitors of the activity (mushrooms, insects, bacteria, weeds). They may also be used by all people, whether it is the individual, the farmer or local communities, national ... the idea makes its way, the use of products of plant origin, these products are undoubtedly one of the keys to the sustainable development of agricultural activities in the world. Most of the research on these biopesticides has been carried out in the past and is now being replaced by fungicides and other pesticides in their environment. In Algeria, studies have been made by a number of Algerian researchers (biologists and agronomists) on the essential oils of aromatic plants as alternatives for synthetic pesticides, we talk of their effects against various pests with low toxic impact to untargeted organisms, its the food security. Our work is based on a bibliographical synthesis on work carried out in the context of biopesticides in Algeria based on methods and techniques that can be used in biological control.

Keywords: chemical pesticides, biological control, biopesticides, essential oils, aromatic plans, toxic.



Non-indigenous decapod crustaceans in the Adriatic waters: A short review

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Abstract

During the past few decades, various factors, such as climate change, anthropogenic activity and Lessepsian migration have altered the composition of Adriatic fauna. Extensive investigations carried out in recent decades have brought to attention of scientists many species, previously not recorded or reported for the Adriatic Sea. Among these, there is a significant number of non-indigenous species, the presence of which may be attributed to the processes of bioinvasion and tropicalisation as well as human activities and modern maritime traffic. Fifteen non-indigenous (alien) species of decapod crustaceans have been recorded up to now in the Adriatic Sea and five can be regarded as established. The impact of successful colonizers on the native communities is unknown yet. Seven species are represented only by records of single specimens. Several non-indigenous species have been also reported for the Adriatic Sea the occurrence of which is highly questionable (for example: *Thenus orientalis*, *Portunus sanguinolentus*, *Plagusia squamosa*). The present hydrological status of the Adriatic Sea still seems unsuited for the tropical species that invaded the Eastern Mediterranean through the Suez Canal, as the alien decapods recorded in the Adriatic originate mainly from the temperate region of the West Atlantic or the West Pacific. Their introduction seems mainly related to maritime traffic.

Keywords: Adriatic Sea, alien species, non-indigenous, decapoda



Preliminary data on the feeding habits of *Synodus saurus* (Linnaeus, 1758) from the eastern Adriatic Sea

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Abstract

Preliminary investigations on the feeding habits of *Synodus saurus* from the eastern Adriatic Sea were undertaken in 2018. Until recently, this fish was considered rare in the eastern Adriatic, but in recent the years it became relatively common in the middle Adriatic. Samples were collected from the beach seine fishery operating in the cold period of the year while lower number of samples were collected from gill-nets in the warmer period of the year. In all, 119 specimen of *S. saurus* were collected for the analysis of its feeding habits. Food items were found in 62 stomachs and vacuity index for the whole sample was 47,9%. Our results showed that preferred and most frequent food items were fishes *Spicara smaris* (16%) and *Sardina pilchardus* (13,5%). Beside these, *Atherina* sp. was also notable prey item. Almost all prey items were fishes indicating strictly piscivorous nature of this species. The only other prey items were cephalopods, but with very low frequency of occurrence (1,7%). Due to unavailability of the specimens throughout the year, mostly as a result of temporal restrictions of fishing gear used for samplings, we were not able to provide an analysis of importance of prey items in different seasons. However, there was a notable difference in main food index (MFI) with *Spicara smaris* dominating in the colder part of the year, and *Sardina pilchardus* in warmer.

Keywords: Adriatic Sea, *Synodus saurus*, feeding habits, *Spicara smaris*, *Sardina pilchardus*



Laboratory Evaluation of Environmental Risk Assessment of Pesticides for Mosquito Control: Impact of Dimilin on *Gambusia affinis*

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Abstract

Benzoylureas are used as insecticides because of their ability to act as insect growth regulators (IGR). One such insecticide is the trade chemical dimilin, or diflubenzuron. The aims of the present study was to investigate the probable effects of diflubenzuron (DFB) chitin synthesis inhibitors on growth of a larvivorous fish *Gambusia affinis* (Cyprinodontiformes, Poeciliidae), extensively used in biological control of mosquitoes, and to test the detoxification system by measuring the glutathione (GSH) amount and glutathione-S transferase (GST) activity. *Gambusia affinis* (Baird and Girard, 1845) was collected from Kherraza River (4° 04' N, 04° 02' E) located at the west of Annaba city (Northeast Algeria). The compound was added in rearing water at two concentrations corresponding to LC50 and LC90 against the fourth instar larvae of *Culex pipiens* (Diptera, Culicidae). The adult females (50 fishes for each concentration) were exposed in a continuous treatment for 28 days. The growth, metric indexes, GSH and GST activities were determined at different exposure times (0, 7, 14, 21 and 28 days). The results of ANOVA showed that DFB had no significant ($P > 0.05$) effects on growth, hepato-somatic, gonadal-somatic indexes and condition factor. Furthermore, treatment affected both GSH amounts and GST activities. The observed effects (GSH amounts and GST activities) varied as function the exposure time and the concentration. Conclusively, the experiment on DFB chronic exposure on a non-target organism *G. affinis* revealed that DFB exhibited a slight toxicity. Moreover, this compound stimulated the detoxification system as evidenced by an increase of GST activities and an inhibition of GSH amounts.

Keywords: Diflubenzuron, *Gambusia affinis*, Growth, Glutathione, Glutathione S-transferase



Antimicrobial and Anti-biofilm Activities of Synthesized Hydroxyapatite Nanoparticles Against Drug-Resistance Bacteria

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Abstract

The resistance of certain pathogenic bacteria causes a huge problem of public health. It leads to an increase in nosocomial infections and hospitalizations, an increase in medical expenses and an increase in mortality. The formation of biofilms by the adherence of bacteria to medical devices, implants and damaged tissues is the main origin of such infections. Nanotechnology is expected to open new avenues to fight and prevent disease using atomic scale tailoring of materials. This work focuses on the antimicrobial and antibiofilm activities of synthesized hydroxyapatite nanoparticles (HAP NPs) against drug resistance Bacteria. The antimicrobial activity of Hap NPs was evaluated using the determination of minimum inhibitory concentration (MIC) by the dilution method on agar medium. The obtained results show a significant antimicrobial activity on the strains tested: *Pseudomonas aeruginosa* ATCC27853: 8µg/mL, *Staphylococcus aureus* ATCC29213: 2µg/mL, *Escherichia coli* ATCC25922: 2 µg/mL and *Candida albicans* : 1µg/mL. The antibiofilm activity of Hap was evaluated using a microplate biofilm test. The obtained results show a significant antibiofilm activity on the strain tested: *Staphylococcus aureus* which was significantly reduced by 88.05%, after contact with 100 µg/ml of HAP NPs. The HAP NPs appear to be attractive candidates of choice to be an effective alternative to antibiotics and pave the way for a promising new strategy antibacterial nanoscale as dental implant coating materials.

Keywords: Nanoparticles, Hydroxyapatite, Antimicrobial Activity, Antibiofilm Activity, Inhibition rate.



Accumulation of Heavy Metals in Trees of Wood plants in the Mining Industry Zone Gadabay District, Azerbaijan

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Abstract

Today researches shows that it is also possible to use trees to monitor levels of air pollution. The study [1] found evidence that leaves of trees change both chemically and physiologically when exposed to different levels of air pollution. An air pollutant is a substance in the air that can have adverse effects on humans and the ecosystem. There are a few evidence that trees play important role in ecosystems because they transfer elements from the abiotic environment to the biotic one and to reduce human exposure to the anthropogenic pollutants [2]. Air pollution can pose serious risks to human health and the environment. Traditionally, expensive equipment is used to accurately monitor air pollution. By adopting trees as bio-indicators, the physical and chemical changes in such organisms can be used to directly assess the effects of air pollution on the environment. The aim of this research was study and assessment of the impact of the mining industry (Gadabay gold mine) on transboundary pollution of forest vegetation. Currently, the gold mines of Gadabay mining non-ferrous metals (gold, copper, silver) is produced by the open pit method. Man-made impact (pollution) ore mining on the environment and its components, in particular on vegetation, is inevitable. Parametric estimation of the amount of heavy metals in the leaves of the main forest-forming tree species (beech, doom and hornbeam), as well as in the needles of pine species (ordinary and Crimean), widely distributed in forest cultures. Samples of leaves and needles for laboratory tests to determine the amount of heavy metals were collected at the end of the growing season (September, 2016), on a single test plot. The pilot site is located in the south-east direction, located at a distance of 5 km from the source of pollution (Gadabay gold mine) and coincides with the direction dominant winds. Elemental determination was carried out by epithermal neutron activation analysis (ENAA) at the reactor IBR-2 of FLNP JINR. For the first time 39 elemental concentrations were determined (Na, Mg, Al, Cl, K, Ca, Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Se, Br, Rb, Sr, Mo, Cd, Sb, I, Cs, Ba, La, Ce, Sm, Eu, Tb, Tm, Hf, Ta, W, Au, Th, U). Multivariate statistical analysis of the analytical results obtained will make it possible to identify the main sources of pollution and to assess the role of long-range transport of pollutants.

Keywords: Air Pollution, Tree leaves, Neurton Activation Analysis, Heavy Metals

1. Khavanin Zadeh, A.R., Veroustraete, F., Buytaert, J.A.N. et al. (2013). Assessing urban habitat quality using spectral characteristics of Tilia leaves. *Environmental Pollution*. 178: 7-14. DOI:10.1016/j.envpol.2013.02.021.
2. Martínez-López, S., M.J. Martínez-Sánchez, C. Pérez-Sirvent, J.Bech, M.C. Gómez Martínez and A.J. García-Fernandez (2014). Screening of wild plants for use in the phytoremediation of mining-influenced soils containing arsenic in semiarid environments. *Journal of Soils Sediments*, 14: 794–809



Effect of fungicide Chlorothalonil on kidney function in the male *Wistar* rat

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Abstract

Chlorothalonil is one of widely used fungicides in the east region of Algeria because of its efficacy against a broad spectrum of fungi and their associated plant diseases. This study aims to study the effects of the Chlorothalonil on the renal function in the male *Wistar* rats. Animals were divided into three groups (10 rats in each group); the first one was served as a control, the second and the third were respectively given two doses of Chlorothalonil at 60 and 180 mg/body weight/day by gavage for 4 weeks. At the end of the experimental period, animals were sacrificed and the kidney were weighted. Blood samples were collected from all animals to assess kidney function through determination of urea, creatinine and uric acid to measure the effect of the use fungicide on renal activity. The kidney of all group was weighted and the histopathology changes study was made in accordance with classic method. the obtained results indicated an increase in the absolute weight of kidneys in the treated animals compared to control. The biochemical parameters of the treated groups revealed an increase of urea and creatinine concentrations compared to the no treated animals. Serum uric acid level demonstrated a significant decrease in animals received the fungicide. The microphotography of kidney of the treated rats showed certain alteration as a peritubular inflammatory reaction, necrosis, cell desquamation, and degeneration of the epithelium of all distal tubules in the treated groups as compared to the control. In conclusion, the present data demonstrate that the medium exposure of Chlorothalonil may causes many disorders in the kidney function in rats.

Keywords: Toxicity, Chlorothalonil, kidney function, Biochemical parameters, Rat, histology



Biochemical Stress Indicators of honey bees (*Apis mellifera intermissa*) after exposure to zinc oxide nanoparticles

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Abstract

The serious ecological consequences and effects on human and animal health have been found to be related to the presence of nanoparticles (NPs) in bio systems. Among the most important pollinators that faced many threats by environmental pollution, pest control and potentially, by products of nanotechnologies is the honey bees. Therefore, there is a crucial need for investigating the potential toxic effects of NPs on honey bees. In this study we investigated the toxicity of ZnO NPs on the local honey bees in Algeria: *Apis mellifera intermissa*.

Adults of *A.mellifera intermissa* were fed syrup containing ZnO NPs during 96h. The LC50 values of ZnO after 24, 48 and 96 h exposure were calculated. The potential neurotoxicity of ingested ZnO NPs have been investigated on honey bees. A variety of biomarkers, including the neurotoxicity biomarker acetylcholinesterase (AChE) and the activities of a stress-related enzyme glutathione S-transferase (GST) have been evaluated. Specific activities of AChE were determined in the head of the surviving honey bees after 24, 48 and 96 h of the oral treatment. The glutathione S-transferase was extracted from the midgut of tested bees.

The activity of AChE was found to be lower in bee workers exposed to the tested substance. The results revealed that the specific activity of AChE in the untreated bees was higher than that of treated bees with the tested concentrations. It can be concluded that the AChE activity was strongly inhibited by ZnO NPs and this substance has a neurotoxic potential and thus can contribute in the colony failure. The increase in GST activity, suggests the induction of oxidative stress by ZnO NPs. This induction may be due to the glutathione-dependent enzymes system that provides major protection against this toxic substance.

The results suggested that ZnO is moderately to highly toxic to honey bees, depending upon the dose used and length of exposure. Overall, our results are valuable not only in evaluating the toxicity of ZnO NPs for honey bees, but also in highlighting the validity of enzymes activities as proper indicators for exposure to nanoparticles. More studies are required to address the histopathological and ultra-structurally effects of NPs on tissues of the midgut of honey bee workers and to investigate and elucidate their potential toxicity on brood, queen, drones vitality, colony vigor and its potential role in colony collapse disorders.

Keywords: Biomarkers AChE, GST, ZnO NPs, Toxicity, *Apis mellifera intermissa*



Assessment of genotoxic impact of Zinc oxide nanoparticles on the population of mosquitofish *Gambusia affinis* using the micronucleus test

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Abstract

Micronucleus assays with fish have been shown to be useful in vivo techniques for genotoxicity testing, and show potential for in situ monitoring of impact of nanoparticles on freshwater fishes and water quality. Research has demonstrated that metallic nanoparticles produce toxicity in aquatic organisms that is due largely to effects of particulates as opposed to release of dissolved ions. The choice of Zinc oxide nanoparticles is justified because it has very interesting physicochemical properties, which explains its wide use.

This study focuses on assessing the impact of zinc oxide NPs on organisms involved in mosquito control: the freshwater fish *Gambusia affinis*. The genotoxic potential of ZnO NPs was evaluated using MNT (micronucleus test). The fishes were exposed to different concentrations (50, 75, 100, 150 µl/mL) of ZnO NPs and (MMS, methyl methane sulfonate) was used as a positive control at a concentration of 1,56 mg/L, the exposure time was 2, 4, 8 and 12 days.

Our results showed high mitotic indices in erythrocytes: bi-nucleation, multinucleation and high mitotic index were also observed and quantified. About micronucleus frequencies, there were significant differences between the positive control (MMS) and the groups exposed to Zinc NPs concentrations, whatever the time of exposure. Our results revealed genotoxic effects of the ZnO nanoparticles on *Gambusia affinis* only at the highest concentrations and the longest time exposure (12 days). Results suggested the suitability of the micronucleus test used as tools in environmental monitoring programs of risk assessment.

Keywords: Genotoxicity, Micronucleus test; Zinc oxide nanoparticles; *Gambusia affinis*; MMS.



Effect of the mixture of two fungicides and one insecticide on fertility and the histology of testes and epididymides in the male rat

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Abstract

The recent decline in sperm concentration observed in men has developed over a short period of time, suggesting that it could be the result of environmental factors. Disorder of the reproductive system leads to infertility and therefore has been in the center of attention within the recent decades. The purpose of this study is to evaluate the toxic effect of a mixture of the most widely used pesticides in the field of agriculture (acitamidrid, maneb, tubeconazole), on the histology of some organs in the Wistar rat. 25 male pupal rats were divided into three groups. G1 is the control group and both groups G2 and G3 were treated with a mixture of 3 pesticides at doses (1/30 LD50 and 1/60 LD50) in the diet for 8 weeks. Our results show a significant decrease in epididymal mass and testis in the treated groups especially at the highest dose compared to the control group. Observation of the histological sections of the testicle shows a decrease in the number of spermatozoa and testicular atrophy with a decrease in the diameter of the seminiferous tubes in the groups treated with the mixture compared to the control group. The histological sections of the epididymis demonstrated a remarkable decrease in spermatozoa in the epididymal canal lumen, as well as the presence of some immature germ cells and cellular debris in the epididymis of treated animals with the mixture compared to the control group. In conclusion, these results suggest that mixture pesticides exposure of male rats causes a decrease in the quantity and quality of sperm in the treated animals.

Keywords: fertility, acitamidrid, maneb, tubeconazole, histology, mixture pesticides



Stairway to happiness through a better-protected environment: the case of 19 European countries

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Abstract

This study investigates the long-run relationship between environmental protection expenditure and happiness at the European level. We adopt the recently developed dynamic panel heterogeneity analysis using an autoregressive distributed lag model estimated by the dynamic fixed effect, the mean group and the pooled mean group estimators. The sample covers 19 countries in the period 1997-2016. Our results support the existence of a direct long-run equilibrium between happiness and environmental protection expenditure. The unemployment rate has, instead, a negative impact on happiness but only in the short run. The policy implication suggested by our findings is that government environmental protection may not only offer a solution to market failure but, by increasing happiness, could also improve the quality of social life.

Keywords: environmental protection expenditure; happiness; long-run relationship; dynamic fixed effect; mean group; pooled mean group.

JEL: C22, I31, Q58.



Relationship between Useful Maters and Milk Production in Holstein and Monbéliarde Cows in Eastern Algeria

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Abstract

The performances of high producing dairy cows imported in Algeria represent a serious problem for the farmers. The purpose of this study is to determine the existence of the relationship between diet, and production and milk composition in useful maters in relation to body condition score (NEC). Two lots of heifers, 20 Prim'Holstein (PH) and 20 Montbeliarde (MB), pregnant with 5.6 ± 0.4 (PH) and 5.5 ± 0.4 (MB) months were followed under the same breeding conditions on three successive lactations, except during the dry period. Foods such as barley silage, clover green, barley grain and wheat bran were the staple foods while the concentrate was consumed twice daily during milking. The state of body reserves deteriorated progressively during the three lactations to reach values of the NEC below 2 points. Dairy production was $4,211 \pm 340$ kg (MB) and $3,965 \pm 328$ kg (PH) in first lactation, $5,024 \pm 360$ kg (MB) and $4,660 \pm 420$ kg (PH) in 2nd lactation, $5,700 \pm 530$ kg (MB) and $5,180 \pm 400$ kg (PH) in the 3rd lactation. The comparison of TB and TP between the PH and MB revealed that TB was 4, 65% vs 4,42% and TP 3,48% vs 3,22 %. At the peak of lactation, the values varied between 3,30-3,18 % (TB) and 2,94-2,72 % (TP) vs 3,14-3,12 % (TB) and 2,86-2,54% (TP) respectively for PH and MB. At day 90 PP, increases were higher in TB than in TP. Thereby, the exaggerated loss of state related to food (including the absence of concentrated during the dry period) was detrimental to performance. Performance improvement depends on the breed, the age at introduction in rearing, the age at first calving, the quality of the feed and the control of reproduction.

Keywords: Ingestion, lactation, BCS, overfeeding, dry period, butyrous rate, protein level.



Potential Hazards of a Chitin Synthesis Inhibitor Diflubenzuron In the Shrimp *Penaeus kerathurus*: Biochemical Composition of the Hemolymph and Muscle during the Molt Cycle

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Abstract

Dimilin (25% wettable powder) is a trade formulation of diflubenzuron an insect growth regulator inhibiting chitin synthesis. This insecticide is widely used in Algeria against the forest pest insects. *Penaeus kerathurus* (Forsk., 1775) (Crustacea, Decapoda) is abundant in the Bay of Annaba and an economically important species for the local fishery industry. The aim of the present study is to investigate the toxic impact of dimilin on the changes of main biochemical constituents (Proteins, lipids, carbohydrates) during a moult cycle in this non-target organism, *P. kerathurus* a highly valued commercial species fished principally in the Annaba Bay. The compound was added to the rearing seawater at a final concentration of 1 µg active ingredient/L. The selected biochemical constituents were measured in the hemolymph and muscle of *P. kerathurus* adults during a moulting cycle. In control individuals, level changes of all constituents present a similar profile with a peak at stage C. The data obtained give information on the nutritive value of the tested shrimp as evidenced by the determination of the main constituents (proteins, lipids, carbohydrates) of the flesh and the selected biochemical constituents. This insecticide can pose side-effects on this shrimp species.

Keywords: Crustacea, *Penaeus kerathurus*, Pesticides, chitin synthesis inhibitor, Dimilin, Biochemistry



Life history and silvering process of European eel *Anguilla anguilla* of the lake Oubeïra (NE, Algeria)

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Abstract

The European eel *Anguilla anguilla*, recently considered “outside safe biological limits” and has become red-listed as “Critically Endangered species”. The lack of data on the growth of the European eel of South Mediterranean perimeter -in particular Algeria- pushed us to realize this work that includes: growth, age and diet of eels populating Oubeïra Lake.

The work was carried out over a period of 7 years; (November 2010-May 2016; N=722). Eels and their horizontal and vertical diameters of the right and left eyes, length of pectoral fin, gonads, empty gut and liver are measured and weighed. After dissection of the fish, the digestive tracts were open and the prey identified. Finally, age was estimated by otolithometry and the results were treated by FiSAT II (FAO) Software.

Our results highlights that 95% were females (of which more than half were silvered), they exhibited an extremely fast rate of growth and the silvering transition occurs at a very young age (5 ± 0.87 years). The relationship between the size and the weight revealed a majorant allometry ($Wt = 1E-07Lt^{3.3973}$) and finally, a positive correlation was noted between: GSI-size ($R^2=60\%$), GSI-weight ($R^2=60\%$), and negative between GIs-weight, GIs-size and GIs-age of eels ($R^2 > 50$).

The study of the diet of European eel fished in the lake Oubeïra, shows that this fish presents a preference for the preys of animal origin (fish and shellfish).

Keywords: *Anguilla anguilla*, growth, life history, diet, Oubeïra, Algeria.



Antibacterial activity of the essential oils from *Salvia officinalis* L., *Melissa officinalis* L. and *Origanum vulgare* used in traditional medicine of Algeria

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Abstract

Salvia officinalis, *Melissa officinalis* and *Origanum vulgare* are aromatic plants used in traditional medicine of Algeria. In order to demonstrate their value as a source of bioactive natural substances, we evaluated their antibacterial activity. The method we have advocated is that of the aromatogram. We first extracted the essential oil from the flower stems and dried leaves. This operation is carried out using a standard apparatus used for the extraction of essential oils. Thin layer chromatography has shown us the chemical screening of the plant. Indeed, it appears the major chemical components which are carvacrol and thymol. To mount the aromatogram, we used pathogens resistant to many antibiotics: *E. faecalis*, *S.aureus*, *E. coli*, *K. pneumoniae*, *E. cloacea*, *S. spp*, *A. baumannii*, *P. aeruginosa*, *C. freundii*. The results of the aromatogram indicate that the crude essential oil of these species as well as their different degrees of dilution show a significant bacteriostatic activity on the selected strains. Indeed, all these strains are very sensitive to the crude essential oil have a variable sensitivity depending on the different degrees of dilution. Significant zones of inhibition are observed with diameters up to 50 mm. According to these results we can conclude that the pathogens we selected are sensitive to the essential oils of both species, whether raw or diluted. The three plants, with are a valuable source of bioactive natural substances that could be a solution for certain infectious pathogens, especially those caused by multidrug-resistant germs that are resistant to different antibiotics.

Keywords: Essential oil, antibacterial activity, aromatic plants, pathogenic germs, multidrug-resistant, aromatogram



Relationship Among Supplementary Irrigation and some Morpho-Agronomic traits in Durum Wheat (*Triticum durum* DESF) assessed under stressed and irrigated conditions

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Abstract

The present study was carried on the experimental site of ITGC (Technical Institute of Field Crops) station of Setif, Algeria. The objective of this study is to compare diverse genotypes under drought stress, and to detect the effect of drought stress on yield and morpho-agronomic traits of durum wheat genotypes. Ten durum wheat cultivars were evaluated under both moisture stress and non-stress field environments using a randomized complete block design for each of the environment. Morphological traits were measured at anthesis and yield, yield components traits were evaluated at ripening time.

The results of this investigation exhibited large variation for agronomic and morphological traits among varieties. The number of spike m², 1000-kernel weight, plant height, grain yield and peduncle length were highly significant ($P < 0.01$) affected by water deficit conditions and genotype effects. Chlorophyll content, number of grains per meter square and thousand kernel weights were positively associated with grain yield under drought conditions. The varieties Waha, Sooty, Dukem and Hoggar showed high yield ($GY \geq 60$ Qx/ha).

Keywords: Durum wheat, water stress, irrigation, grain yield, yield components, morphological traits



Quality of camel milk collected in the wilaya of Sétif

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Abstract

Camel milk is undoubtedly of particular interest to nomads and people in the south, because it is perfectly in line with the requirements of man because of its high content of basic nutrients (proteins, lipids, lactose), vitamin C and niacin. While in our region (Setif) its use is more medicinal and therapeutic than nutritional.

The present study aims to determine the physicochemical, biochemical and microbiological quality of camel milk. The work involved analyzing 30 samples of camel milk marketed in the wilaya of Sétif.

The physicochemical analyzes of the samples show that the pH (6.39 ± 0.45); Density (1.030 ± 0.0019); conductivity (9.74 ± 2.13) and freezing point (-0.621 ± 0.03) are acceptable. On the other hand, the titratable acidity of the milk (26.61 ± 7.83 ° D) exceeds the estimated standards.

Microbiological analyzes show that the sold camel milk has an unacceptable microbial quality; whose microbial load of total aerobic mesophilic flora is 6.45.106 CFU / ml, that of fecal coliforms is 5.08.105 CFU / ml, and total coliforms with a microbial load of 1.1×10^6 CFU / ml, then pathogenic germs (faecal streptococci) are absent. Milk quality parameters are very variable. The physicochemical composition of the milks can be qualified as average for the majority of the samples. Hygienic quality is poor for all milk samples.

Keywords: Milk, camel, physicochemical and hygienic quality, Setif



Biodiversity of Patellidae (Gastropoda, Prosobranchia) in Jijel at northeastern coast of Algeria

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Abstract

This work is part of the search for indicators related to disruption of ecosystems and benthic structures this problem is currently in full expansion. A sampling of limpets was conducted in the spring of 2019 at two sites on the Jijel coasts. The collection of specimens was carried out with a knife on a quadra of 1 m², with 3 catches per station. In fact, the qualitative study of Patellidae's family in Jijel, reveals the existence of four species: *Patella caerulea*; *P. rustica*; *P. ulyssiponensis*, and *Cymbula safiana* at Beni Belaid Station. Nevertheless, at Zaway Rabta we found only two species: *Patella caerulea* and *P. rustica*. The station of Beni Belaid confirms its special status of reference station with the highest density values with 92 ± 4 compared to the Zaway Rabta station (64 ± 8). We recorded a predominance of *Patella caerulea* in the resort of Beni Belaid (65, 26 %) and a strong presence in Rabta Zaway station with a rate of 40%.

Keywords: Inventory, Patellidae, density, dominance, Jijel East-Algerian coast.



Response of two biomarkers of environmental stress in a freshwater fish *Gambusia affinis* in the region of Annaba and EL teref (Algeria)

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Abstract

Contamination of the terrestrial and aquatic environments in particular by toxic substances is a growing source of ecological, socio-economic and health problems. Often due to agricultural activity, plant protection products enter the aquatic environment through leaching, causing deterioration of water quality and contamination of species such as fish. Many organisms are used as an indicator of freshwater quality. Among them, *Gambusia affinis* was chosen as the biological model for our study because of its position in aquatic ecosystems, abundance values in the study region and relevance for toxicity testing. It was first introduced into Algeria in 1928 as part of the biological control of *Anopheles* larvae responsible for malaria.

The objective of this study is to evaluate the impact of pollution on the response of two biomarkers of environmental stress, glutathione S-transferase in the liver and acetylcholinesterase in the brain of a non-targeted organism *Gambusia affinis* collected during the reproduction period at three sites with different levels of exposure to polluting sources: Sidi Brahim and El Karma polluted sites compared to Oued Messida. The results show a significant variation in biomarker activity, including a very highly significant ($p < 0.0001$) increase in GST activity that reveals GST induction and a very highly significant reduction ($p < 0.0001$) in acetylcholinesterase activity observed in adult male and female individuals of Sidi Brahim compared to individuals of El Karma and Oued Messida. The sum of the results obtained concerning the response of biomarkers in *Gambusia affinis* suggests that the Sidi Brahim site is affected by significant pollution compared to those of El Karma and Oued Messida.

Keywords: Pollution, *Gambusia affinis*, Biomarkers, Glutathione S-transferase, Acetylcholinesterase



Sub chronic effect of nano-silver (AgNPs) on reproduction of zebrafish (*Danio rerio*)

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Abstract

The field of nanoparticles (NPs) and nanotechnology is a growing research niche. Among these NPs, nano-Silver (AgNPs) applied in several fields such as Medical, Cosmetics and Food. The food industry is hiding it as a food additive in the dyestuff category (SIN174). However, the question of the danger that these NPs may have on the health of consumers remains unanswered until now. From this observation, our goal is to evaluate the toxicological impact of AgNPs on adult *Danio rerio*. Nano-silver is added to fish feed at 3 concentrations: 0.0005g / 10g feed (lot2), 0.05g / 10g (lot3) and 0.5g / 10g (lot4) with a control lot (lot1). Each lot is repeated 3 times and the treatment lasted 21 days at 2rations per day. The results of our experiment reveal a significant correlation between the concentration of nano-silver and the number of eggs laid; the higher the concentration, the lower the number of eggs laid. In addition, chronic exposure to AgNPs significantly influenced egg fecundity; more than the duration of the treatment is prolonged, the number of fertilized eggs decreases and that of the unfertilized eggs increases. In light of these results, the nano-silver incorporated into the human diet constitutes a potential danger to public health. It is recommended to the authorities more vigilance compared to the ingredients used by the manufacturers. Thus, a rigorous, effective and applicable regulation is necessary in order to minimize the risk related to these nanoparticles.

Keywords: Sub chronic effect, nano-silver, reproduction, zebrafish.



National park of Babors North East of Algeria (Characteristic and reservation)

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Abstract

The Babors forest is situated in the central part of North Algeria. It is dominated by *Cedrus atlantica* and several endemic species like an Insect *Macrothorax morbillosus*, a bird *Sitta ledanti*, fungus *Tricholoma calligatum*, tree *Abies numidica*. However, this biodiversity is experiencing considerable pressure besides the vulnerability that characterizes the forest. However; this biodiversity is experiencing considerable pressure besides the vulnerability that characterizes the Mediterranean forest. We see several factors degradation. In our present study we will enumerate major human actions unfavorable to the forest such as fires (we give the burned area), the amount of cedar resins extraction. The species affected by illegal logging. Different factors of pollution (air acidification due to sulfur and acidification due to the phytochemical pollution). In this study we propose also solutions like phytoremediation and biological fight.

Keywords: Forest, Babors, Endemic, Pollution



Securing the production of durum wheat (*Triticum durum* Desf.) by supplementary irrigation in the semi-arid zone (south of setif province, Algeria): case of the bousselem variety

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Abstract

The study was conducted on the experimental site of the SAGRODEV pilot farm in Sétif province during the 2012/2013 farming season. To quantify the beneficial effects of supplemental irrigation made at different phenological phases on the yield components of durum wheat (*Triticum durum* Desf.) Variety Boussalam. Study was conducted under water restriction conditions. Two different field trials were employed. The first treatment led to maximal evapotranspiration (ETM) during the entire vegetative cycle and the second led to rainwater (PL). In the first trial, 4 water-restricted treatments were conducted, where we simulated precipitation with water supplies in the form of supplementary irrigations to bring the soil back to its holding capacity at the beginning of each of 4 phenological phases of the development period corresponding to the phases (Germination-Tillage), (heading-heading) and (flowering-filling of the grain) according to the contributions (respectively 15mm, 30mm, 30mm, 20mm). The results show that supplementary irrigation significantly improves the number of plants / m² (NP / m²), number of ears / m² (NE / m²), thousand grain weight (PMG), grain yield (Rdtg) and stem height (HT), number of grains per ear (Ng / ear), grain yield (Rdtg) and straw yield (Rdtpai). These results show the productivity potential of the Boussalam variety, expressed under the supplementary irrigation which constitutes a factor of improvement of the yield.

Keywords: *Triticum durum* Desf.) Variety Boussalam, supplemental irrigation, water restrictions, the yield, improvement



Impact of an insecticide/acaricide Oberon (Spiromesifen) on lipids, malondialdehyde and fatty acids composition in snail *Cornu aspersum* used as bioindicator species of soil pollution

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Abstract

The massive use of pesticides has resulted in chronic contamination of all compartments of the ecosystem, whether aquatic, atmospheric and terrestrial, resulting in toxic impacts on non-target organisms. In this context, we evaluated the effect of an insecticide/acaricide belonging to a new class of pesticides of the Ketoenol family, Oberon® 240 (active ingredient Spiromesifen) on a non-target species used as bioindicator species of soil contamination, the snail *Cornu aspersum* (Mollusk, Gastropod). Oberon was administered at two lethal concentrations (LC₅₀) of 5 and 10 µg/ml at 96 hours, used against whiteflies. After topical treatment, a qualitative and quantitative analysis of hepatopancreas fatty acids was performed by gas chromatography (GC). In addition, the effect of this insecticide/acaricide was evaluated on lipid and malondialdehyde (MDA) rates in the same organ. The results obtained revealed a profile of sixteen (16) fatty acids of which three (03) are saturated, four (04) monounsaturated and nine (09) polyunsaturated. Comparison of lipid and fatty acid levels in individuals of *C. aspersum* showed a decrease of total lipids and four fatty acids C16:1 (palmitoleic acid), C20:1 (gadoleic acid), C20:4n-6 (arachidonic acid) and C22:4n-6 (adrenic acid) in snails treated at the two concentrations 5 and 10 µg/ml compared to controls. Moreover, an increase in MDA rates was observed in snails treated at both concentrations compared to controls translating a lipid peroxidation. These results confirm the specific mode of action of Spiromesifen, which is the inhibition of lipid biosynthesis. Furthermore, this study reveal the negative impact of this insecticide on non-target species. Thus, *C. aspersum* can be used as suitable bioindicator species of soil pollution.

Keywords: *Cornu aspersum*, Oberon, Fatty Acids, Lipids, Malondialdehyde, Contamination.



Environmental risk of a neonicotinoid insecticide: chronic growth toxicity in *Gambusia affinis*

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Abstract

Since their discovery as a new class of insecticide in the 1990s, neonicotinoids have become widely used in the world of culture, these synaptic nicotinic acetylcholine receptor agonists cause nerve cell stimulation, paralysis and insect death. The use of these insecticides has resulted in unintentional contamination of aquatic environments, posing a risk to non-target aquatic species. In this study we have highlighted the effect of one of the most widely used insecticides in agriculture against crop-biting and sucking pests: Actara (25% active ingredient "Thiamethoxam") for a non-target species during both periods of its life cycle. *Gambusia affinis* (Baird & Girard, 1853), a freshwater Culiçiphage fish introduced into Algeria as part of the biological control of mosquito larvae of medical and environmental interest. Female adults were collected and acclimatized for at least 15 days before exposure. The assays were conducted in 50-liter glass aquaria (60 × 30 × 30 cm) with continuous aerated dechlorinated water and under laboratory conditions (Temperature 16.33±0.66 °C, pH 7.66±0.53, Dissolved Oxygen 14.52±6.65 %, Salinity 0.223 ± 0.004 psu). Growth (total height, total weight) and condition factor were examined during the reproduction and resting period of the species during a 28-day exposure period at different concentrations of 10 mg. L⁻¹, 20 mg. L⁻¹ and 40 mg. L⁻¹. Exposure to the insecticide has no effect on the growth of female *G. affinis*, but a significant effect has been recorded for the condition factor. In the future, the risks of this insecticide to non-target aquatic species should be assessed through other biochemical parameters (acetylcholinesterase) and reproductive parameters (vitellogenes).

Keywords: *Gambusia affinis*, Neonicotinoid, Actara, Growth, Condition Factor, Toxicity.



Characteristics of the fouling communities from the south-eastern Adriatic Sea (Boka Kotorska Bay, Montenegro)

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Abstract

Paper presents results of long term research of fouling communities from the Boka Kotorska Bay (Montenegro). As study points we have chosen one marina and equipments from three different aquaculture sites in the Bay. Among identified species as very abundant was alien species. During this study species *Paraleucilla magna*, *Styela plicata*, *Pinctada imbricata radiata* are for first time recorded for the Montenegro.

Keywords: Fouling communities, alien species, south-eastern Adriatic Sea, Montenegro



Evaluation of the impact of infestation by a lepidopteran pest stored commodities *Ephestia kuehniella* on the quality of flour by control of physicochemical analyzes.

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Abstract

According to the Food and Agriculture Organization of the United Nations (FAO), the global population, of 6.13 billion in 2001, will be able to reach, by 2025, a figure of 8.50 billion. The population increase will therefore require an additional agricultural production of 24.10 tons / year. This forecast, strictly dependent on the improvement of crop productivity, can only be achieved by appropriate control of biotic agents. Crop losses, estimated on average at 40% of potential production, are due mainly to pests. Pests, considered to be one of the major problems in agriculture, can also be vectors of pathogens and pose a threat to animals including humans. Therefore, the purpose of this study is to evaluate the impact of these pests on the quality of the flour. Precisely the study of the infestations of a pest insect of stored food (*E. kuehniella*) on the quality of the flour.

The results obtained show an alteration in the quality of the flour which results in a highly significant reduction of proteins and Gluten content as well as a significant increase in the Zeleny sedimentation index. Regarding humidity, there was a significant increase in water content, a significant decrease in absorption. There was an increase in particle size and ash content. Through the various tests carried out in this study and in the light of the results obtained, the infestation of flour by these pests induces a sharp degradation of the quality of the flour by making these nutritive values out of the ordinary.

Keywords: Stored food pests, *Ephestia kuehniella*, flour quality, physicochemical analysis.



Taxonomic structure of nematode communities in agroecosystems of Khulo (Ajara, Georgia)

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Abstract

Potatoes is the fourth important food crop worldwide after maize, wheat, and rice and are grown in more than 100 countries worldwide under temperate, subtropical and tropical conditions, however, they are considered as cool temperature crop. Potatoes are good source of carbohydrate, vitamin C, potassium, phosphorus, and magnesium along with dietary antioxidants.

Potato crops are severely affected by approximately forty soil borne diseases worldwide including those caused by soil inhabiting fungi, bacteria and nematodes. Plant-parasitic nematodes are among the important pests of potato production, they can cause serious yield losses but remain unnoticed, in most cases. Above ground symptoms of nematode damage are rarely observed since most nematodes cause damage on roots and tubers.

Potato growing has always been the subject of great importance for settlement of food supply problems in Georgia.

The aim of this study was to determine the prevalence of plant parasitic nematodes in Khulo, which are largest potato growing area in Ajara. Such researches are conducted for the first time in this territory.

Four agroecosystems were selected, each of 5a. The 3 composite samples collected from each field (weighing 300-500g) consisted of 50 individual sub-samples of soil and roots.

During the research process in the studied ecosystems there were registered 60 forms of free-living and phyto-parasitic nematodes, from which 37 forms are determined as species. The registered nematodes belong to 2 subclasses, 7 orders (*Enoplida*, *Areolaimida*, *Dorylaimida*, *Mononchida*, *Rhabditida*, *Tylenchida*, *Aphelenchida*) 31 genus and 13 families. The largest abundance of nematodes was observed in village Okropiridzebi (N41.3856; E42.827) – 115 specimens/ 50g soil and the smallest was in Dekanashvilebi (N41.3906, E42.1757) - 37 specimens/50g.

Plant-parasitic nematodes from 6 genera (*Helicotylenchus*, *Xiphinema*, *Ditylenchus*, *Tylenchorinchus*, *Tylenchus* and *Aphelenchus*) were found in soil and (or) potato root samples. *Ditylenchus destructor* was the most prevalent and abundant. The highest rate of its number 41% is established in village Okropiridzebi (sites I) and the lowest 19% in village Uchkho. The results of this survey revealed the significant prevalence of plant parasitic nematodes in Khulo potato growing areas. It is necessary to give more attention to agrotechnical actions, reducing danger of infection of a potato.

Keywords: Plant parasitic, Nematoda, *Ditylenchus destructor*, Taxonomy, Ajara, Georgia



Impact of insecticide mixtures on the glutathione S-transferase and catalase activities in the land snail *Helix aspersa*

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Abstract

The pollution caused by agricultural and industrial activities generally leads to a decrease in biodiversity, a trivialization of the environment, and even the destruction of certain links in terrestrial and aquatic ecosystems. Thus, in this context, we estimated by an experimental study the effect of mixtures of two insecticides on the terrestrial gastropod *Helix aspersa aspersa* (syn. *Cantareus aspersus* or *Cornu aspersum* O.F. Müller, 1774). The first is thiamethoxam (included in the neonicotinoid chemical family) used as a commercial preparation (25 g of thiamethoxam in 100 g of insecticide), and the second is tefluthrin (included in the pyrethroid chemical family). This insecticide is also used as a commercial preparation (1.5 g of tefluthrin in 100 g of insecticide). They are widely used in the Algerian North-East region. The concentration of the selected mixtures are lower or equal to the concentrations that are applied in field. In this work, adult snails were used to estimate the effect of four mixtures of thiamethoxam and tefluthrin on hepatopancreatic glutathione S-transferase (GST) and catalase (Cat) activities, which are biotransformation enzymes involved in xenobiotic detoxification. The impact of these mixtures was assessed on the snail after six weeks of exposure by ingestion and contact to fresh lettuce leaves soaked in these mixtures. Then, enzyme activities were measured by spectrophotometric methods. Significant inductions of GST and Cat activities were observed in snails treated with all mixtures compared to control snails. These variations in activity are related to the duration of exposure, the concentration and the nature of the mixtures tested.

Keywords: *Helix aspersa*, Insecticide, Mixtures, Thiamethoxam, Tefluthrin, Hepatopancreas, Glutathione S-transferase, Catalase.



Evaluation of the biocidal potential of aqueous leaf extracts from two endemic species of Brassicaceae

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Abstract

Pesticides have been widely used for several decades, leading to their spread in all environmental media and long-term persistence in some cases. Numerous data attest to their presence in human biological fluids, even after their prohibition. They are implicated in several cancerous pathologies, neurological diseases and reproductive disorders. They can also have a negative effect on biodiversity by affecting wildlife and reducing species diversity. In addition, the intensive use of pesticides leads to the resistance and selection of new insect or weed individuals. This example has led us to a return to nature and its untapped resources to find new solutions to these problems. In this context, we have contributed to the study of the allelopathic potential of different aqueous leaf extracts of two species of the Brassicaceae family *Brassica fruticosa* and *Brassica proconbens* resulting from a screening of endemic plants in Algeria. The allelopathic activity was evaluated by a test to detect the existence of inhibitory or stimulating effects of three aqueous extracts of each of the two plants on the growth of local carrot foliage. We found that the infusion of *B. fruticosa* and the infusion of *B. proconbens* had an immediate allelopathic effect. The target plants die after three days, and even after regeneration with ordinary water, this proves that the hydrophilic molecules of these aqueous extracts play a role as bio-herbicides. However, the other preparations showed a delayed effect. The target plants remained intact for more than one week and the growth inhibitory effect appeared during the second week compared to the control. Thus, these aqueous extracts of the two plants must be studied using other target plants to precisely verify allelopathic activity through the production of chemical molecules released into the environment. These metabolites are, today, one of the levers of a possible ecological intensification of agriculture, by substituting the use of chemical compounds by natural defense mechanisms of plants.

Keywords: Allelopathic potential, Aqueous leaf extracts, *Brassica fruticosa*, *Brassica proconbens* Natural defense, Bio-herbicides, Algeria



Biological activity of Plants for Protecting Stored products from Mediterranean Flour Moth *Ephestia kuehniella* infestation

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Abstract

Due to the significant losses caused by harmful insects in stored foodstuffs and environmental and health problems related to the use of synthetic pesticides, which are alarming, the application of plant extracts is our main scientific concern. The Mediterranean flour moth *Ephestia kuehniella* Zeller (Lepidoptera: Pyralidae) is a worldwide pest of many stored products of grains, nuts, dried fruits, legumes, dates, cocoa beans and other stored food. In Algeria, this pest is also known as mill moth and is considered a major pest particularly of stored grains. Aqueous extracts of *Ocimum basilicum* and *Rosmarinus officinalis* were administered *in vivo* by topical application with a quantity of 2 µl to newly exuviated pupae of *E. kuehniella*. The toxic effects of the plants are examined on mortality rates and on several biochemical parameters during metamorphosis and adults. *Rosmarinus officinalis* is the best plant that has shown good contact insecticidal activity against *E. kuehniella* as compared to *Ocimum basilicum* and showed a slight decrease in pupal body weight. All extracts showed a reduced significantly the body lipid content in pupae and adult treated at any age. They also caused a reduction in carbohydrate content and body protein but relatively less marked than fat. This work shows that the extracts of tested cause a disruption in the development process of *E. kuehniella*.

Keywords: Aqueous Extracts, *Ocimum Basilicum*, *Rosmarinus Officinalis*, Toxicology, Development, *Ephestia kuehniella*



Insect control with alternatives to conventional Pesticides: Evaluation of the juvenile hormone analogue against stored product pests

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Abstract

The side effects of conventional insecticides (neurotoxic) and environmental requirements (preservation of human and animal health) have encouraged the search for alternative methods of pests and vectors control. Chemical control is the major means of controlling these pests. However, it is increasingly using selective molecules and high metabolic and environmental stabilities. These molecules are insect growth regulators (IGRs) renamed IGDs (Insect growth disruptors) or growth disruptors. These molecules are insect growth regulators (IGRs) renamed IGDs (Insect growth disruptors) or growth disruptors. In this context we have proposed to study the impact of kinoprene, a juvenile hormone analogue, on the thickness and biochemical composition of the nymphal cuticle in *Ephestia kuehniella* Zeller, insect pest of stored products all over the world (Lepidoptera: Pyralidae). The product was dissolved in acetone and topically administered to the newly exuviated female pupae at two lethal doses. Histological study conducted, indicates histopathological changes in integuments, and the recorded results show that the product causes the increase in the thickness of the nymphal cuticle (old cuticle) at different ages (5, 7, 9 days). In addition, it increases the thickness of the new cuticle with the highest dose. Moreover, the biochemical assays carried out on the chemical composition of the nymphal cuticle by a gravimetric method, shows that the kinoprene causes an increase in the levels of the chitin at the 3rd, 5th, 7th and 9th days, as well as cuticular protein levels in older pupae 7 days with LD90.

Keywords: IGRs, *Ephestia kuehniella*, Cuticle, Chitin, Proteins.



Larval Helminths in *Helix lucorum* Linnaeus, 1758 in Some Regions of Georgia

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Abstract

Terrestrial molluscs as intermediate hosts have the important roles in spreading parasitic diseases in the natural and agroecosystems. The aim of this research was to investigate and determine the role of terrestrial mollusc *Helix lucorum* Linnaeus, 1758 as intermediate hosts of helminths in some regions of Georgia. This issue is studied less in Georgia. Only one paper was published in the last last years (L. Murvanidze et al., 2010) where is reviewed the role of terrestrial molluscs in spreading of trematodiasis in urban environment. Our investigation were provided in spring and autumn of 2013-2018 on the various regions of Georgia - Imereti, Adjara (West Georgia), Kakheti, Qvemo Qartli, Tbilisi (East Georgia). Total 764 samples of land snails *H. lucorum* were collected and examined. The study of the parasites was carried out on live objects with temporary preparation. Research showed that 113 samples of molluscs (14, 79%) were invaded by larval forms of trematodes and nematodes. There has been underlined invasion with larval forms of trematodes (cercariae and metacercariae) family Brachylaimidae in 4 researched region. Larval forms of nematodes were registered in Imereti and Tbilisi regions. In West Georgia - Imereti, which is characterized with subtropical, humid, damp climate, *H. lucorum* were invaded much more by nematodes (31.8%). Whereas in the dry, moderate climate conditions of Eastern Georgia, particularly in the area of Tbilisi, high percent of invasion of trematodes was distinguished (38,15%). There was a simultaneous invasion of both parasites in the same regions. Our research brought to light that terrestrial mollusk *H. lucorum* play the significant role in the spreading of trematodiasis and nematodiasis in some regions of Georgia particularly in the area of Imereti and Tbilisi.

Keywords: Parasite, Intermediate host, Trematoda, Nematoda, Georgia



Biochemical modification and rate of acetylcholinesterase in an edible mollusc (*Donax trunculus*) during transplantation into a polluted environment

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Abstract

The city of Annaba is a bay opened to an industrial and tourist vocation which activities constitute a serious threat to the quality of coastal water and increase the risk of oxidative stress among marine organisms. The Gulf of Annaba has been the subject of many investigations using a sentinel species *Donax trunculus*, an edible bivalve mollusc widely used in biomonitoring programs. In addition, metal contamination is prevalent. The objective of this study, in continuity with previous works, is to evaluate the responses of *D. trunculus* transplanted from a reference site (El Battah) to a polluted site (Sidi Salem) for a period of 21 days. Biochemical analyses (lipids, carbohydrates) as well as the specific activity of acetylcholinesterase (AChE) carried out on the mantle collected at different times during transplantation (0, 7, 14 and 21 days) indicate that at 0 days individuals from El Battah have higher lipid levels than those from Sidi Salem. However, no significant differences between the two sites ($p = 0.9516$) were observed after 14 days of transplantation. Concerning carbohydrate levels, Sidi Salem individuals have lower rates at 0 days and do not differ significantly over time, but from 21 days the rates between the two sites are comparable ($p > 0.05$). At 0 days, acetylcholinesterase activities of Sidi Salem individuals are significantly inhibited ($p < 0.0001$) compared to those of El Battah but from 14 days there is no significant difference between the two sites ($p = 0.7022$). Two way ANOVA reveals that time, site and time/site interaction effect lipid and carbohydrate levels as well as AChE activity, significantly. The environment contaminated mainly by heavy metals causes neurotoxicity and affects the nutritional quality of this mollusc.

Keywords: Gulf of Annaba, Contamination, Transplantation, *Donax trunculus*, Lipids, Carbohydrates, AChE.



Impact of physico-chemical soil parameters on biodiversity of terrestrial pulmonate gastropods, growth of *Cornu aspersum* and their relationship to the pollution in the northeast of Algeria

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Abstract

Terrestrial pulmonate gastropods, slugs and snails, are herbivores and detritivores species living in interface with soil, plant and air, so of being in direct contact with different ecosystems and have the capacity to accumulate several classes of pollutants. This study aims to evaluate the impact of some physico-chemical soil parameters (pH, electrical conductivity, porosity, carbon content, organic matter, hygroscopic humidity, total limestone, active limestone, phosphorus) on the biodiversity of terrestrial pulmonate gastropods and growth of snail *Cornu aspersum* and their relationship to pollution. Soil and species sampling was carried out seasonally in 2016 at four sites located in the extreme northeast of Algeria and selected according to their level of exposure to pollution. The site of El Hadjar, exposed to industrial pollution; El Tarf and Bouteldja, sites subject to urban and agricultural wastes; and finally El Kala, unpolluted site. The results of physico-chemical parameters reveal that the site of El Kala present a best quality soil, rich in limestone, organic matter and poor in phosphorus compared to the other sites considered polluted. Regarding biodiversity, we have observed a variation of spatial and temporal distribution, we listed twelve (12) species in El Kala, eleven (11) in El Tarf, ten (10) in Bouteldja and only nine (09) species in El Hadjar. A dominance of snails *C. aspersum* and *Cantareus apertus*, in all study sites was recorded with a total of 19.16% and 13.66% respectively. Growth results of *C. aspersum* revealed that El Kala individuals are bigger in size and weight than those of the other sites especially of El Hadjar site. In addition, a season effect was observed in winter and autumn compared to other seasons. Our results of biodiversity and growth are related to the nature of soil and the levels of the contamination of these sites. Furthermore, this study shows that *C. aspersum* and *C. apertus* are a good models used for biomonitoring studies of soil quality in northeast of Algeria.

Keywords: Pilmonate gastropods, Biodiversity, Growth, Soil, Pollution, Algeria.



Growth, condition index and biochemical composition of gonads in *Donax trunculus* (Mollusk, Bivalve) used as bioindicator species in biomonitoring of Annaba Gulf (Algeria)

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Abstract

The city of Annaba is one of the most important tourist and economic areas of the east coast of Algeria. A wide range of urban, agricultural, harbour and industrial contaminants are released in the Gulf of Annaba. This contamination affects a wide variety of aquatic organisms including the Bivalve Mollusk, *Donax trunculus* (Linnaeus, 1758). In this context, we determined the impact of pollution on growth, condition index and biochemical composition (proteins, lipids, carbohydrates) of the gonads of males and females of *D. trunculus*. The samples were collected during the four seasons of 2016, at three sites located in the Gulf of Annaba; Sidi Salem, site subject to industrial pollution; Echatt, under the influence of urban and agricultural wastes; and El Battah, a site far from any source of pollution. Results showed that growth was better in El Battah individuals compared to those of Echatt and Sidi Salem. In addition, seasonal effect of condition index was observed in individuals of the three sites. The biochemical content of the gonads showed a decrease of proteins, lipids and carbohydrates in Echatt and Sidi Salem as compared to El Battah. Furthermore, a seasonal effect was observed with higher biochemical contents in spring corresponding to beginning of reproduction season. The comparison between the two sexes revealed that females accumulate more metabolic reserves and mobilize more energy than males during the reproductive process. The results obtained are related to the level of exposure of the sites to the different sources of pollution. Thus, *D. trunculus* can be used as a suitable bioindicator species of pollution in the gulf of Annaba.

Keywords: *Donax trunculus*, Growth, Condition index, Metabolic reserves, Gulf of Annaba, Pollution.



Inventory and distribution of annelidian fauna in the Algerian east coast

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Abstract

Among the marine invertebrates, the most abundant taxon in the benthic communities in terms of numerical wealth and biodiversity is that of the Polychaete Annelidae. The purpose of this work is to compare the abundance and distribution of different species of polychaete annelids in general and Nereidae particularly at different study sites: EL-Kala, Annaba and Skikda.

After the establishment of an inventory according to the taxonomic classification criteria, a morphometric analysis after each harvest was carried out. This study allowed the identification of several species of annelids (*Nereis falsa*, *Platynereis dumerillii*, *Perinereis marionii*, *Lepidonotus clava*, *Nereis diversicolor* ...) at these different study sites, while pointing out that some species are very specific to others.

The variations in the distribution of certain species in certain sites are related to certain external factors (temperature, salinity, pH and dissolved O₂) as well as the reproduction period and testifying above all to the direct impact of the pollution of certain sites on the abundance of Polychaete Annelidae as well as the biodiversity of benthic species in the Algerian east coast.

Keywords: Inventory, Biodiversity, Polychaete annelids, Nereidae, Algeria.



Impact of marine pollution on the reproduction of two species of Polychaete Annelidae in the East Coast of Algeria

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Abstract

The present work consists in estimating the state of health or at least the level of contamination of the Algerian east coast, at the Skikda and Collo coasts, through the evaluation of certain parameters related to the reproduction of two species of Polychaete annelids: *Perinereis cultrifera* and *Perinereis macropus*, bioindicators, sampled from different stations, namely: Ben Zouit and Tamanart in Collo considered a healthy site, far from any source of industrial pollution, and Ilot and Bikini in Skikda site affected by industrial pollution; since the 1970s it has become a major industrial center of international importance, with several ports, in addition to the largest petrochemical complex in North Africa; however, these facilities located on the coastline discharge discharges of its various activities, polluting the air, water, and soil, resulting in deleterious effects on the health of these ecosystems.

Length L3 and fresh weight in both species highlight the evolution of the allometric growth process, as well as the characteristic changes in epitokia in *P. macropus* with a lower size (L3 and fresh weight) than *P. cultrifera*. In addition, these biometric data confirm the much slower effect of pollution on growth in *P. cultrifera* individuals from the two Skikda stations. The biometric study in both species of oocyte growth shows a similar evolution with the other Nereididae species registering the maximum values during the reproduction period, the oocyte development shows an asynchronous aspect, where the diameter oocytes in *P. cultrifera* are higher than those in *P. macropus*, whereas *P. cultrifera* breeds in the atoque form during the months of April to June (Collo), and during the months of May to June (Skikda). On the other hand, the effect of anthropogenic pressure at the two stations of Skikda is emphasized on the oocyte diameter in females of *P. cultrifera* relatively lower than the females harvested from the two Collo stations, likely to be related to lower levels of accumulation of energy reserves in females of Skikda. The structural and biometric study of the immune cells of coelomic fluid in *P. cultrifera*, allowed us to identify three types of coelomocytes which are granulocytes, semigranulocytes, and hyalinocytes, with variability in the proportions of these three populations.

Keywords: Marine Pollution, Algerian East Coast, Polychaete Annelids, Reproduction, Immunity.



The distributional ranges of *Nereis falsa* in eastern coastline of Algeria

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Abstract

The Polychaetes are an important component of the fauna of the Mediterranean sea. For our work, permanent monthly surveys have been carried out since February 2019 at the three sites of eastern Algeria (EI-Kala, Annaba and Skikda) in order to harvest only individuals of *Nereis falsa* (Nereidae), a species of wandering Polychaete Annelida, it was found within Rhodophyceae, in algal-covered hard bottoms. The individuals occur low in the intertidal zone and extend down into the sublittoral; in consequence, the intertidal and shallow sublittoral hard bottoms were sampled methodically by scraping algae.

As it has been recorded morphometric differences as well as morpho-anatomical abnormalities from one site to another, and the absence of this species among the material collected previously at the same stations might suggest that it has recently become established in the area. A re-description of the species together with its ecological, reproductive, feeding and distributional aspects are provided.

Keywords: *Nereis falsa*, Taxonomic, Nereidae, eastern coastline of Algeria.



Studies on the benthic macroinvertebrate community from K'sob Wadi (M'Sila, Algeria)

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Abstract

The benthic macroinvertebrate community was investigated in K'sob Wadi which is a semi-permanent stream that flows into the Chott Hodna where three stations were chosen. The sampling was conducted between February and May 2016. The species were determined and the ecological indices were calculated (abundance, diversity and equitability). We observed similarity of the community structure between the three sample sites due to the constant type of habitats and the water depth.

Keywords: Diversity, macroinvertebrates, community structure, habitats, Chott Hodna.

Introduction

The aquatic insects perform several critical roles in ecosystem functioning by virtue of their numerical abundance, taxonomic diversity and trophic significance. Freshwater habitats from puddles to rivers and to lakes, including both lentic and lotic habitats, are home to a greater biodiversity of insect fauna (Abhijna et al., 2013). Benthic macroinvertebrates are known by being a good indicator of the health of aquatic ecosystems (Djamai et al., 2019).

Macroinvertebrates react quickly to a change in their environment, their presence, disappearance or decrease after a proven presence, and a significant change in their frequency show whether the state of the water is satisfactory or not.

The aim of this study is to characterize the species composition, abundance, and diversity of the assemblages of the benthic macroinvertebrate species living in K'Sob Wadi.

Material and Methods

The present study was conducted in the K'sob Wadi, located in a semiarid region of the Saharan Atlas National Park in the Hodna Basin geomorphologic area, northeastern Algeria (M'Sila province). The Mediterranean climate of the region is subject to the influence of the Sahara and is characterised by wet winters and dry summers. The rainy period extends from October to May, and the dry season usually extends until August (Mimeche et al., 2013).

We have chosen three stations (Fig.1). The sampling was conducted between February and May 2016; three samples were taken at each station using a Surber net sampler (0.3 mm mesh). The captured specimens were collected using a flexible entomological forceps, then stored in jars filled with 70% ethanol. At the place of sampling, labeling is essential; we mention the date of capture and the sampling station. Samples were taken back to the laboratory for sorting, determination and analysis. All specimens were identified down to species under a binocular loop using books, collections and keys in the laboratory.

Water temperature, dissolved oxygen, pH and conductivity were measured near the surface (0.5 m depth) at three points distributed throughout the study area (Table 1).

Table 1. Mean \pm SE (standard error), min and max of physico-chemical parameters per sampling site in K'sob Wadi (2016).

	T Eau (°C)	pH	CE (μ S/cm)	O ₂ (mg/l)
S1	12.48 \pm 2.19 (7.7-19.6)	8.45 \pm 0.15 (8.06-8.97)	1070.80 \pm 89.56 (822.00-1320.00)	7.68 \pm 0.35 (7.00-9.00)
S2	12.58 \pm 2.11 (7.9-18.4)	8.04 \pm 0.24 (7.47-8.83)	980.20 \pm 112.42 (701.00-1250.00)	7.76 \pm 0.31 (7.10-8.90)
S3	11.98 \pm 2.27 (6.5-17.9)	7.93 \pm 0.14 (7.6-8.36)	1070.00 \pm 58.30 (900.00-1250.00)	8.3 \pm 0.10 (7.90-8.30)

Data were analyzed using XLSTAT software (Version 2014.5.03) to evaluate the species abundance, species diversity and the differences in community composition and structure at each site. The indices used to examine macro-invertebrates community were: species richness (S), relative abundance (RA), Shannon diversity index (H'), Evenness(E). In order to assess differences in macroinvertebrate descriptors among sampling sites, we used one-way analyses of variance (ANOVA). These indices are useful for comparison between populations of three sites of K'Sob Wadi.

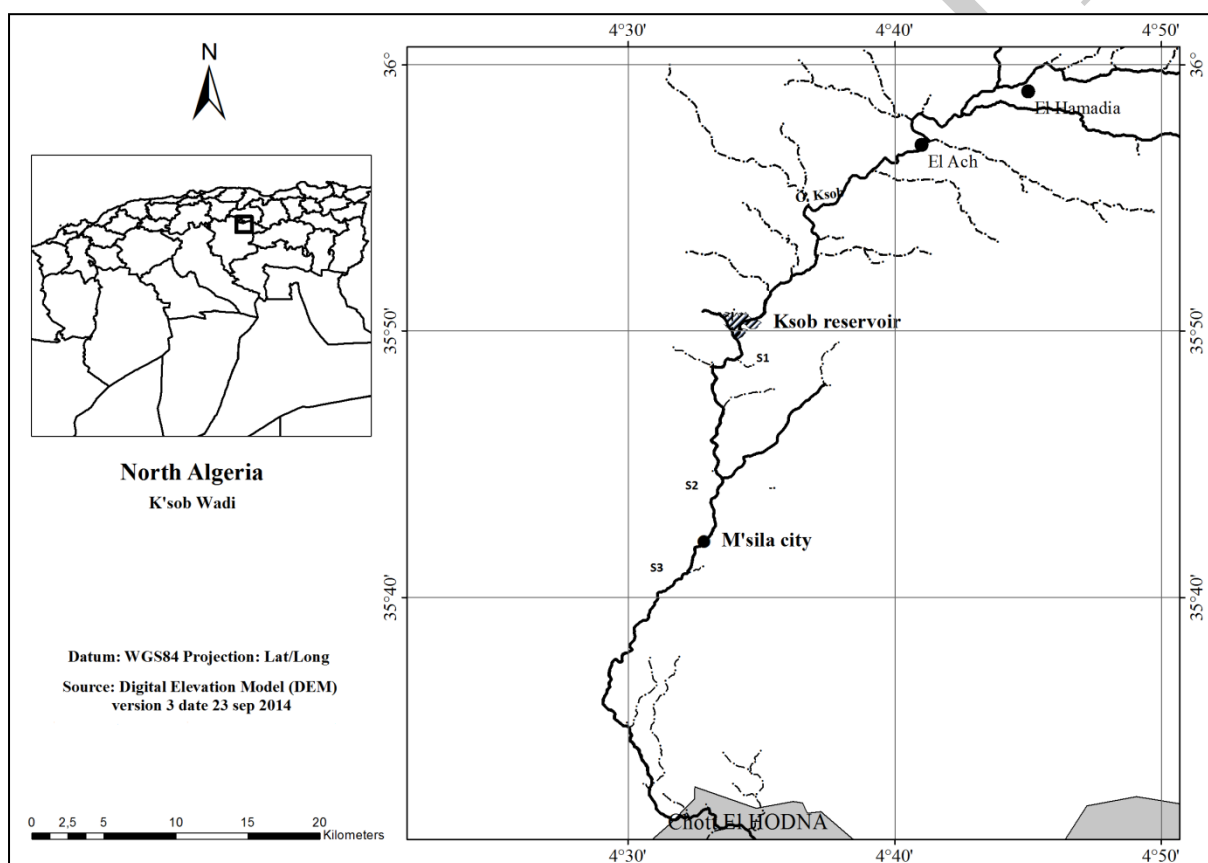


Figure 1. Map of the study area, with locations of sampling stations.

Results

A total of 879 macroinvertebrate individuals belonging to 7 high taxonomic groups (mostly class/order), 25 family and 30 species were collected in this study (Table 1).

94.65 % of the total fauna belongs to insects, the most abundant order were Diptera (47.55%), Coleoptera (22.41%) and Hemiptera (19.68%). The other orders had low representation rate such as in Gastropoda (5.01%), Ephemeroptera (4.10%), Tricoptera (0.91%) and the class of Annelida (0.34%).



The most abundant species were *Simulium pseudequinum* (15.02% individuals), followed by *Graptodytes laeticulus* (10.58%), *Chironomus riparius* (8.76%), *Anopheles rufipes* (8.19%), *Simulium ruficorne* (6.03%), *Chironomus plumosus* (5.80%), *Corixa affinis* (5.57%) and *Naucoris maculatus* (5.35%) (Table 2).

Table 2. Abundance of macroinvertebrates per taxa collected in K'sob Wadi at each sampling site.

Class/Ordre	Family	Species	S:	S:	S:	Total	RA(%)
Diptera	Chironomidae	<i>Chironomus plumosus</i>	50	0	1	51	5.80
		<i>Chironomus riparius</i>	70	7	0	77	8.76
	Simuliidae	<i>Simulium pseudequinum</i>	40	20	60	132	15.02
		<i>Simulium ruficorne</i>	2	0	5	53	6.03
	Culicidae	<i>Culex pipiens</i>	10	20	0	33	3.75
		<i>Anopheles rufipes</i>	0	0	70	72	8.19
Hemiptera	Corixidae	<i>Corixa punctata</i>	30	5	0	35	3.98
		<i>Corixa affinis</i>	20	20	4	49	5.57
	Gerridae	<i>Gerris thoracicus</i>	20	10	7	42	4.78
	Naucoroidea	<i>Naucoris maculatus</i>	10	30	2	47	5.35
Coleoptera	Dytiscidae	<i>Graptodytes laeticulus</i>	3	60	30	93	10.58
	Hygrobiidae	<i>Hygrobia hermanni</i>	10	20	0	31	3.53
	Hydrophilidae	<i>Anacaena globulus</i>	0	0	40	40	4.55
		<i>Berosus affinis</i>	4	8	10	27	3.07
	Hydroenidae	<i>Hydraena</i> sp	3	0	0	3	0.34
	Tenebrionidae	<i>Clamoris crenatus</i>	1	0	0	1	0.11
	Elmidae	<i>Heterocerus</i> sp	0	0	2	2	0.23
Ephemeroptera	Ephemerellidae	<i>Serratella ignita</i>	1	0	0	1	0.11
	Ephemeridae	<i>Ephemera glaucops</i>	0	0	2	2	0.23
	Caenidae	<i>Caenis luctuosa</i>	0	4	0	4	0.46
	Baetidae	<i>Baetis punicus</i>	0	6	9	15	1.71
	Leptophlebiidae	<i>Habrophlebia fusca</i>	3	7	0	10	1.14
	Heptageniidae	<i>Rhithrogena</i> sp	0	4	0	4	0.46
Tricoptera	Ecnomidae	<i>Ecnomina</i> sp	0	0	1	1	0.11
	Leptoceridae	<i>Ceraclea</i> sp	0	3	0	3	0.34
	Hydroptilidae	<i>Hydroptila</i> sp	0	3	0	3	0.34
	hydropsychidae	<i>Hydropsyche</i> sp.	1	0	0	1	0.11
Gasteropoda	Physidae	<i>Physa</i> sp	10	0	0	17	1.93
	Lymnaeidae	<i>Lymnaea</i> sp	20	0	0	27	3.07
Annelida	Hirudidae	<i>Hirudo medicinalis</i>	3	0	0	3	0.34

Taxa abundance was similar and did not differ significantly between sampling sites ($p > 0.05$). H' revealed no significant variation among sampling sites ($p > 0.05$). The highest richness was found at S1 (20 species), and the lowest at S3 (14) (Table 2). The values of H' at sampling sites ranged from 2.01 at S3 to 2.44 at S1 (Table 3). The values of E at sampling sites ranged from 0.53 at S3 to 0.67 at S2 (Table 3). E revealed no significant variation among sampling sites ($p > 0.05$).



Table 3. Diversity indexes of macroinvertebrates of the three stations at K'sob Wadi

	S1	S2	S3
Richness	20	16	14
Individuals	341	237	301
Shannon_H'	2.44	2.37	2.01
Evenness_E	0.57	0.67	0.53

Discussion

This study was performed at a semi-permanent river located in a semiarid area. During our study we found that the macroinvertebrates community is not different in the three sample sites in this semi arid ecosystem because of the similarity of the type of habitats and the anthropic impact. After analyzing the relationship between the number of individuals and the species diversity at each station we found that S1 meets both the highest number of species and the highest number of individuals. Diptera, Coleoptera and Hemiptera use the aquatic habitat in the adult and larval form. Mimeche et al., (2018) shows a high numbers of Chironomidae and Simuliidae (Order Diptera) in the K'sob reservoir. This ordre shows a large degree of tolerance to extremes of pH and tolerance of other chemical stress (Bartoo, 1978). Diptera, Coleoptera and Hemiptera are known to be salinity tolerant (Boronat et al., 2001; Pinder et al., 2005). The Coleoptera species are present with high abundances. According to Gáldeanet al. (2001), Coleopterans were found only on sandy substrate, preferred by them. Most of the Ephemeroptera and Trichoptera species are sensitive to pollution due to low levels of adaptive mechanisms. The Hirudidae (Oligochaetes) were favoured by nutrient enrichment (Prenda & Gallardo-Mayenco, 1996).

The *Graptodytes laeticulus* (Coloeptera) are distribute in North and East of Algeria (Fery & Bouzid, 2016). The species of Diptera are very abundant, *Simulium pseudequinum* and *Simulium ruficorne* most abundant and distribution species in Algeria are founded by Lounaci et al., (2000a,b), Chaoui Boudghane-Bendiouis et al., (2012) and Cherairia et al., (2014). *Chironomus riparius* and *Chironomus plumosus* are founded in northeastern Algerian by Chaib et al., (2011; 2013). The *Anophele srufipes* captured by Hamaidia & Berchi (2018) in Souk Ahras hydrosystem (northeastern Algerian). Two speices of Hemiptera are abundant, *Corixa affinis* and *Naucoris maculatus* captured by Benslimane et al., (2019) in northeastern Algeria.

The Mediterranean stream reported that variation of community macroinvertebrates composition depends on the length of water permanence.

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References

- Abhijna, U.G., Ratheesh, R., & Biju Kumar, A. (2013). Distribution and diversity of aquatic insects of Vellayani lake in Kerala. *Journal of Environmental Biology*, 34, 605-611.
- Boronat, L., Miracle, M.R., & Armengol, X. (2001). Cladoceran assemblages in a mineralization gradient. *Hydrobiologia*, 442, 75-88.
- Bartoo, P. (1978): The Environmental Requirements and Pollution Tolerance of Aquatic Insects of the Regional Copper-Nickel Study Area. Minnesota Legislative Reference Library. <<http://www.leg.state.mn.us/lrl/lrl.asp>, accessed at: 2018.08.20.>
- Benslimane, N., Chakri, K., Haiahem, D., Guelmami, A., Samraoui, F., & Samraoui, B. (2019). Anthropogenic stressors are driving a steep decline of hemipteran diversity in dune ponds in north-eastern Algeria. *Journal of Insect Conservation*, 23(3), 475-488.
- Chaib, N., Samraoui, B., Marzial, L., & Rossaro, B. (2011). Chironomid taxocenosis in a south mediterranean wadi, the Kebir-East (algeria). *Studi Trentini di Scienze Naturali*, 89, 29-34.
- Chaib, N., Fouzari, A., Bouhala, Z., Samraoui, B., & Rossaro, B. (2013). Chironomid (Diptera, Chironomidae) species assemblages in north Eastern Algerian hydrosystems. *Journal of Entomological and Acarological Research*, 45(1), 4-11.



- Chaoui Boudghane-Bendiouis, C., Belqat, B., Hassaine-Abdellaoui, K. & Yadi, B. (2012). Check-list des simuliés (Diptera: Simuliidae) d'Algérie. *Boletín de la Sociedad Entomológica Aragonesa*, 50, 305-308.
- Cherairia, M., Adler, P. H., & Samraoui, B. (2014). Biodiversity and bionomics of the black flies (Diptera: Simuliidae) of northeastern Algeria. *Zootaxa*, 3796(1), 166-174.
- Djamai, S., Mimeche, F., Bensaci, E., & Oliva-Paterna, F.J. (2019). Diversity of macroinvertebrates in Lake Tonga (northeast Algeria). *Biharean Biologist*, 13 (1), 8-11.
- Fery, H., & Bouzid, S. (2016). Notes on Graptodytes SEIDLITZ, 1887, re-instatement of *G. laeticulus* (SHARP, 1882) as valid species and description of *Tassilodytes* nov. gen. from Algeria (Coleoptera, Dytiscidae, Hydroporinae, Siettitiina). *Linzer Biologische Beiträge*, 48(1), 451-481.
- Gáldean, N., Callisto, M., & Barbosa, F.A.R. (2001). Biodiversity assessment of benthic macroinvertebrates in altitudinal lotic ecosystems of Serra Do Cipo (Mg, Brazil). *Revista Brasileira de Biologia*, 61 (2), 239-248.
- Hamaidia, H., & Berchi, S. (2018). Etude systématique et écologique des Moustiques (Diptera: Culicidae) dans la région de Souk-Ahras (Algérie). *Faunistic Entomology*, 71, 1-8.
- Kripa, P. K., Prasanth, K. M., Sreejesh, K. K., & Thomas, T. P. (2013). Aquatic macroinvertebrates as bioindicators of stream water quality-a case study in Koratty, Kerala, India. *Research Journal of Recent Sciences*, 2, 217-222.
- Lounaci, A., Brosse, S., Ait Mouloud, S., Lounaci-Daoudi, D., Mebarki, N., & Thomas, A. (2000a). Current knowledge of benthic invertebrate diversity in an Algerian stream: a species check-list of the Sébaou River basin (Tizi-Ouzou). *Bulletin de la Société d'Histoire Naturelle de Toulouse*, 136, 43-55.
- Lounaci, A., Brosse, S., Thomas, A. & Lek, S. (2000b). Abundance, diversity and community structure of macroinvertebrates in an Algerian stream: the Sébaou wadi. *Annales Limnologie*, 36, 123-133.
- Mimeche, F., Biche, M., Ruiz-Navarro, A., & Oliva-Paterna, J. F. (2013). Population structure, age and growth of *Luciobarbus callensis* (Cyprinidae) in a man-made lake from Maghreb (NE, Algeria). *Limnetica*, 32 (2), 391-404.
- Mimeche, F., Zedam, A., Chafaa, S., Mimeche, H., & Biche, M. (2018). Étude saisonnière du régime alimentaire du barbeau *Luciobarbus callensis* (Valencienne 1842) dans le réservoir de K'sob (M'Sila, Algérie). *Revue des sciences de l'eau*, 31(2), 163-171.
- Pinder, M.A., Halse, S.A., McRae, J.M., & Shiel, R.J. (2005). Occurrence of aquatic invertebrates of the wheatbelt region of Western Australia in relation to salinity. *Hydrobiologia*, 543, 1-24.
- Prenda, J., Gallardo-Mayenco, A. (1996). Self-purification, temporal variability and the macroinvertebrate community in small lowland Mediterranean streams receiving crude domestic sewage effluents. *Archiv für Hydrobiologie*, 136, 159-170.



First finding of cestodes in mole rat *Nannospalax nehringi* (Satunin, 1898) in the Southern Georgia

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Abstract

In September 2018 helminthological investigation of mole rat *Nannospalax nehringi* was performed. The material was collected on the territory of the Akhalkalaki region (Southern Georgia). The cestodes (5 strobiles and 2 scolexes) were found in the small intestine of three mole rats. The intensity of invasion was 1-2 individuals. The length of strobiles is about 152-200 mm. Together with strobiles their separate fragments were also found. The scolex is unarmed, with four large, disk-shaped suckers. Mature proglottids differed between cestodes: two cestodes had short and wide segments and oval eggs, while three cestodes had longitudinal segments longer than wide and round eggs with well developed dark stripe in the middle. According to the characteristic structure of the scolex and strobila, the discovered cestodes should belong to the order Cyclophyllidea Braun, 1900, family Anoplocephalidae Cholodkowsky, 1902, genus *Paranoplocephala* syn. *Aprostotandrya*. The presence of cestodes in the body of mole rat *N. nehringi* is the first finding of the helminthes of this class in Georgia. Further morphometric study of the preserved material is ongoing.

Keywords: Mole rat *Nannospalax nehringi*, Cestodes, Helminthes, Georgia



The harmful effects of a hepatotoxic solvent in male wistar rat

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Abstract

The liver is a vital gland for the body, because it ensures exocrine and endocrine secretion to many substances at once. Many of the substances secreted by the liver, whether intrinsic or extrinsic, are too insoluble in water to be eliminated in the urine. Since our life is threatened by exposure to several toxic substances (heavy metals, drugs, solvents, etc.) the liver remains a target organ for its toxicity. The purpose of this work is to study toluene-induced hepatotoxicity in adult male wistar rats, which were divided into 4 groups (n=10 per group); the control group received tap water, the second group (H) received corn oil, the other groups were treated with toluene by gavage at two doses (D1: 275 mg/kg bw and D2: 550 mg/kg bw) for 6 weeks. Our results showed that subchronic exposure to toluene affected a number of liver parameters, which is reflected in a significant decrease in the albumin concentration with a significant increase in transaminase concentrations (aspartame aminotransferase and alanine aminotransferase) and alkaline phosphatases. Concerning the absolute weight of the liver, the obtained results showed a significant increase in the groups treated with toluene compared to the control and positive control groups.

Keywords: Toluene, rats, hepatotoxicity, albumin, transaminases.



Study of intoxications of dogs and cats admitted in consultation

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Abstract

A prospective survey (from December 2018 to May 2019) was conducted at five veterinary practices in the region of El Tarf and Annaba on canine and feline clients consulted for poisoning cases. The different characteristics of the canine population admitted in consultation for this reason of consultation are represented by the German Shepherd breed with 50% followed by the crossed dogs. Males dominate with 64.28% and the age group of more than two months is the most exposed with 71.42%. Utility dogs living in garages are the most affected with 42.85% followed by house dogs with 35.71%. For cats the common breed represents 60% of cases of intoxication mainly in males older than two months. Drug poisoning was the most diagnosed.

Keywords: Intoxications - dogs - cats - veterinary practitioners



Biochemical characterization of the ovary of a lepidopteran pest stored commodities *Ephestia kuehniella*

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Abstract

The world's population is growing rapidly, raising fears of overcrowding and inadequate food supplies. Indeed, the rate of growth in crop production and crop yields worldwide is steadily declining. Therefore, there is a pressing need to increase agricultural production while reducing pre- and post-harvest losses. Among the storage enemies we find several species, we quote the insect pests of stored commodities. Lepidoptera and more particularly the family Pyralidae are the most found at the level of stored food. Among these pyralidae is flour mealworm: *Ephestia kuehniella* which is a common species in warehouses. The fight against insects therefore becomes a pressing economic necessity for all countries, whatever their degree of scientific evolution. Knowledge of the mechanisms that control the reproduction or development of these pests is therefore of fundamental interest and economic interest. Therefore, the purpose of this study is to determine the biochemical characteristics of different protein levels and ovarian vitellins in newly hatched females (0 day) of *Ephestia kuehniella*.

The results obtained show that the growth phase corresponding to the accumulation of various plastic and energetic materials: lipids, carbohydrates, proteins and mineral salts, corresponds to vitellogenesis. Any changes in protein concentration during vitellogenesis may lead to impaired reproduction.

Keywords: Lepidoptera, *Ephestia kuehniella*, protein levels, ovarian vitellins.



Characterization of bioactive compounds and formulation from extracts of *Aloe barbadensis* Miller [*Aloe vera* (L.) Burm F.] from Algeria

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Abstract

Aloe barbadensis Miller [*Aloe vera* (L.) Burm F.] is an endemic species used in traditional medicine in Algeria. This plant is rich in bioactive compounds mainly anthracene derivatives and polyphenols, which justifies its action on various types of pathologies. The objective of this present work is on the one hand the valorization of this endemic plant of a certain interest for public health. On the other hand the identification of its bioactive principles. The method followed is a characterization, on the one hand, by specific physicochemical reactions, and on the other hand, by chromatography on silica gel. This method makes it possible to precisely identify this species and to determine its main components, anthracenosides and polyphenols. These reactions are made from extracts of aloe leaves that are the juice and the gel. Our results are the identification of aloe-emodin, aloin, aloenoins, aloenosides A and B and aloesin. We made a formulation of a cream based Aloe Vera gel whose property is moisturizing and healing on the skin and mucous membranes. *Aloe barbadensis* is a species whose extracts, gel and juice are likely to treat certain pathologies and therefore can be an alternative treatment of certain diseases as well as to carry natural care.

Keywords: *Aloe barbadensis*, extracts, characterization, formulation, polyphenols, anthracene derivatives, Algeria



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