

**Joint ESENIAS and DIAS Scientific Conference
2022 and 11th ESENIAS Workshop**

**Invasive alien species under conditions of
global crisis**

13 – 15 November 2022

Book of Abstracts

Demre, Antalya, Türkiye

2022



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Ministry of Agriculture and Forestry, Türkiye (GDFA)**

**General Directorate of Agricultural Research and Policies,
Ministry of Agriculture and Forestry, Türkiye**

East and South European Network for Invasive Alien Species (ESENIAS)

Danube Region Invasive Alien Species Network (DIAS)

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**Mediterranean Fisheries Research, Production and Training Institute,
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Bulgarian Academy of Sciences, Bulgaria (IBER-BAS)**

**East and South European Network for Invasive Alien Species
(ESENIAS)**

Danube Region Invasive Alien Species Network (DIAS)

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2022



Participants (in-person) in the Joint ESENIAS and DIAS Scientific Conference 2022 and 11th ESENIAS Workshop 'Invasive alien species under conditions of global crisis', 13–15 November 2022, Demre, Antalya, Türkiye.

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Demre, Antalya, Türkiye

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**The content of the abstracts are responsibility of
the authors**

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CONFERENCE PROGRAMME

13th November 2022

10:00 – 10:30 **Opening**

Chair: Dr. Mahir Kanyılmaz

Dr. Teodora Trichkova, IBER-BAS, ESENIAS and DIAS

Prof. Dr. Ahmet Uludağ, COMU, ESENIAS and DIAS

Dr. Mustafa Altuğ Atalay, General Director, GDFA

Session 1

Chairs: F. Güler Ekmekçi, Rumen Tomov

Keynote presentation 1

10:30 – 11:00 **Bayram Öztürk** – Non indigenous marine species in Turkish waters and some considerations

11:00 – 11:15 **Georgios Vagenas, Anthi Oikonomou, Paraskevi K. Karachle** – The fish fauna inhabiting the Mediterranean and Red Sea: a comparative analysis of traits between native and non-indigenous species

11:15 – 11:30 **Aylin Ulman, Taner Yıldız, Sinan Mavruk, Stefanos Kalogirou, Nazli Demirel, Daniel Pauly** – An update on pufferfish research in Turkey: biology and ecology for *Lagocephalus sceleratus* and *Torquigener flavimaculosus*

11:30 – 11:45 **Mahir Kanyılmaz, Mustafa Altuğ Atalay, Suna Çiftci, Derya Özcan, Elvan Tercan** – Evaluation of pufferfish catching incentive model in Türkiye

11:45 – 12:00 **Ioannis Andrianopoulos, Paraskevi K. Karachle, Aikaterini Dogrammatzi, Evangelia Michaloudi** – The feeding habits of the non-indigenous *Etrumeus golanii* from the Aegean Sea

12:00 – 12:15 **Coffee break**

Session 1 (Cont.)

Chairs: F. Güler Ekmekçi, Rumen Tomov

12:15 – 12:30 **Hilal Aydın, Emine Erdem Cingöz** – Phytoplankton invasions in Mediterranean Sea

12:30 – 12:45 **Merve Karakuş, Coşkun Menderes Aydın** – Some findings on the diversity and biomass of alien and invasive alien species in the Mediterranean coast of Turkey

12:45 – 13:00 **Madona Varshanidze, Marina Mgeladze, Tinatin Joglidze, Paata Vadachkoria, Ramaz Mikeladze, Bella Japoshvili** – Present state of Rapa whelk (*Rapana venosa*) on the Black Sea coast of Georgia

13:00 – 14:00 **Lunch break**

Session 2

Chairs: Paraskevi K. Karachle, Deniz İnnal

Keynote presentation 2

- 14:00 – 14:30 **Teodora Trichkova, Rumen Tomov, Vladimir Vladimirov, Milcho Todorov, Elena Tsvetkova, Violeta Tyufekchieva, Hristina Kalcheva, Polina K. Nikova** – Applying citizen science tools for invasive alien species: case study from Bulgaria
- 14:30 – 14:45 **Aylin Ulman, Jasmine Ferrario, Anna Occhipinti-Ambrogi, Christos Arvanitidis, Agnese Marchini** – Recreational boating as a major vector of spread of nonindigenous species around the Mediterranean
- 14:45 – 15:00 **Deniz İnnal** – Identification of non-native freshwater fishes in Turkey's Mediterranean brackish water systems and assessment of their potential threats to the native fish fauna
- 15:00 – 15:15 **Emine Erdem Cingöz, Hilal Aydın** – Invasive phytoplankton spreadings in the Black Sea
- 15:15 – 15:30 **Mülkibar Çiftçioğlu, Hasan Cerim** – Assessment of invasiveness potential of *Diadema setosum* (Leske, 1778) (Echinodermata: Diadematidae) by the Aquatic Species Invasiveness Screening Kit (AS-ISK)

15:30 – 15:45 **Coffee break**

Session 2 (Cont.)

Chairs: Paraskevi K. Karachle, Deniz İnnal

- 15:45 – 16:00 **Gamze Dogdu** – A critical growing challenge: Environmental and health impacts of invasive alien species
- 16:00 – 16:15 **Anna Maria Mannino, Paolo Balistreri, Maria Cristina Gambi** – An updated overview of biological invasions in Sicilian Islands, Southern Mediterranean Sea
- 16:15 – 16:30 **Gerasimos Kondylatos, Dimitris Mavrouleas, Alexios Conides, Dimitris Klaoudatos** – EXPLIAS – Non-indigenous species in experimental fishing with static nets in Rhodes Island
- 16:30 – 16:45 **Yağmur Akgün, Ekin Akoğlu** – The impact of Lessepsian migrant Randall's threadfin bream (*Nemipterus randalli*) on the food web and fishery

16:45 – 17:00 **Coffee break**

17:00 – 18:00 **Poster Session 1**

18:00 – 18:45 **11th ESENIAS Workshop**

14th November 2022

Session 3

Chairs: Naime Arslan, Stojmir Stojanovski

- 09:30 – 09:45 **Mehmet Ekmekçi, Baran Yoğurtçuoğlu, F. Güler Ekmekçi, Şükran Açıkl**
– Use of ecohydrological approach in controlling invasive species: A case study
in Acıgöl groundwater dependent ecosystem
- 09:45 – 10:00 **Cüneyt Kaya, Fitnat Güler Ekmekçi, Baran Yoğurtçuoğlu** – First
introduced record of Doctor fish (*Garra rufa*) in Turkey
- 10:00 – 10:15 **Ümit Kebapçı** – To or From? A Snail Story
- 10:15 – 10:30 **Mehmet Zeki Yıldırım, Ümit Kebapçı** – Exotic pet trade snails in the
Mediterranean Region of Türkiye

10:30 – 10:45 **Coffee break**

Session 4

Chairs: Carla Gavrilesu, Algimantas Paulauskas

Keynote presentation 3

- 10:45 – 11:15 **Rumen Tomov, Roxana Ciceoi** – Non-chemical pest management in
horticulture by alien beneficial organisms – knowledge gap analysis
- 11:15 – 11:30 **Ümit Kebapçı, Mehmet Zeki Yıldırım** – Nonnative invasive terrestrial slugs
of Türkiye
- 11:30 – 11:45 **Ümit Kebapçı** – Feral ground of invasiveness
- 11:45 – 12:00 **Algimantas Paulauskas, Loreta Griciuvienė, Vytautas Mažeika, Nijole
Paulauskienė, Irma Ražanskė, Jana Radzijeuskaja** – Invasion of golden
jackal *Canis aureus* in Baltic countries
- 12:00 – 12:15 **Roxana Ciceoi, Oana Venat, Minodora Gutue, Vasilica Luchian, Mala-
Maria Stavrescu-Bedivan** – Establishment of *Aceria kuko*, Goji berry gall
mite, in Romania
- 12:15 – 12:30 **Alexandr Vasiliev** – First evidence of *Simulium dahestanicum* (Rubtsov,
1962) in Europe
- 12:30 – 12:45 **Simeon Lukanov, Irina Lazarkevich, Emiliya Vacheva, Miroslav Slavchev,
Nikola Stanchev, Blagovesta Dimitrova, Nikolay Todorov, Angel
Dyugmedzhiev, Borislav Naumov** – Removal of the invasive terrapin
Trachemys scripta elegans from a protected site in Bulgaria – risk assessment
and future perspectives

12:45 – 13:45 **Lunch break**

14.00 – 19.00 **Conference excursion**

15th November 2022

Session 5

Chairs: Madona Varshanidze, Ahmet Uludağ

Keynote presentation 4

09:30 – 10:00 **Ali Serhan Tarkan** – InvaCost, a public database of the economic costs of biological invasions worldwide – current situation and the way forward

Keynote presentation 5

10:00 – 10:30 **David Lunsford, Florence Tremblay Otis, Robert Bajada (Stream Ocean)** – Making the invisible visible: A solution for improved underwater surveillance of invasive alien species

10:30 – 10:45 **Mihaela Urziceanu, Eugenia Nagodă, Alina Georgiana Cişlariu, Ioana-Minodora Sîrbu, Petronela Camen-Comănescu, Maria Raicu, Paulina Anastasiu** – Alien plant invasion hotspots in the lower Danube sector, as a result of human-modified landscapes. Study case: Borcea Branch, Romania

10:45 – 11:00 **Necmi Aksoy, Ahmet Uludağ, İlhan Üremiş, Bilge Tunçkol, Neval Güneş Özkan** – *Reynoutria japonica* Houtt.: Its pathways, ecological and chorological notes for flora of Türkiye

11:00 – 11:15 **Yasin Emre Kitiş, Osman Çavuşoğlu, Ramazan Süleyman Göktürk** – A new alien plant species recorded for the flora of Türkiye: *Fatoua villosa* (Thunb.) Nakai (Moraceae)

11:15 – 11:30 **Neval Güneş Özkan, Nihan Koçer, Necmi Aksoy** – First record of invasive macrophyte *Elodea nuttallii* (Planch.) H. St. John (Hydrocharitaceae) in Türkiye

11:30 – 11:45 **Coffee break**

Session 6

Chairs: Sava Vrbničanin, Marga Grădilă

11:45 – 12:00 **Alina Georgiana Cişlariu, Petronela Camen-Comănescu, Ioana-Minodora Sîrbu, Mihaela Urziceanu, Eugenia Nagodă, Maria Raicu, Paulina Anastasiu** – Risk assessment of *Phytolacca americana* in Romania

12:00 – 12:15 **Ahmet Uludağ, İrem Eysan Sezer** – The non-native genus *Echinochloa* as weeds in the non-native crop rice in Gönen, Türkiye

12:15 – 12:30 **Ahmet Uludağ, Necmi Aksoy, İlhan Üremiş, Giuseppe Brundu** – *Eucalyptus* L'Hér. spp. (Myrtaceae), potential threat to Mediterranean ecosystems of Türkiye

12:30 – 12:45 **Haroon Khan, Ömer Süha Uslu, Osman Gedik** – The impact of climate change and invasive alien weeds on biodiversity of Pakistan

12.45 – 13:00 **Muhammad Akbar, Ali Raza, Tayyaba Khalil, Nasim Ahmad Yasin, Yasir Nazir, Aqeel Ahmad** – Allelopathic activity of *Digera muricata*, against two weeds, *Avena fatua* and *Melilotus indicus*

13:00 – 14:00 **Lunch break**

Session 7

Chairs: Bella Japoshvili, Teodora Trichkova

Keynote presentation 6

- 14:00 – 14:30 **Phil I. Davison, Gordon H. Copp** – Environmental DNA (eDNA) for detecting alien fishes and inform management decisions on eradication: a case study in Southern England
- 14:30 – 14:45 **Gordon H. Copp, Jennifer A. Dodd, Hannah J. Tidbury, Rob S.E.W. Leuven, Eric Feunteun, Karin H. Olsson, Stephan Gollasch, Anders Jelmert, Kathryn A. O'Shaughnessy, David Reeves, Jorge Brenner, Hugo Verreycken** – Invasiveness risks of naked goby, *Gobiosoma bosc*, to North Sea transitional waters
- 14:45 – 15:00 **Ahmet Özer** – The current parasitic assemblages in native gobiid fishes in Türkiye and their interactions with gobiid hosts in expanded ranges
- 15:00 – 15:15 **Polina K. Nikova, Teodora Trichkova, Milcho Todorov** – Invasive alien species of Union concern in fresh waters of Sofia Region: Preliminary results
- 15:15 – 15:30 **Deniz Mercan, Sadi Aksu, Naime Arslan, Özgür Emiroğlu, Ali Serhan Tarkan** – Determination of potential invasion areas of *Pontogammarus robustoides* (Sars, 1894) (Amphipoda) for Turkish inland waters with ecological niche modeling
- 15:30 – 15:45 **Konstantin Zdraveski, Sasho Trajanovski, Biljana B. Gjoreska, Sonja Trajanovska, Teodora Trichkova** – Scaling the anthropogenic impact and conservation challenges through ecosystem services and biological inventory in Sveti Naum Springs (Lake Ohrid)
- 15:45 – 16:00 **Pinar Arslan, Mehmet Zeki Yıldırım, Aysel Çağlan Günal** – The effects of fipronil on the freshwater snails

16:00 – 16:15 **Coffee break**

Session 8

Chairs: Eugenia Nagodă, Petronela Camen-Comănescu

- 16:15 – 16:30 **Oana-Viorica Danci, Constantin Drăgulescu** – Riparian invasive alien plant species in Southern Transylvania, România: history of introduction, chorology and ecology
- 16:30 – 16:45 **Bilge Tunçkol, Neval Güneş Özkan, Necmi Aksoy, Ahmet Uludağ** – Taxonomical notes, ecological and chorological update on *Opuntia macrorhiza* Engelm. in Türkiye
- 16:45 – 17:00 **Tautvydas Žalnierius, Vaidevutis Šveikauskas, Sigita Jurkonienė** – Seeds of *H. sosnowskyi* from terminal and satellite umbels developed under gibberellic acid treatment, germinate differently
- 17:00 – 17:15 **Markola Saulić, Ivica Djalović, Dragana Božić, Sava Vrbničanin** – Soil Seed Bank of Ragweeds under different management systems
- 17:15 – 17:30 **Mustafa Zengin, Serdar Süer, Melih Rüzgâr** – Modification studies to reduce the impact on the benthic ecosystem of beam trawling, which is predominantly used in sea snail (*Rapana venosa*) fishing

17:30 – 17:45 **Coffee break**

17:45 – 18:45 **Poster Session 2**

POSTERS

Poster Session 1

(17:00 – 18:00h, 13.11.2022)

Chair: Baran Yoğurtçuoğlu

- P1.01: Bella Japoshvili, Giorgi Epitashvili, Tatia Kuljanishvili, Ani Bikashvili, Madona Varshanidze, Levan Mumladze** – Invasive species and protection of native biodiversity in Georgia
- P1.02: Detelina Belkinova, Desislava Stoianova, Mihaela Beshkova, Plamen Stoyanov, Rumen Mladenov** – Current and predicted distribution of the invasive and potentially toxic species *Raphidiopsis raciborskii* (Cyanoprokaryota, Nostocales) in stagnant water bodies in Bulgaria
- P1.03: Sergiy Bushuyev, Sergiy Snigirov, Genadiy Kharlov, Yuriy Kvach** – New data on the distribution of the Far-Eastern shrimp, *Macrobrachium nipponense* (Malacostraca: Palaemonidae) in the southwestern Ukraine
- P1.04: Kathrin Theissing, Jean-Yves Georges, Mihails Pupins, Oksana Nekrasova, Oleksii Marushchak, Andris Čeirāns, Arturs Skute** – Prospects for the distribution of the North American species signal crayfish *Pacifastacus leniusculus* in Europe
- P1.05: F. Güler Ekmekçi, Baran Yoğurtçuoğlu, Şerife G. Kırankaya, Cüneyt Kaya, Davut Turan** – Is zebra mussel a potential threat for native fauna in Alpaslan II Reservoir watershed

Chair: Yuriy Kvach

- P1.06: Ovidiu Drăgan, Dan Cogălniceanu** – Introduced fish species in Romanian alpine lakes: Retezat National Park case study
- P1.07: Serhii Khutornoi, Mikhail Son, Yuriy Kvach** – New fishes in the fauna of the Sukhyi Lyman, North-Western Black Sea, Ukraine
- P1.08: Yuriy Kvach, Yuliia Kutsokon, Volodymyr Yuryshynets** – The parasite of the big-scale sand-smelt (*Atherina boyeri*) in native and acquired range in Ukraine
- P1.09: Stojmir Stojanovski, Dijana Blazhekovikj-Dimovska, Lidija Velkova-Jordanoska, Vasil Kostov, Irina Manevska, Julijana Arsovska** – First record of *Acanthocephalus lucii* (Müller, 1776) Lühe, 1911 (Paleacanthocephala: Echinorhynchidae) in minnow (*Phoxinus lumaireul* Linnaeus, 1758) from Belčišta wetland, North Macedonia
- P1.10: Dijana Blazhekovikj-Dimovska, Stojmir Stojanovski, Lidija Velkova-Jordanoska, Vasil Kostov, Irina Manevska, Julijana Arsovska, Kristijan Veljanovski** – First record of *Pomphorhynchus bosniacus* (Kiškarolj et Čanković, 1969) (Paleacanthocephala: Pomphorhynchidae) in some cyprinid fish from Belčišta wetland (North Macedonia)

Chair: Şerife Gülsün Kırankaya

- P1.11: Igor Davydenko** – Waterfowl and wetland birds as a factor of distribution of invasive fish species on the territory of Ukraine
- P1.12: Milica Jaćimović, Marija Smederevac-Lalić, Dušan Nikolić, Gorčin Cvijanović, Slađana Spasić, Željka Višnjić-Jeftić, Stefan Skorić, Jasmina Krpo-Ćetković** – Effects of selective removal of the black bullhead (*Ameiurus melas*) on other non-native fish populations in the Ponjavica Nature Park (Serbia)

P1.13: Lidija Velkova-Jordanoska, Stojmir Stojanovski, Dijana Blazekovikj-Dimovska, Kristijan Veljanovski – Fish populations on Belcista wetland – risk assessment, prevention and management

Poster Session 2

(17:30 – 18:30h, 15.11.2022)

Chair: Necmi Aksoy

P2.01: Jesús Jiménez-Ruiz, Juan Pablo Del Monte, M^a Inés Santín-Montanyá – Phenotypic plasticity of *Arundo donax* L. (Giant reed) in Mediterranean ecosystems

P2.02: Marga Grădilă, Valentin Marius Ciontu, Raluca Monica Cristea, Daniel Jalobă – Monitoring of spreading of invasive plant *Erigeron annuus* (L.) Pers. (daisy fleabane) in cereals crops in southeast Romania

P2.12: Olena A. Lykholat, Nina O. Khromykh, Tetyana Y. Lykholat, Oleh O. Didur, Maxim O. Kvitko, Yuriy V. Lykholat – Introduced fruit crops as a way of floral enrichment (on the example of Jostaberry plants)

Chair: Rumen Tomov

P2.03: Ilija Gjonov, Monika Pramatarova, Erdem Hızal, Sevcen Öztemiz – *Acanalonia conica* (Say, 1830) (Hemiptera: Acanaloniidae) - a new alien species in Bulgaria

P2.04: Marius Skolka, Dan Cogălniceanu, Daniyar Memedemin, Ovidiu Drăgan, Carla Gavrilescu, Teodora Tanase – *Corytucha arcuata* (Say, 1832) (Heteroptera, Tingidae) in alpine habitats from the Romanian Carpathians

P2.05: Marius Skolka, Daniyar Memedemin, Ovidiu Drăgan, Carla Gavrilescu – New data on the presence of *Sceliphron curvatum* (F. Smith, 1870) (Hymenoptera, Sphecidae) in Romania

P2.06: Rumen Tomov – Alien insect species in areas with rich biodiversity in Sofia Municipality

P2.07: Rumen Tomov – Occurrence of *Cacopsylla pulchella* (Löw, 1877) (Hemiptera, Psyllidae) in Bulgaria

P2.08: Emek Koçak, Berkay Türk – *Pheidole* sp. and *Tapinoma* sp. (Hymenoptera: Formicidae) changing food preferences

P2.09: Delka Salkova – Prevalence and pathways for introduction of small hive beetle (*Aethina tumida*)

P2.10: Dimitar Velchev, Nataliya Petrovska, Teodora Toshova, Danail Takov, Ivaylo Todorov, Daniela Pilarska, Miklós Tóth – Potential of the mycoinsecticide Naturalis® for use in strategies of crop protection against *Diabrotica virgifera virgifera* LeConte, 1858

P2.11: Miglė Razgūnaitė, Jana Radzijeuskaja, Algimantas Paulauskas – Domestic cat part-wild hybrid identification using diagnostic molecular methods

KEYNOTE PRESENTATIONS

Environmental DNA (eDNA) for detecting alien fishes and informing management decisions on eradication: a case study in Southern England

Phil I. Davison^{1,2}, Gordon H. Copp^{1,2,3}

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Accurate detection methods are a key component of management actions (early detection and rapid response) for dealing with alien species, and in recent years environmental DNA (eDNA) surveys, i.e. analysis of water samples to detect DNA released by an organism, have often proved to be more effective than conventional sampling for detecting non-native fishes. We developed methods to detect invasive topmouth gudgeon *Pseudorasbora parva*, a small cyprinid fish native to eastern Asia that is a host of the rosette agent pathogen and has been linked to changes in fish assemblages in some waters it has invaded. In a case study in southern England, we used eDNA surveys of ponds at a commercial angling venue in southern England to evaluate the success of an eradication attempt. Our eDNA detections confirmed the continued persistence of a small population of *P. parva* in a 1.4 ha pond, but not in other ponds on the site, nor in an adjacent (unconnected) stream. These results informed a second eradication attempt, which was shown to have been successful by further eDNA surveys which did not detect the species. The trial also demonstrated the high number of water samples that need to be collected from around a pond to reliably detect a small fish population. We will also present provisional results from our more recent study, which aimed to answer the question of how many samples need to be collected for reliable detection.

Key words: Nested PCR, conventional trapping, eradication, control and containment, Topmouth gudgeon, *Pseudorasbora parva*.

Making the invisible visible: a solution for improved underwater surveillance of invasive alien species

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Invasive alien species (IAS) are a continuous threat to native biota in Europe, causing damage worth billions to the European economy every year. The EU Regulation 1143/2014 on Invasive Alien Species (IAS Regulation) provides a coordinated approach at a European level by providing sets of measures to combat the spread of IAS. One of these types of measures is early detection and rapid eradication, whereas Member States (MS) are bound to develop a surveillance system to detect the presence of IAS of Union concern as early as possible and take rapid eradication measures to prevent them from establishing. In the current market, existing underwater surveillance solutions have important limitations when it comes to the assessment of projects' performance, scalability and stakeholder engagement.

Stream Ocean addresses this challenge and brings innovation to the field by developing autonomously powered underwater cameras, connected to the internet and coupled with our AI for continuous monitoring. These cameras form a network (a global underwater observatory) which brings the underwater environment to life for project stakeholders, academics and governments. Our AI technology analyses images captured by our cameras and yields reliable biodiversity metrics such as overall richness and evenness of the ecosystems, as well as the presence of keystone or invasive species. Consequently, we offer a standardized, cost-efficient, data-rich and scalable solution to monitor and report on aquatic environments, including restoration and conservation projects.

Key words: Invasive alien species, surveillance, underwater cameras, artificial intelligence.

InvaCost, a public database of the economic costs of biological invasions worldwide – current situation and the way forward

Ali Serhan Tarkan

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Invasive species can cause wide ranging detrimental impacts in their receiving ecosystems, ranging from altered individual behaviours in native species through to alterations to ecosystem functioning. Understanding the ecological processes that enable these impacts to develop is important however without placing a monetary value into the context, proper management actions and awareness levels towards biological invasions still remains inadequate on policy agendas hence could hamper effectively communicate with citizens and decision makers.

A new database called InvaCost and statistical analysis tools were developed to synthesise the economic costs of biological invasions for the first time in 2019. This initiative brought over 100 natural and social scientists together to quantify the economic impacts of biological invasions globally. From over 2000 entries, the database synthesized the costs for 343 species totalling at US\$ 1,288 billion. The most current version v. 4.1 encompasses 13,553 entries covering more than 1000 species and a total of US\$ 2,168,045 million (as of 2022-02-15 in 2017 US\$) based on data from multiple languages.

After three years of global efforts to analyse and publish the content of InvaCost, monetary dimension of biological invasions has received a growing interest and the database highlighted gaps in the coverage of data, with certain regions being underrepresented. Here, I will provide an overview of a recent international interdisciplinary collaboration revealing cost of biological invasions at global scale. I will also outline recent complementary research on several new aspects such as geographic, taxonomic, environmental, ecological, sectoral and temporal contexts to inform impact predictions and management efforts for biological invasions.

Key words: Monetary value, impact prediction, management actions, decision makers, international collaboration.

Non-chemical pest management in horticulture by alien beneficial organisms – knowledge gap analysis

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Horticulture represents the main source of food and well-being, especially in the urban environment, by cultivation, processing, and offer to market of vegetables, fruits, nuts, grapes, cut and rooted ornamental plants. In the context of the European Green Deal, an Erasmus+ project was developed, entitled “Enhancing practical skills of horticulture specialists to better address the demands of the European Green Deal” (Hort4EUGreen), gathering experts from Hungary, Romania, Bulgaria and Türkiye. One of the results delivered by the project is the handbook “Chemical pesticide-free horticulture” dedicated to non-chemical approaches for pest management, including the use of beneficial organisms. Recent papers, projects, and legislative documents related to the use of alien beneficial organisms for pest control in horticulture were reviewed and knowledge gaps were reviewed.

An analysis of available published sources shows that it is widely accepted that the use of exotic biological control agents (BCAs) and beneficial micro-organisms formulated as plant protection products may pose risks to humans and the environment. It is necessary to be verified that their use is safe and has no negative consequences for human and animal health or towards other non-target organisms. In this respect, the IPPC International Standard for Phytosanitary Measures 3 (ISPM 3) gives guidelines for the export, shipment, import, and release of biological control agents and other beneficial organisms. EPPO Standards PM 6 on the safe use of biological control provide guidelines for assessing and reducing the risks associated with various aspects of the introduction and use of BCAs. The use of beneficial micro-organisms as plant protection products in EU is regulated by the Regulation (EC) No 1107/2009 and recently the European Commission adopted four implementing Regulations that amend the current rules applicable to micro-organisms. In contrast, there is still a gap in the EU legislation concerning the use of exotic BCAs in pest control. Registration for invertebrate biocontrol agents is currently done at the Member State level, following national law. To facilitate the decision-making process by Member States additional studies of the non-target effect of exotic BCAs used are required.

Key words: Exotic biological control agents, micro-organisms, non-target effect.

Acknowledgements: This study was conducted in the framework of the project „Enhancing practical skills of horticulture specialists to better address the demands of European Green Deal Initiative“ (Hort4EUGreen), Erasmus+, Programme – Strategic Partnership, Project No 2020-1-RO01-KA203-080398, funded with support from the European Commission.

PRESENTATIONS

TOPIC 1: INVASIVE ALIEN SPECIES TRAITS AND TRENDS

Invasive alien species introduction and spread, biological and ecological traits; characteristics of recipient environment; invasive alien species and climate change; viruses, bacteria and other small organisms as IAS

The feeding habits of the non-indigenous *Etrumeus golanii* from the Aegean Sea

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During the last decades due to global climate change the occurrence of Lessepsian migrants in the Eastern Mediterranean Sea have increased as well as their successful population establishment. This in turn affects their new environments due to competitive interactions with indigenous species among others. Thus, information regarding the feeding habits of the non-indigenous species is of great importance in order to assess a sufficient understanding of the effects that these species have on the indigenous marine community dynamics. *Etrumeus golanii*, is an indigenous species to the Western Indian Ocean, and it was first observed in the Mediterranean Sea in Hayfa Bay, Israel in 1961, yet it had not been found in the Aegean Sea (Greece) until 2003, when it was recorded for the first time from the Rhodos Island. It is a pelagic, mainly inshore, clupeid fish, which started to expand in all of the Mediterranean Sea. The aim of the present study was to analyze the diet of *Etrumeus golanii* collected in the Aegean Sea and to compare the fish's food items with the diet of indigenous competitive species. *Etrumeus golanii* specimens were collected seasonally from Saronikos gulf through by commercial purse seines from July 2020 to May 2021. Overall, the stomach contents of 224 individuals were examined under a stereoscope and identified. Fifty percent of the stomachs were empty (Vacuity Index 51.7%). Arthropods of the class Malacostraca were the sole representatives among the prey items identified. More analytically the frequency of occurrence for the separate prey items were: order Isopoda 63.8%, decapoda and mysida 39.8% and Amphipoda 4.8%. The results of this study indicate the high preference of *Etrumeus golanii* for Isopoda, which have not been recorded as preferred food items by other competitive species, such as *Sardina pilchardus* and *Engraulis encrasicolus*.

Key words: Golani's round sardinella, diet, Aegean Sea.

Phytoplankton invasions in the Mediterranean Sea

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Global warming are expected to alter the species composition of local planktonic communities and increase their susceptibility to invasion by exotic species. Current climate model simulations have indicated a significant warming in the Mediterranean Sea. Human activities are responsible for the massive transfer of species between the different oceans of the world. This happens particularly when ships take on ballast water in one harbour and pump it out in another, frequently in a different part of the World. But a new study demonstrates that current ballast water regulations do not consider natural phytoplankton populations, limiting control efforts for potentially harmful non-indigenous species. Global warming and increasing stratification may influence the plankton productivity through reduced nutrient enrichment of the euphotic zone and also the metabolic rates of both low and high trophic level (ectothermic) organisms. Global warming will also increase the number of alien species with tropical and subtropical distributions and Indo-pacific origin entering the Mediterranean. Dinoflagellates *Alexandrium andersoni*, *Alexandrium catenella*, *Coolia monotis*, *Karenia mikimotoi* and diatoms *Chaetoceros coarctatus* and *Proboscia indica* are non-indigenous phytoplankton species in the Mediterranean Sea. The purpose of this review is to present a brief summary of invasive phytoplankton of the Mediterranean Sea, and discuss the factors affecting future trends such as climate change and new ballast water regulations.

Key words: Mediterranean Sea, global warming, invasive phytoplankton.

Establishment of *Aceria kuko*, Goji berry gall mite, in Romania

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Goji berry gall mite (*Acari: Eriophyidae*), having its origin in South Asia, entered Europe in 2007 via solanaceous plants for planting, which are prohibited for import from third countries. The species is now spread over more than 20 European states. The mite hosts are goji berry plants, *Lycium barbarum* or *L. chinense*, two species with a tremendous growing demand on the market in the last decade, in the US and Europe. The mite species was first identified in Romania in 2013, still on plants imported for planting. The species spread in the country silently until 2021, when it was first discovered on wild goji berry plants, at around 5 km away from the first report. Following a citizen science campaign, the mite was found in another 5 counties, 4 locations of spontaneous shrubs (Constanta, Giurgiu, Ilfov and Prahova) and two of cultivated locations (Bucharest and Buzau). The recent identifications occurred both on wild goji berry plants that escaped from the cultivated areas but also in areas where the wild plants are native and have been there since many years. The discovery of this pest, which in laboratory tests produced symptoms on *Capsicum annuum* and *Solanum nigrum*, in the current challenging context of climate changes and peace threats raise the question of sustainability and resilience, both for goji berry crops and the other solanaceous crops, of which some are the most important agricultural produce. Studies on goji berry gall mite spread in Romania continue inside the ProtecGoji project.

Key words: Goji berry gall mite, *Aceria kuko*, *Lycium* sp, wild species hosts.

Acknowledgements: The research work was carried out with the support of a grant of UASVM of Bucharest No. 1268/30.07.2021, acronym ProtecGoji, within IPC 2021.

Invasive phytoplankton spreadings in the Black Sea

Emine Erdem Cingöz, Hilal Aydın

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The Black Sea is under increasing anthropogenic pressures in the second half of the 20th century. Eutrophication, which is considered an important environmental problem in the Black Sea, has also seriously affected the food chain. Eutrophication, marked by the proliferation of non-native species, has become a basin-wide problem. Beginning of the 1990s eutrophication culminated, the small pelagic fish stock collapsed and a huge outbreak of the non-indigenous ctenophore *Mnemiopsis leidyi* was observed, changing the food web to a wasp-waist structure. However, since the mid-1990s nutrient inputs to the Black Sea have decreased and signs of oligotrophication were observed. Significant decreases of the phytoplankton abundances were observed after the mid 1980s, concurrently with changes in the species composition of the communities, with an evident shift toward smaller cells or organism sizes. *Lingulodinium machaerophorum*, *Brigantedinium* spp, *Spiniferites belerius*, *Impagidinium caspiense* and *Caspidinium rugosum rugosum*, *Pentapharsodinium dalei* and *Spiniferites cruciformis* are non-indigenous phytoplankton species in the Black Sea. The aim of this review is to summarize the invasive species in the Black Sea.

Key words: Invasive phytoplankton, eutrophication, the Black Sea.

**Invasiveness risks of naked goby, *Gobiosoma bosc*,
to North Sea transitional waters**

**Gordon H. Copp^{1,2,3}, Jennifer A. Dodd⁴, Hannah J. Tidbury⁵, Rob S. E. W. Leuven^{6,7},
Eric Feunteun⁸, Karin H. Olsson⁹, Stephan Gollasch¹⁰, Anders Jelmert¹¹, Kathryn A.
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Historically, gobies have dispersed from the Ponto-Caspian region of Eastern Europe in a westerly direction to North American and western European waters. By contrast, the naked goby, *Gobiosoma bosc*, is the only known gobiid species to disperse in an easterly direction from North America to western Europe. The potential invasiveness of *G. bosc* was assessed using the Aquatic Species Invasiveness Screening Kit (AS-ISK) for rivers and transitional waters for the western and eastern sides of the North Sea. Using globally-derived thresholds, *G. bosc* was assessed as low-medium invasiveness risk for both sides of the North Sea under current climate conditions. Under future climate conditions, potential invasiveness increased for both risk assessment areas. Environmental suitability assessment indicated an increase in environmental suitability for *G. bosc* on the eastern coastline of the North Sea under climate change scenarios and suitability remained unchanged on the western coastline, reflecting the authors' expectations of invasiveness risk.

Key words: *Gobiosoma bosc*, naked goby, North Sea, invasiveness potential, risk screening, environmental suitability assessment.

**Riparian invasive alien plant species in Southern Transylvania, Romania:
history of introduction, chorology and ecology**

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The establishment and spread of invasive alien plant species (IAPS), outside their natural habitats have irreversibly affected native biodiversity in almost every habitat type and are an important threat to biodiversity at global level and also in Southern Transylvania. IAPS have posed severe threats to the ecosystem services, environmental quality, human health and local biodiversity including changes in the aspect and floristic composition of phytocoenosis. For Southern Transylvania, we estimate that there are about 200 adventive plants, the list of alien plant species includes 69 species for Sibiu County alone. From these, we selected 16 invasive alien plant species that inhabit riparian habitats, the most common, abundant, frequent or with higher impact on habitats and human health, from Southern Transylvania and studied the history and pathways of their introduction in the study area and their chorology and ecology. All the studied species, that have been introduced in Europe between VIX century and XIX century, are found in any of the fourth counties in the Southern Transylvania, the rate at which humans translocate species beyond their native ranges has substantially increased during the last centuries, a wide range of motivations underlie the introduction of alien species, in the study area predominate the introduction pathways escape from confinement - ornamental and horticulture and aesthetic release in nature.

Key words: Invasive alien plant species, riparian, Southern Transylvania, history, introduction paths.

Some findings on the diversity and biomass of alien and invasive alien species in the Mediterranean coast of Turkey

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The Mediterranean Sea coasts of Turkey have been exposed to by definition, alien species have to do with human interference (including the Suez Canal as it is a man-made opening) the introduction of alien species originating from the Indo-Pacific for many years. When an alien species, becomes well established and heavily impact biodiversity, health and ecosystem services, it is called invasive alien species. It is observed that the diversity and population of alien and invasive alien species have increased in recent years in the Mediterranean coasts. Here we present the results of a study we conducted along the Mediterranean coasts of Turkey. Totally, 456 trawl surveys were carried out to estimate demersal fish stocks in the Gulf of Antalya (2015–2017: monthly), between Mersin and Iskenderun Bays (2015–2017: seasonally), and between Antalya and Iskenderun Bays (2021–2022: annually). A total of 27 alien species were recorded in these surveys. Biomass amounts according to years and regions were found to be 772.81 kg/km² for the Antalya bay and 1965.23 kg/km² for the Mersin and Iskenderun Bay between 2015–2017 and 2021–2022, respectively. As the migration of alien species to the Mediterranean Turkish coasts is a continuous one, it is considered that relevant studies should be carried out regularly in order to monitor the establishment, and biomass of these species, as well as for early detection and prevention of further expansion.

Key words: Mediterranean, alien species; invasive alien species, biomass, diversity, trawl survey.

First introduced record of Doctor fish (*Garra rufa*) in Turkey

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Garra rufa has a wide distribution range in Euphrates & Tigris drainages, from cold headwater in Turkey to brackish Shatt al Arab. This small, omnivorous cyprinid is used in the fish-spa industry to exfoliate human skin. *Garra rufa* also known as 'doctor fish' have risen in popularity in recent times due to their use in a spa beauty treatment, as a therapy or to treat skin. Until now, it has not been reported from the wild outside its native range. Here, we record a translocated and established population in Ilıca Stream (Manavgat, Antalya) in Turkey, where no *Garra* species have been recorded before. Fish were collected by electrofishing and identified in-situ based on morphological investigation. *Garra rufa* is frequently demonstrated and used for fish therapy at spa resorts. It can be found in almost all hotels in Antalya, which were brought to the hotels illegally, and recently has started rearing in fish farms in this region. Therefore, our result has suggested fish spas/*Garra* farms to act as an introduction pathway. Based on this finding, the species' invasiveness risk should also be reassessed.

Key words: Doctor fish, invasive species, escaped fish, translocated, established population.

To or From?: A Snail Story

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Balkans and Anatolia acted as glacial refugia for a variety of organism groups, such as plants and animals, distribution areas of which fluctuated in climatic cycles that extended into the Anthropocene, a period of intensive landscape and biota modification centered around the region and a rather recent spin-off resulting in what is termed as Global Extinction Crisis. To the complexity of native or nonnative question entwined with the faunal exchange and human history, today hidden introductions and recent expansions of certain molluscan taxa add new dimensions. Recent findings on the malacofaunal history of the region and the molluscan invasion patterns are given. New challenges with increasing pace of invasions in the face of extinction crisis, with regional and broadscale conservative implications are also discussed.

Key words: Climate change, extinction, Europe, introduced species, Gastropoda, native.

Nonnative invasive terrestrial slugs of Türkiye

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Due to their feeding habits and short life histories, slugs tend to be agricultural pests and many become invasive within and beyond their natural ranges. Türkiye is among the countries with the most diverse malacofaunas in the region, comprising 63 slug and semi-slug species. With the recent addition of 2 species (*Ambigolimax valentianus* and *Drusia ibera*), a total number of alien invasive species became 9. This relatively small number indicates that further records are awaited. Distributions and descriptions of the invasive slug species of Türkiye are given, along with a brief discussion on their possible pathways of introduction.

Key words: Agriolimacidae, Arionidae, Limacidae, Milacidae, Parmacellidae.

**A new alien plant species recorded for the flora of Türkiye:
Fatoua villosa (Thunb.) Nakai (Moraceae)**

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This species, which has not been previously found in the flora of Turkey, was first recorded in banana greenhouses located at the Çakış Mah. Yeniköy Sok. Manavgat, Antalya province. The species was first noticed by Osman Çavuşoğlu in May 2018. The identification of the species was made by Y. Emre Kitiş and R. Süleyman Göktürk. The first specimen was recorded at the Akdeniz University Herbarium (international code: AKDU) with the number 6330. The natural distribution of the species is in Southeast Asia and the north of Australia. However, it is known that it was transmitted to the USA in the early 1960s and has now spread to 26 states. It has been observed that the plant prefers moist and shaded places, but it can also be found in places with direct sun. *F. villosa* is a summer annual herbaceous plant. In some reports that the species shows perennial character in greenhouse conditions. The plant grows erect, and its leaves are alternate with serrate or crenate margins. Since the leaves look like the leaves of a mulberry tree, it's commonly called mulberry-weed. Plants, including leaves and stems, are pubescent. The flowers emerge from the leaf axils in clusters. Seeds are very small (about 1 mm), and shape is oval. Seeds are mostly dropped near the mother plant, but some seeds are explosively dehiscent. This is seen as one of the natural distribution ways of the plant. *F. villosa* was found extensively in some greenhouses. In the greenhouses we observed, the temperature varies between 16-33 °C and the relative humidity ranges between 60-80% depending on the season. The species commonly found with *F. villosa* in the greenhouse; *Ipomoea triloba* L., *Pilea microphylla* (L.) Liebm., *Cardamine occulta* Hornem. and *Amaranthus* spp. It is reported that the environmental selectivity of the species is not high, and it spreads rapidly where it is infected. This shows that the plant has an invasive character. In our surveys, it was observed that the species was spread both inside and outside the greenhouses. This indicates that the species can also pose a problem outdoors in hot and humid regions. We do not have clear information about the transmission route. On the other hand, we think it is probably contaminated with propagation materials, peat and soil. It is understood that checking of the media and production materials and sanitation are very important to prevent the spread of the species in clean areas. Studies on the distribution and density of the species are continuing.

Key words: Greenhouse, new record, alien species, weed.

EXPLIAS – Non-indigenous species in experimental fishing with static nets in Rhodes Island

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In the frame of EXPLIAS project, experimental fishing was conducted with two small scale fishing vessels in Rhodes Island, southeastern Aegean Sea, Greece. Sampling stations were selected based on information provided by local fishers, and a total of 36 monthly samplings (April 2021 to March 2022) with trammel nets (600 m length, 1.7 m height, 24–32/130 mm mesh size) and gill nets (600 m length, 1.7 m height, 22 mm mesh size) were conducted. The mean soaking time for the former was 12 h/sampling and two h/sampling for the latter.

Overall samplings yielded a total fish biomass of 410.3 kg corresponding to 1841 individuals of 66 species of bony fish of which 52 species (78.8%) were indigenous and 14 species (21.2%) were non-indigenous. Three of the most invasive alien species (IAS) in the Hellenic Seas, *Lagocephalus sceleratus*, *Pterois miles* and *Fistularia commersonii*, had the highest biomass (107.5 kg, 93.8 kg and 64.8 kg respectively), followed by *Sparisoma cretense* (40.6 kg), *Dasyatis pastinaca* (13.3 kg), and *Siganus rivulatus* (11.4 kg). *Fistularia commersonii*, *S. cretense* and *P. miles* showed the highest number of individuals (361,235 and 207 respectively), followed by *L. sceleratus* (110), *Spicara maena* (97) and *S. rivulatus* (95).

In addition, based on experimental fishing studies with static nets conducted by the Hydrobiological Station of Rhodes/HCMR within 2014 to 2022 in Rhodes Island, it is clear that the percentage of the non-indigenous species biomass has risen from 19.8% (5 species) to 72.21% (14 species). Within the period 2002 to 2022, the percentage has risen from 0.2% (4-5 species) to 72.21% (14 species), based on experimental fishing trials with both static nets and boat seining. The results of this study add valuable information on the course of small-scale fisheries in the marine area of Rhodes Island and of the Eastern Mediterranean.

Key words: Aegean Sea, gill nets, invasive fish, *Lagocephalus sceleratus*, Rhodes Island, trammel nets.

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An updated overview of biological invasions in Sicilian Islands, Southern Mediterranean Sea

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Non-indigenous species (NIS), pointed out as a major threat to biodiversity, may become invasive alien species (IAS) and may cause biodiversity loss and ecosystem service changes. In the Mediterranean Sea, Islands, which represent hotspots of biodiversity, are particularly vulnerable to biological invasions. As a result of their geographical location at the crossroads between the Western and Eastern Mediterranean - plus exposure to heavy maritime traffic, Sicily and its surrounding Islands spread in Southern Mediterranean, most of which host MPAs, are particularly prone to NIS invasions.

A total of 45 non-indigenous and cryptogenic species was recorded for the Sicilian Islands (21 Macrophytes, 13 Invertebrates and 11 Fish), with the Pelagian Islands (26: 12 Macrophytes, 6 Invertebrates and 8 Fish) and the Egadi Islands (21: 11 Macrophytes, 6 Invertebrates and 4 Fish) registering the highest number. This result is unsurprising given the position of these Islands from both a geographical and a transport-stowaway point of view. *Asparagopsis armata* Harvey, *Caulerpa cylindracea* Sonder and *Percnon gibbesi* (H. Milne Edwards, 1853) were the most frequently recorded species. The presence of *C. cylindracea* (considered IAS) in all the Sicilian Islands, confirms the invasiveness of this species, which is able to compete with native species, and may change native benthic communities, perhaps leading to an impoverishment of subtidal communities.

Maritime traffic is certainly the main vector for the introduction and spread of NIS. The expansion of NIS by recreational vessels represents a risk for Island biodiversity, which are popular touristic destinations. Moreover, global warming may involve both NIS and indigenous thermophilous species subjected to a process defined as “tropicalization and “meridionalization”, respectively.

The creation of permanent observatories and alarm systems, able to early detect new introductions and to follow the spread of species already present might be an effective tool in the management of present and future introductions of NIS in Sicilian Islands, most of which host MPAs, whose major aim is biodiversity conservation. To this end, citizen science initiatives involving citizens (students, tourists, divers, underwater photographers, fishermen and other amateurs) may provide a valuable contribution in raising awareness, collect data and also flagging early-warning signs.

Key words: Biodiversity, global warming, Islands, Mediterranean Sea, non-indigenous species.

Determination of potential invasion areas of *Pontogammarus robustoides* (Sars, 1894) (Amphipoda) for Turkish inland waters with ecological niche modeling

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Pontogammarus robustoides (Sars, 1894) is invasive Ponto-Caspian amphipod species in several European countries. The natural distribution area of *P. robustoides* includes the lower reaches of the Volga, Don, Dnieper, Dniester, and Danube River systems, as well as the brackish and freshwater lakes adjacent to the Black Sea. *P. robustoides* in Türkiye was reported for the first time in 1964 from lakes Apolyont, İznik, Sapanca, and Manyas. Since then, it has been reported from various freshwater ecosystems in Marmara, Aegean, Thrace, Central Anatolia and Mediterranean regions of Türkiye.

This study determined the current and future potential distribution area of *P. robustoides* species in Turkey and Europe. Future climate change projections for the years 2021–2040, 2041–2060, 2060–2081 and 2081–2100 were conducted using the Shared Socioeconomic Pathways; intermediate greenhouse gas emissions (SSPs245). In the model, Türkiye occurrence data were obtained from literature reviews and field studies, and European occurrence data were obtained from the Global Biodiversity Information Facility (GBIF). Variables data were prepared using bioclimate, land cover, hydrological, soil and geology, and topographic and anthropogenic variables to predict scenarios for the current geographic distribution of the species.

As a result of modelling, the current habitat distribution of the *P. robustoides* species will show the greatest similarity in the future in 2021–2041 and the least in 2081–2100. This indicates that the current habitats of the species will change. However, this change will be about 30% in 2100. Especially Kızılırmak, Yeşilirmak, Sakarya, Susurluk Marmara and Meriç Ergene basins were found to be the most suitable habitats for the species in the future. Relative contributions of the environmental variables to the Maxent model; Temperature annual range (BIO5–BIO6) (Max Temperature of Warmest Month, Min Temperature of Coldest Month), lake volume and inundation extent maximum.

Key words: Invasive species, Amphipoda, ecological niche modelling, maxent.

The current parasitic assemblages of native gobiid fishes in Türkiye and their interactions with gobiid hosts in expanded ranges

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Gobiidae is a very diverse family with more than 2000 fish species and they are among the important components of native and invasive species compositions in their distributional areas. Ponto-Caspian gobies, such as round goby *Neogobius melanostomus*, tubenose goby *Proterorhinus marmoratus*, monkey goby *Neogobius fluviatilis*, bighead goby *Ponticola kessleri*, are native to the coastal areas of the Sea of Marmara, the Black Sea, the Sea of Azov, and the Caspian Sea and are known to be highly invasive in their expansion areas via either their gradual and successive migration or via ballast waters, during the intentional introduction, and with sand carried on barges. During the migration of Gobiids outside of their native areas, accompanying parasites may also be spread to new geographical ranges. Several possible outcomes for parasitism following invasions are proposed; 1) an invader may benefit from a reduction in parasite diversity and/or prevalence as a result of invasion – Enemy release, 2) an invader may acquire parasites in the new habitat - Parasite acquisition, 3) Parasites introduced with the invader may infect novel host species in the new habitat – Parasite introduction. In the present study, previously reported parasite diversities from 12 gobiid species inhabiting freshwater, brackish water, and marine environments in Türkiye are provided. Round goby *N. melanostomus* was reported to be infected by the highest number of parasite diversity (26), followed by the black goby *Gobius niger* (13), monkey goby *N. fluviatilis* (12), tubenose goby *P. marmoratus* (10) and the rest had lower numbers of parasite species. On the other hand, among higher parasitic taxa, Trematodes infected the highest number of gobiid fish species (10), followed by Cestoda (8), Nematoda (6), Ciliophora (4), Monogenea (4), Arthropoda (4), Myxozoa (4) and Acanthocephala (3). Parasites infecting the gobiid hosts can be either generalists or specialists and their above-mentioned interactions together with the other fish hosts inhabiting the same native and invaded environments must be revealed through surveillance programs. Considering the high and aggressive invasive potential of gobiids, the transformation of parasitic fauna in native and translocated areas is possible. This study provides details on the current parasitological fauna of native Ponto-Caspian gobiids in Türkiye and discusses their appearances in expanded areas.

Key words: Gobiid fishes, parasite, generalist, specialist, native, invasive.

**First record of invasive macrophyte *Elodea nuttallii* (Planch.) H. St. John
(Hydrocharitaceae) in Türkiye**

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The genus *Elodea* Michaux sp., one of the 14 genera of the Hydrocharitaceae family, is represented by 9 taxa in the world. Any taxa of this genus are not native to Türkiye. *Elodea nuttallii* (Planch.) H. St. John an aquatic plant native to North America, has entered most European countries such as Greece, Bulgaria, and Romania, as also Crimea, China, Japan, and the Philippines in recent years. *Elodea nuttallii* was found in Türkiye for the first time as a new record with this study. This taxon was collected in the “Monitoring of Plant Species and Identification of Threats in Aquatic Ecosystem and Habitat Areas in Bolu Lakes” project. The first specimens of *Elodea nuttallii* were detected in June 2022 at Göksu Nature Park of Bolu province in Türkiye. Plant samples collected during the field survey were photographed, morphologically identified, and recorded in the DUOF Herbarium collection. This paper gives the distribution map, description, population and ecological status, and suggestions for risk management of the taxon.

Key words: *Elodea nuttallii*, macrophyte, invasive plants, Göksu Nature Park, Bolu, Türkiye.

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Invasion of golden jackal *Canis aureus* in Baltic countries

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Golden jackal (*Canis aureus*) was recorded for the first time in Baltic countries in Estonia in 28.02.2013 and three specimens of golden jackal were hunted in Latvia in 2014. In Lithuania the first golden jackal was found in 07.02.2015. The species was identified using morphological and mitochondrial DNA control region (CR1) analysis.

The golden jackal has already been declared an invasive species in Baltic States. In Lithuania, hunting of these animals has been permitted from 15 October till 1 April.

Few studies in the past have revealed golden jackal potential role as carriers of zoonotic diseases and intestinal helminthes parasites. In present study presence of parasites in golden jackal specimen have been investigated. No tick-borne pathogens (*Anaplasma phagocytophilum*, *Babesia* sp., *Bartonella* sp.) were found in spleen of golden jackal. However, the flukes *Apophallus donicus*, nematodes *Uncinaria stenocephala*, and unidentified individuals of class Cestoda have been detected. Helminths *A. donicus* and *U. stenocephala* are not new species for Lithuania and/ or neighboring territories. The diet of jackal consists of plants, invertebrates and vertebrates.

Key words: Golden jackal, *Canis aureus*, invasion, Baltic countries.

**Taxonomical notes, ecological and chorological update on
Opuntia macrorhiza Engelm. in Türkiye**

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Recent floristic work in and around Karasu and Kocaali districts of Sakarya province and Susurluk district of Balıkesir province in northwestern Türkiye, Hasanlar Dam Lake's surrounding of Düzce Province, and at Parion Antique city, Karabiga village of Biga District of Çanakkale Province has revealed new populations of a new alien species to the country, *Opuntia macrorhiza* of the family Cactaceae. It has been first recorded in Kastamonu and Sinop provinces of western Black Sea Region in 2020. Typically, *O. macrorhiza* has spines, (1) 2–3 (6) per areole. However, some populations do not have spines. Those fall within the *O. macrorhiza* clade phylogenetically based on some data and not within the *O. humifusa* species complex. They are not *O. humifusa* but rather one of the many forms of *O. macrorhiza* s.l. This is the form commonly called *O. grandiflora*, and recorded diploid populations of this type from Texas. The red-orange tinged inner tepals are one of the giveaways, as are the yellowish glochids and more upright growth form. It also tends to form these massive colonies, and the fruit are this glaucous (or dark) purple color and long clavate. The second record is in the West Black Sea dune areas and the third record is at the slope and hilly areas in the Susurluk Lake Basin of the South Marmara region; It has been determined that it is widely distributed in different habitat types and ecological regions in Turkey. All of the specimens are deposited at DUOF Herbarium. It has not been revealed its pathway in none of the records. This species is known a fast-spreading invasive species. We suggest that the plant should be immediately eradicated because they have not spread widely.

Key words: Cactaceae, invasive alien plant, new population, *Opuntia*.

**An update on pufferfish research in Turkey: biology and ecology for
Lagocephalus sceleratus and *Torquigener flavimaculosus***

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This serves as a review of several key papers published in the last two years which presented lots of new information on the growth, ecology, fecundity, and diet of both *Lagocephalus sceleratus* and *Torquigener flavimaculosus*, which we consider to be the two invasive pufferfish species of highest concern in the Mediterranean. Additionally, we also present predators of both species, and an update on the monstrous sizes reached by *L. sceleratus* in the Mediterranean. Based on literature data, for *L. sceleratus*, the estimated growth parameters were $L_{\infty} = 88.7$ cm, $K = 0.27$ year⁻¹, $C = 0.6$ and $WP = 0.1$. Their sex-ratio was $M/F = 1:0.69$. *Lagocephalus sceleratus* appears to be a batch spawner with discontinuous oocyte recruitment and has different spawning seasons in the Eastern Mediterranean which seem to be based on temperature cues which get shorter in duration as one moves north from the Suez. We also report their first positive ecological trait, that they are controlling some other invasive species through their diets, such as lionfish, Red Sea goatfish, rabbitfish and longspine sea urchins, in addition to controlling themselves through cannibalism, which appears to be density-dependent. They are indeed a top predator in the region with a trophic level of 4.1. We suggest that targeted fishing using improved gear-types to reduce fishing gear damages should be further developed, and that finding commercial markets for pufferfish could help to naturally fund ongoing control efforts. The parameters of the von Bertalanffy Growth Function for *T. flavimaculosus* in the Eastern Mediterranean were: $L_{\infty} = 17.4$ cm and $K = 0.96$ year⁻¹, implying a longevity of about 4 years, while the mean length at first maturity was about 10 cm (total length; TL) for both sexes. An average-sized adult female (13 cm TL, 45.7 g live weight) was found to contain 1,250 eggs per gram of body weight, corresponding to 54,820 eggs being shed per year. Based on its high invasiveness and negative impacts to ecology of the Eastern Mediterranean and the human health, we suggest that *T. flavimaculosus* should be listed as a priority invasive species and that its population closely monitored within the Mediterranean.

Key words: Invasion ecology, traits, predators, prey, reproduction, growth.

The non-native genus *Echinochloa* as weeds in the non-native crop rice in Gönen, Türkiye

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Rice, a staple crop, is one of the cash crops in Türkiye with one million tones production on 125 thousand ha. Weeds are among the main problems of rice cultivation worldwide. Weed problem in rice in Turkey has been increasing in every year with new species arriving, current weeds spreading further, lack of crop rotation due to ecology and economy, relying on entirely chemical control, herbicide resistance weeds and lack of new herbicides with varying mode of actions. *Echinochloa* species, namely *E. crus-galli* (native to old world), *E. oryzoides* (native to Caucasus to Japan and Philippines), *E. colonum* (Tropical & Subtropical Old World), *E. oryzicola* and *E. erecta* have been reported from rice fields of Türkiye although latter two are considered synonym of the former two, respectively. A study is conducted in the Gönen District, a foremost rice producing area in the Marmara Region of Turkey to identify *Echinochloa* species and lower taxons. In Gönen, 29 *E. crus-galli* (2 of them *E. oryzicola*), 3, *E. oryzoides* and 5 *E. colonum* were identified. *E. colonum* is reported first time form rice fields of the Marmara Region. Further studies with identification, ecology and biology have been going on.

Key words: Herbicide resistance, weed identification, lower taxon, Marmara region.

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The fish fauna inhabiting the Mediterranean and Red Sea: a comparative analysis of traits between native and non-indigenous species

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The Mediterranean Sea is one of the most invaded marine regions of the world in terms of non-indigenous species (NIS), due to human activities and/or climate change. In this work, we compared the most important life-history traits' frequency distribution of the fish species native in the Mediterranean (MED), with those found in the neighbouring Red Sea (RS), and NIS in the Mediterranean. Fishes' life-history traits reported up to December 2021 were extracted from FishBase, and included: the von Bertalanffy infinite length (L_{inf}); the growth coefficient k of the von Bertalanffy growth function and the mean temperature of preference ($^{\circ}\text{C}$). A total of 1234 species, belonging to 216 families, was recorded. Gobiidae was the dominant family (97 species), followed by Labridae (61 species) and by both Blenniidae and Carangidae (45 species). In the Mediterranean basin with a total of 535 species, Gobiidae (53 species) and Sparidae (25 species) were the dominant out of the 142 families recorded. In the RS (517 species), 96 families have been recorded, with Labridae and Gobiidae being the dominant ones, each represented by with 41 species each. Overall, 77 different families were identified in the NIS list (182 species), with Serranidae being the dominant one, with 11 species. Based on our results, MED showed broader range of L_{inf} values compared to NIS and RS, which highly overlapped. The dominant length class was 0-50 cm in all cases. We observed the same distribution pattern of k for MED, RS and NIS, respectively with the class of 0-0.5 displaying the highest frequency. In the case of mean temperature preference, the majority of MED demonstrated a preference to lower mean temperatures (dominant class: 19 $^{\circ}\text{C}$), whereas RS and NIS showed a similar single peaked distribution, with the class of 28 $^{\circ}\text{C}$ being the dominant one. The dataset and framework presented herein could be useful in future studies towards the exploration of the relationships between species' life-history traits, extinction risk and invasiveness in the Mediterranean Sea.

Key words: Life history traits, non-indigenous, native, Mediterranean, bio-invasions, fishes.

Acknowledgements: This study was undertaken in the frame of the project 4ALIEN: Biology and the potential economic exploitation of four alien species in the Hellenic Seas, funded by the NRSF 2017-2020 (MIS (OΠΣ): 5049511).

**Present state of Rapa whelk (*Rapana venosa*)
on the Black Sea coast of Georgia**

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The study of Rapa whelk (*Rapana venosa*) is an essential step towards sustainable resource management in the Black Sea region. Rapa whelk is an important invasive alien species in the Black Sea, it was introduced into the Black Sea in 1946 and extended along the Caucasian and Crimean coasts and to the Sea of Azov within a decade. The mass development of *Rapana* has impacted the biodiversity of the Black Sea environment. In the 1960s, *Rapana* completely destroyed the famous Gudauta oyster bank. With the influence of this invasive gastropod there are half as many species of bivalve mollusks in the Black Sea today as they were 40-50 years ago. Many bivalve mollusks have become extinct (Black Sea oyster), and many are on the edge of extinction (mussels, pecten etc.). In Georgia, this is the first scientific investigation of Rapa whelk, conducted in October 2020. During a five-day expedition in the Gonio-Anaklia region of the Black Sea coast of Georgia, nine water areas were sampled, corresponding to 25 selected stations, which evenly covered three different depth strata (i.e 5–15 m, 15–25 m, 25–35 m). In the laboratory the size-age composition and the sex of the Rapa whelk were estimated. The age of the rapa whelk was calculated by the spawning marks, the sex was determined following Bondarev. Our work summarized the results of this survey, more specifically: abundance, size, frequency of distribution, sex ratio, average size, and average age.

Key words: Beam trawl, Rapa whelk, Black Sea, Georgia.

Acknowledgements: The study was supported by the Food and Agriculture Organization of the United Nations (FAO), the General Fisheries Commission for the Mediterranean (GFCM), „BlackSea4Fish“ project.

First evidence of *Simulium dahestanicum* (Rubtsov, 1962) in Europe

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The species *Simulium dahestanicum* (Rubtsov, 1962) has geographical distribution in Iran, Iraq and Russia (Caucasus). The messages about the species are scarce and rare.

Recently, it has been identified from the samples in the Republic of Moldova. The samples were collected from the river Ichel, tributary of the river Dniester near the settlements Chetroasa (26 May 2021) and Coșernița (31 March 2022). Accompanied species are *S. erythrocephalum* (De Geer, 1776), *S. frigidum* Rubtsov, 1940, *S. intermedium* Roubaud, 1906, *S. kiritshenkoi* Rubtsov, 1940, *S. pseudequinum* Séguy, 1921 (complex) and *S. rubzovianum* (Sherban, 1961). The species *S. dahestanicum* and *S. frigidum* are new records for the Republic of Moldova.

The identification was made on all life stages. Specimens from Moldova were verified with type specimens of *S. dahestanicum* stored in Simuliidae collection in ZIN RAS.

Moldova and previous countries where the species was registered are related to the Palearctic Region, however climate conditions and altitude for *S. dahestanicum* are different in Moldova and countries with previous records. Although the research on black flies in Europe is not vigorous, appearance of *S. dahestanicum* in European simuliidofauna is unusual.

Key words: Diptera, Dniester, Republic of Moldova, Simuliidae.

Exotic pet trade snails in the Mediterranean region of Türkiye

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Along with the developments in the pet trade over the past few decades, new exotic species have been added into market each year, including land and freshwater taxa. Several such species have been known to exhibit invasiveness especially where the climatic conditions are suitable and for that reason Mediterranean areas are in particular susceptible to invasive species. In the recent years several gastropod taxa (1 Achatinidae, 5 Ampullariidae, 1 Nassariidae, and 1 Planorbidae species) became highly popularized in the local market in Antalya area and Türkiye in general, posing high potential risk of introductions. These and the previously recorded non-native invasive species (*Physella acuta*) linked with aquarium trade were evaluated, and their invasive potentials based on the climate and habitat suitability were discussed.

Key words: Antalya, aquarium, *Helisoma*, non-native, *Lissachatina*, *Pomacea*.

TOPIC 2: VECTORS AND PATHWAYS FOR INVASIVE ALIEN SPECIES INTRODUCTIONS

Analysis, prioritisation, action plans

***Reynoutria japonica* Houtt.: Its pathways, ecological and chorological notes for flora of Türkiye**

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Floristic monitoring study conducted in and around Akçakoca district of Düzce province in Turkey has revealed new populations of a new alien species to Türkiye, *Reynoutria japonica* Houtt. of the family Polygonaceae. It has been first published at Terme district of Samsun province of middle Black Sea Region in 2020. There are some reasons that cause the deterioration of the natural vegetation and spreading of invasive alien plant species such as interruption of nature, urbanization and climate changes. After its first record in field margins and roadsides in Terme, the second record in the riparian areas in Akçakoca. It has been showed that it is getting widely distributed in different habitat types and ecological regions in Turkey. All of the specimens are deposited at DUOF Herbarium. It might be introduced as ornamental plant because the area where is in the vicinity of the summer houses of people living abroad and many exotic plants such as; *Oxalis articulata*, *Canna indica*, *Paulownia tomentosa*, *Actinidia chinensis*, and *Phoenix canariensis* were detected. It is noticed that the number of invasive plants in Turkey has been increased since the alien flora has been published in 2017 and tend to rapid increase. These species spreads rapidly in disturbed, manmade and even natural areas and is difficult to control. It is suggested that Türkiye should give serious attention to invasive alien plants with all aspects from pathways to capacity building, from legal status to community training.

Key words: *Reynoutria japonica*, invasive alien plant, pathways, new population, Türkiye.

Feral ground of invasiveness

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Domestication is a phylogenetic process involving changes in the phenotype, behavior and life history traits. Feralization on the other hand is the release of a domesticated individual from human provision, often (formerly) seen as returning to the wild state (desocialization) without taking into account selection processes. Several behavioral traits selected for, such as earlier maturation, shorter generation time and life histories, larger litter size, smaller body size and adaptability to different conditions are indeed shared with successful invaders in general, eventually feral species become successful invaders in ESENIAS area and worldwide. Environmental effects and spreading of such often go unnoticed due their filling of empty niches or close association with human habitats. Life history traits and the spread of the feral populations, established or exotic, should be studied in consideration of origins (breed type), species interactions (including synanthropy) and local adaptation to assess the invasion risk. Based mainly on the exemplified mammalian feral species, in the view of global changes, implications for the project area and in broader scale are briefly reviewed.

Key words: Competition, domestication, feralization, Mammal, Vertebrate.

Recreational boating as a major vector of spread of nonindigenous species around the Mediterranean

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This study addresses this shortfall by completing the first ever Mediterranean basin-wide study investigating the influence of recreational boats in the transfer of NIS from biofouling both in marinas and from boat-hulls. First, a thorough investigation of NIS was conducted in 34 marinas across the Mediterranean (spanning from Spain to Turkey), targeting benthic macroinvertebrates. All marinas were found to host NIS, ranging from 2 to 27 per marina. This first output of this research provides a massive update of new NIS records and updated species distributions for the Mediterranean, and presents three new species in the Mediterranean basin, 51 new NIS country records and 20 new subregional records, which can now be fed into models and databases to gain a better comprehension of the composition and scale of NIS colonizing marina habitats. It was realized that almost 80% of sampled fouled vessels were found to host at least 1 NIS, while 11 was the maximum NIS found on one boat-hull. It was also found that recreational vessels visiting new marinas sometimes carry NIS not yet present neither in that marina nor in the country in which they are visiting, thus providing ample evidence of recreational boating supplying new NIS to marinas. The results revealed that a higher species richness of NIS in Mediterranean marinas was influenced by the following factors: water temperatures above 25°C, a higher number of berths, absence of floating pontoons, proximity to the Suez Canal and proximity to commercial harbours. Whereas the similarities between NIS assemblages amongst marinas were more influenced by environmental factors such as temperature, biogeographical region, climate type, primary productivity and again proximity to the Suez Canal. The significance of the Suez Canal as a prominent factor in both analyses coincides with the general trend of higher total NIS found in the Eastern Mediterranean strongly influencing NIS distributions.

Key words: Invasive species, non-indigenous species NIS, recreational boating, marina, Mediterranean, vector.

TOPIC 3: THE DANUBE RIVER AS INVASIVE ALIEN SPECIES CORRIDOR

Priority species for the Danube Region,
impact on threatened species, specificity of
biological invasions in the Lower, Middle
and Upper Danube River sections

Alien plant invasion hotspots in the lower Danube sector, as a result of human-modified landscapes. Study case: Borcea Branch, Romania

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The Danube River is an essential transport corridor for most central and southeaster European countries; therefore, it has been heavily modified over time. In its Lower Basin, the Danube formed an extensive wetland environment which was subjected to various anthropogenic changes between 1950-1989, such as damming, dredging, anti-flood embankments, development of an extensive network of irrigation channels, and conversion of wetlands to arable lands. This led to the loss of 80% of its natural areas, severely altering soil structure and its chemical properties. To stabilise the newly created banks, various plantations with alien species such as *Amorpha fruticosa*, *Populus × canadensis*, *Robinia pseudoacacia* were put into place. Furthermore, all these alterations favoured the introduction and expansion of alien plant species, especially alongside linear elements such as river banks or irrigation channels.

Our study focused on a section of the lower Danube basin, which underwent one of the most radical changes from the entire southern sector: the Borcea Branch. Located in the SE region of Romania, the Borcea Branch is protected by the Ramsar Convention as a wetland of international importance and by the Natura 2000 Network because still harbours some natural habitats such as lakes, sand dunes, marshes and small islands. One of the main threats to these area is the expansion of invasive alien plant species. During 2020-2021, we collected data within the western area of this sector and identified numerous invasive and potentially invasive plant species for Romania, recording a higher abundance for *Amorpha fruticosa*, *Amaranthus retroflexus*, *Ambrosia artemisiifolia*, *Eclipta prostrata*, *Elodea nuttallii*, *Lindernia dubia*, *Paspalum disclichum*, *Sicyos angulatus*, and *Xanthium orientale* subsp. *italicum*. An increased species richness was recorded near settlements with developed farmland areas and major transport infrastructure (high-capacity roads, bridges across the Danube, railways, etc.).

During the last decades, the ecological importance of maintaining wetlands was acknowledged and various ecological reconstruction projects have emerged. Within this process, implementation of effective management measures to limit the spread of invasive species is highly recommended to ensure their success.

Key words: Invasive plants, Danube River, Ramsar sites, land-use change, river banks.

TOPIC 4: INVASIVE ALIEN SPECIES IMPACT

Impact on biodiversity and ecosystem services, impact on human health, safety and the economy; pests and pathogens; adverse impact on protected areas, endangered species and habitats

The impact of Lessepsian migrant Randall's threadfin bream (*Nemipterus randalli*) on the food web and fishery

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The Eastern Mediterranean Sea is one of the most invaded marine ecosystems due to the impact of Lessepsian species, which migrated from the Red Sea to the Mediterranean Sea after the construction of the Suez Canal. The impacts of Lessepsian species on the indigenous fish and fisheries can be both positive and negative. Some Lessepsian species may positively affect the fishery, by providing additional income sources for the fishers'; yet this happens at the expense of negatively impacted native species and, hence, the ecosystem. This study was conducted to understand the impact of the Lessepsian species Randall's threadfin bream (*Nemipterus randalli*) on the food web and fishery dynamics in the Mersin bay, using Ecopath with Ecosim modelling, the latter being one of the most widely adopted mass-balance model. Scenarios were applied to compare *N. randalli*'s impacts on other species and fishery. The results showed that the species has a significant role in the Eastern Mediterranean food web. The findings highlighted that *N. randalli*'s increasing population in the Eastern Mediterranean negatively affects commercially exploited native fish species, such as Red mullet (*Mullus barbatus*), Striped mullet (*Mullus surmuletus*), Common pandora (*Pagellus erythrinus*), and Axillary seabream (*Pagellus acarne*). We suggest that targeted fisheries exploitation of the species as an alternative management measure can reduce its negative impacts on the food web in the Eastern Mediterranean Sea.

Key words: Eastern Mediterranean Sea, Lessepsian migration, Suez Canal, food web, invasive species.

A critical growing challenge: Environmental and health impacts of invasive alien species

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Invasive alien species are crucial contributors of climate change, environmental damages, biodiversity loss and destruction of ecosystem services globally. The risk of spreading of these invasive species has increased due to climate change in recent years. The expanded distribution of non-native species have adverse effects on ecosystem function, social economy and human health while they lead to biodiversity reduction which is aimed to address by the policy targets of the EU Biodiversity Strategy 2020 and alteration of landscape structure. The aquatic systems can be invaded by invasive species through physiological characteristics such as deep roots, high biomass and evaporation which create unsafe irrigation and drinking water, lower water quality, flood risk, soil attributes alteration (e.g. increased soil erosion, decreased water holding capacity), economic loss and human health problems. Due to complex relationship between climate change, human health and diversity, biodiversity loss which is induced by invasion alters temperature and other climate factor that indirectly strive adverse impacts on human wellbeing. Besides, anthropogenic activities (e.g. eutrophication), rapid coastal urbanization, globalization and accelerating international trades lead to main changes concentration of alien species especially in Mediterranean Sea. Various health symptoms such as gastrointestinal disorders like nausea, diarrhea, vomiting and neurological and muscular conditions are attributed by invasive species. Many studies were indicated the negative impacts of invasive species on human health related to stinging, poisoning and intoxication like *Osteichthyes*, *Cnidaria* and *Echinodermata*. On the other hand, some alien or cryptogenic species were recorded as positive impacts on human health especially in pharmaceutical industry as biomolecule. A sulfated polysaccharide that is known as anticoagulant, is extracted by the sea hare *Bursatella leachii* which is an invasive species in the Mediterranean Sea. Therefore, the fundamental aim of this review is shedding light in several perspectives on the environmental and health impacts of invasive alien species worldwide.

Key words: Invasive alien species, human health, environmental impacts, marine.

Identification of non-native freshwater fishes in Turkey's Mediterranean brackish water systems and assessment of their potential threats to the native fish fauna

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The Mediterranean region of Turkey has many important lagoon lakes and rivers, and their fishery resources play an important role in the local economy and food provisioning. The natural brackish water systems in Turkey over the last century has been greatly changed as a result of human interventions. Native fish communities in brackish water systems have come under increasing stress due to overpopulation settlements along the coasts, water engineering projects, pollution, overfishing, and the introduction of alien fish species. More than 30 freshwater fish species introduced for different purposes have been reported in Turkey. Despite the wide distribution of non-native species in the inland water systems of Turkey, knowledge about the distributions of these species in brackish water systems is rather limited. This research aims to analyze the occurrence, distribution and potential risks of non-native fishes in the Mediterranean brackish water systems. The study was carried out in brackish water systems along the entire Mediterranean coast of Turkey between November 2014 and June 2017. A total of 15 localities were repeatedly surveyed. Six non-native freshwater species from five families were identified. These species are *Carassius gibelio*, *Pseudorasbora parva*, *Coptodon zillii*, *Oreochromis niloticus*, *Gambusia holbrooki*, and *Oncorhynchus mykiss*. The non-native fish species composition and assemblage differed between the studied locations. The most widely distributed non-native fishes were *G. holbrooki* and *C. gibelio*. Brackish water systems should be closely monitored for alien species and measures should be taken for the prevention of new introductions and the control of already establish populations.

Key words: Alien fish, endemic fish, endangered fish, fish assemblages, functional guilds.

The impact of climate change and invasive alien weeds on biodiversity of Pakistan

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Pakistan is one of the world's most climate-sensitive countries, ranking 8th on the list of countries most vulnerable to climate change. A number of facts over the previous few years point to a deteriorating climatic scenario, including rising average temperatures and higher rainfall variability across the nation. In addition, the frequency of climate-related calamities like floods, droughts, heat waves, etc. has grown recently. In the current review, we discuss the impacts of climate change on invasive plant species; a serious threat to agricultural productivity and biodiversity. Invasive plant species are estimated to cost the world's economy \$400 billion annually. The annual cost of invasive plants was calculated to be US\$ 34.7 billion in the USA alone. More than 175 million Euros are spent yearly on Japanese knotweed management in the UK. It is estimated that invasive plants cost the world's wheat, maize, and rice crops \$96 billion per annum in output losses of 16%. Unfortunately, due to climate change, tourism, and commerce, invasive plant species are rapidly spreading throughout the world and having a greater impact. Given the current threat that invasive plant species pose to the environment, agriculture, and public health, it is extremely important to comprehend the likely impacts of climate change on invasive plants' abundance and distribution in Pakistan. One of the main threats to agriculture and biodiversity is invasive plants, but due to the changing climate, managing this threat will become more difficult in two ways. Firstly, the suite of weed species will change and secondly, some weeds will become more invasive. Weed management is greatly hampered by the emerging exotic weed flora. Weeds have evolved unique features in response to the shifting environment and have successfully adjusted to the current circumstances. Due to their resistance to herbicides and conventional weed control methods, several ecotypes of weeds are posing a serious threat to agricultural productivity and weed management. The parthenium weed is out of control and is harming Pakistan's economy. Our overall objectives are to start a synthesis of prospective effects on productivity, to identify pivotal research areas that can be investigated in future research, and to give agriculturists a scientific solid basis to enable them to come up with adaptation options for invasive plant species and climate change as a means of preserving our valuable biodiversity and food security.

Key words: Climate change, invasive alien weeds, impacts, biodiversity, Pakistan.

***Eucalyptus* L'Hér. sp. pl. (Myrtaceae) naturalization and potential threats for Mediterranean ecosystems in Türkiye**

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Eucalyptus L'Hér. sp.pl. are non-native tree species commonly used, during 20th century, in afforestation/reforestation plantings in Turkey for the pulp industry. The most commonly used species are *Eucalyptus camaldulensis* Dehnh., *Eucalyptus globulus* Labill., and *Eucalyptus grandis* W.Hill ex Maiden. Today, these species have naturalized into natural habitats in the planting areas. This process implies a threat to ecosystems and habitats in the Mediterranean region of Turkey, which is the richest in terms of biodiversity. This is particularly the case of rare forest ecosystems and habitats found in riparian, swamp forests and dunes. *Eucalyptus camaldulensis* which was planted in the Mediterranean region in the past, causes water loss and soil drought, threatening these sensitive ecosystems. For the southwestern Mediterranean region of Turkey and the Eastern Aegean Islands, the habitats of the tertiary relict tree, *Liquidambar orientalis* Mill. in swamp forests and riparian are under the invasion threat of *Eucalyptus camaldulensis*. The habitats of sweetgum trees that are threatened by eucalypts should be spatially localized and mapped, and eradication of *Eucalyptus camaldulensis* should be considered a priority action in combination with ecological restoration activities in the framework of dedicated management plans. Furthermore, we suggest that these areas should be declared *in-situ* conservation areas for *Liquidambar orientalis*.

Key words: *Eucalyptus* sp. pl., threat, *Liquidambar orientalis* Mediterranean ecosystems, Türkiye.

TOPICS 5 & 6: INVASIVE ALIEN SPECIES PREVENTION AND MANAGEMENT; MANAGEMENT AND SHARING OF IAS DATA

Early detection and rapid eradication, surveillance systems; risk assessment and horizon scanning; control and containment measures; restoration of damaged ecosystems; education, citizen science, strategies, policy and legislation; IAS networks and information systems, databases, data planning and management

**Allelopathic activity of *Digera muricata*, against two weeds,
Avena fatua and *Melilotus indicus***

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Avena fatua and *Melilotus indicus* are noxious weeds in Pakistan and many other countries. Synthetic herbicides are available to control these weeds but these herbicides have negative impacts. Eco-friendly natural herbicides obtained from plants is a better alternative to synthetic ones. Herein, we reported the identification of two herbicidal compounds from chloroform extract obtained from *Digera muricata*. The chloroform extract was initially tested on the germination and early growth of two weeds; *Avena fatua* and *Melilotus indicus* as well as wheat at two concentration levels (2 and 1 mg/mL) where a significant decline in % age germination and growth of both weeds was observed. Among the 8 different fractions obtained using different chromatographic techniques, fractions 2 and 7 were found to be phytotoxic to both test weeds. The herbicidal efficacy was tested at 200, 150, 100, 50, 25 ppm. These two fractions were further purified on Reversed Phase High Pressure Liquid Chromatography (RP-HPLC). Fraction 2 yielded 3 sub-fractions (2A, 2B & 2C), while, fraction 7 yielded 2 sub-fractions (7A, 7B). Fraction 2B caused 43%, 53%, and 57% decline in seed germination, shoot dry weight, and root dry weight of *A. fatua*, while, these values against *M. indicus* were 50%, 81%, 84%, respectively. Fraction 7A caused 25%, 36%, and 42% decline in seed germination, shoot dry weight, and root dry weight of *A. fatua* while these values against *M. indicus* were 35%, 62%, 69%, respectively, at 200 ppm conc. The herbicidal activity of selected active fractions was compared with commercial herbicide where there was 61% and 50% reduction in seed germination of *A. fatua* and *M. indicus*, respectively, at 200 ppm conc. Reductions caused by herbicide on the growth of *M. indicus* were also comparable with fraction 2B. The herbicidal effects of these two fractions were found nonsignificant against wheat. Fourier Transform Infrared Spectroscopy (FT-IR), elemental analysis (C,H) and Nuclear Magnetic Resonance Spectroscopic analyses of these two fractions depicted the presence of quercetin (Fraction 2B) and β -caryophyllene (Fraction 7A). It was concluded that quercetin and β -caryophyllene isolated from *D. muricata* exhibited toxicity towards both test weeds without harming wheat crop.

Key words: *Digera muricata*, Herbicidal, Phytotoxic, quercetin, β -caryophyllene.

Assessment of invasiveness potential of *Diadema setosum* (Leske, 1778) (Echinodermata: Diadematidae) by the Aquatic Species Invasiveness Screening Kit (AS-ISK)

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The Indo-pacific originated species *Diadema setosum* is distributed in the Red Sea and the east coast of Africa to Japan and Australia. The species was first observed in the Mediterranean in 2006.

The distribution and abundance of the *D. setosum* in the Mediterranean has reached remarkable and undesirable levels. It has drastically negative effects on benthic communities due to the high levels of grazing pressure. In addition, this species is reported to facilitate non-native fish invasion, further confirming the invasion meltdown hypothesis.

Risk screening tools to identify species with a high or low risk of invasiveness are being increasingly used for effective management purposes. Risk screening practices are part of risk assessment systems and are used to estimate a potential invader colonizing a new environment. There are many studies on the invasiveness potential of alien marine invertebrate species with risk identification tools (AS-ISK). Although *D. setosum* is widely spread in the Mediterranean and called as invasive, there has been no evidence-based study of its invasion potential.

In the present work, risk screening of *D. setosum* was carried out using the Aquatic Species Invasive Screening Kit (AS-ISK) for the Mediterranean as the Risk Assessment (RA) area. Basic Risk Assessment (BRA) and Climate Change Assessment (CCA) scores were determined as 24.5 and 36.5, respectively and according to the score determined for MIGs (Marine Invertebrate Groups), it is clear that this species has a high invasion potential compared to its BRA (15.1) and BRA+CAA (14.25) value.

Considering both CCA and BRA scores, they are affected by various factors. While the high climate adaptability, undesirable traits and high invasion potential elsewhere increase the ASK-ISK score, the lack of data on the species tolerance and reproduction decrease.

Key words: AS-ISK, biological invasion, Mediterranean, *D. setosum*.

Risk assessment of *Phytolacca americana* in Romania

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Alien plant species are a pressing concern for the conservation and management of native habitats, as they can disrupt natural processes, decreasing ecosystem services and potentially leading to irreversible impacts. Currently, 37 invasive alien plant species of EU concern pose significant threats to the environment, whilst the list is constantly expanding, with more alien plant species being proposed for inclusion. One such example could be *Phytolacca americana*, an alien plant species spread in many European countries, which may have the potential to exert irreversible damage in the natural environments of the Palearctic Region. Introduced around 1780 as an ornamental and tinctorial plant, *Phytolacca americana* has spread rapidly in Romania and was later assigned as an invasive species. Our study aims to assess the invasion risk of *Phytolacca americana* in Romania based on the data collected within the project “Adequate management of invasive species in Romania” 2014+ 120008, over a three year-period. The parameters that we considered within our analysis included population size, the preferred habitat it currently occupies, as well as the environmental variables which favour its growth. Our results showed that although the species has a widespread distribution across Romania, the highest frequency and abundance were recorded in its southern region, with strong preferences for anthropogenic habitats. The many occurrences recorded within the protected areas show that *P. americana* has already entered natural habitats. Based on our observations regarding the species’ environmental preferences, we consider that *P. americana* has the potential to further spread throughout the country, in various habitat types. Further management procedures for controlling the spread of the species in natural and semi-natural areas may be necessary to be implemented.

Key words: Invasive plant species, ornamental, distribution.

Use of ecohydrological approach in controlling invasive species: A case study in Acıgöl groundwater dependent ecosystem

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Water dependent ecosystems in general and the Groundwater-Dependent Ecosystems in particular function on the basis of two interacting subsystems: hydrology and biology. According to the ecohydrological approach, the interrelation between hydrology and biology is functional, and should be considered in managing ecosystems. Ignoring one results in failure of protection.

The severity of impacts of water resources management on groundwater-dependent ecosystems is gradual. Based on the response of the ecosystem to a stress, its status can be described in four main stages, namely, resilience/elasticity, fragility/vulnerability, strain/plasticity and destruction. Numerous cases have shown that the system is resilient and can recover only when it is in the first (elastic) stage. In this case, the elasticity of the ecosystem where it is resilient against stresses needs to be defined quantitatively. A quantitative prediction of the response of the ecosystem is essential and that it can best be achieved by applying numerical methods, as demonstrated on a case study in Acıgöl Groundwater Dependent Ecosystem, invaded by an alien species *Gambusia holbrooki* (The Eastern Mosquitofish). The freshwater ecosystem that exists along the southeastern edge of a hypersaline Acıgöl lake in western Turkey, forms habitat for *Anatolichthys transgrediens*, a critically endangered fish species. The freshwater is supplied by the groundwater issuing from the carbonate rock mass bordering the lake along a major fault. A previous study has revealed that alteration of the habitat is to the advantage of the invasive alien species. The native *A. transgrediens* is much less tolerant to a) contraction of the areal extension, b) flow regime of spring waters feeding the system, c) loss of biohydromorphological complexity of the habitat and the saline water-fresh water dynamics prevailing in the aquatic system. These factors suggest that controlling the invasive species, above all, requires maintaining the status of the natural ecosystem to which the native species has been adapted.

This paper demonstrates the use of conceptualization of the ecosystem and application of numerical methods to better understand and predict the response of the system to a stress, which in turn would help develop an efficient control strategy against alien species.

Key words: Ecohydrological approach, Mosquitofish, Acıgöl toothcarp, control of invasive species.

Evaluation of pufferfish catching incentive model in Türkiye

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Pufferfish is known as invasive alien fishes in Mediterranean since 2000s. Because of its damage both ecosystem and fishers, Ministry of Agriculture and Forestry of Türkiye has been launched a catching incentive model in 2020 and still is being continued. This study was done October 2022 as online in order to determine effects of the pufferfish incentive model and to make some improvement of the incentive. In this study, 211 voluntarily fishers who licensed fishing vessel owners and engaged in puffer fishing activities in Adana, Antalya, Aydın, Balıkesir, Çanakkale, Edirne, İzmir, Hatay, Mersin and Muğla provinces where located Mediterranean and Aegean Sea coast, were online surveyed. 88.6% of the fishers think that the pufferfish incentive model is beneficial, and 91.9% of them want the incentive should be continued by the Ministry, while 89.1% want other marine invasive species to be included in the support. One of the most important outputs of the survey conducted for the support model is that it reveals the change in the population of invasive puffer fish species in a short time, and 39.8% of the respondents stated that they observed a decrease in the puffer fish population. Because of the pufferfish contain very high levels of TTX toxin, 74.9% of them want to stay away from pufferfish catching. In addition, the participants expressed their demand to change the practice of paying different price according to the type and to pay the same amount for all type.

Key words: Pufferfish, incentive, fishers, invasive.

Removal of the invasive terrapin *Trachemys scripta elegans* from a protected site in Bulgaria – risk assessment and future perspectives

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In this study, we aimed to assess the risk posed by the Red-eared slider (invasive alien species of Union concern) to the native European pond turtle in the natural reserve “Velyov Vir” – a protected site in South-Eastern Bulgaria and important habitat for the native species. We estimated the population ratio of native to invasive turtles by means of using baited funnel traps in August and September 2022. Native turtles were individually marked with a file and released at the site of capture, while invasive terrapins were removed and humanely euthanized by freezing. A total of 17 sliders and 31 individual *Emys orbicularis* were captured and measured; 14 *E. orbicularis* were recaptured (some individuals up to six times), for a total of 60 native turtles. All turtles were adults, with the exception of two Red-eared sliders and one European pond turtle. We used the capture-mark-recapture data for the native turtles to calculate their population size in the free-licence software MARK with the Jolly-Seber model for open population. The model with lowest AIC was with constant survival rate, capture probability and probability of entrance, and the estimated population size was 38 ± 4 . This indicates that the ratio of native to invasive turtles was almost exactly 2:1, and possibly lower. As expected, the invasive turtles were larger than the native ones, with SCL = 145.65 cm ($51.32-221 \pm 48.13$) and SCL = 127.27 cm ($43.21-156.8 \pm 19.34$), respectively (Mann-Whitney U Test $p = 0.02$). Results are concerning in terms of both population ratio and the presence of juvenile Red-eared sliders, which indicate successful breeding in an isolated area with restricted access (i.e., the sliders could not have been released there, but most likely reached it by the nearby Ropotamo river). “Velyov vir” is declared for the protection of a species of water lily that can be damaged by the larger, more aggressive sliders. On the positive, funnel traps appear to be reliable measures for physical removal of sliders in protected areas that cannot be drained or otherwise altered in order to eradicate the invasive species – however, concentrated and sustained effort is required.

Key words: Invasive species, management, population, Red-eared slider, wildlife reserve.

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Soil Seed Bank of Ragweeds under different management systems

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In Serbia *Ambrosia artemisiifolia* L. (common ragweed) was first recorded in the middle of the last century in the area of the Pannonian Plain and has since then spread invasively towards the southern parts of the country. On the contrary, another non-native naturalized ragweed species, *Ambrosia trifida* L. (giant ragweed) has so far been localized in only a few places in central Bačka. In the undisturbed soils, the annual seed production of *A. artemisiifolia* germinates to in high percentages in early following spring, while soil tillage incorporates seeds into deeper layers of the soil and promotes long time persistence of ragweed seeds up to 40 years. Seed of *A. trifida* has a transient soil seed bank and short viability which explains why this alien weed species does not spread as *A. artemisiifolia*. Soil seed bank is important element in order to predict the dynamics of ragweed populations' occurrence and creation of management strategies. For that reason soil seed bank of ragweed is predicted in different management system: (i) monoculture of maize, winter wheat or soybean, (ii) 2-year crop rotation (winter wheat-maize) with and without chemical fertilizer and (iii) 3-year crop rotation (winter wheat-soybean-maize) unfertilized or fertilized with manure or chemical fertilizer. This study was conducted in the Institute of Field and Vegetable Crops, Novi Sad (45°19'N, 19°50'E). Soil was sampled over three years at the depth of 40 cm soil profile and soil seed bank was estimated by physical extraction. Seed bank of *A. artemisiifolia* was the smallest in maize (120 seed m⁻²) followed by winter wheat (225 seed m⁻²) and soybean (1758.3 seed m⁻²). In 2-years crop rotation with mineral fertilizer seed bank was smaller (337.5 seed m⁻²) compared to an unfertilized system (1683.3 seed m⁻²). In 3-year crop rotation seed bank was similar in systems where mineral fertilizer (1413.6 seed m⁻²) and manure (1537.5 seed m⁻²), whereas it was the largest in unfertilized management systems (3866.6 seed m⁻²). *A. trifida* seed's presence was only determined in unfertilized 3-year crop rotation (35 seed m⁻²). This explains that ragweed occurs more often in row crops and better adapts to poorer habitats (stressful conditions) than a cultivated plant, so it acts as a strong competitor where other species are suppressed, therefore impacting the change of diversity.

Key words: Seed bank, common ragweed, giant ragweed, crop rotation, monoculture, fertilization.

Acknowledgements: The research was supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia, grant number: 451-03-68/2022-14/200032 and 451-03-68/2022-14/200116.

Seeds of *H. sosnowskyi* from terminal and satellite umbels developed under gibberellic acid treatment, germinate differently

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Sosnowsky's hogweed (*Heracleum sosnowskyi* Manden.) is an invasive plant included in the list of Invasive Alien Species of Union concern. It is well established in seven EU countries where outcompetes native species and reduces local biodiversity. Moreover, the species is harmful for humans in contact with their sap. The hogweed spreads only by seeds and produces them once in its lifetime thus, the fate of the population depends on the maturation of viable seeds. It is known that the plant hormone gibberellin plays key role in fruit development and can induce parthenocarpy. To figure out the impact of gibberellic acid (GA₃) in dry-fruit development and seed germination of Sosnowsky's hogweed, we applied different concentrations (15, 150 mg/L) of exogenous GA₃ onto flowers before their anthesis in terminal and satellite umbels in 2018–2020-year growth seasons. Results show GA₃ treatment significant effect on decreased width and weight of Sosnowsky's hogweed seeds harvested from both order of umbels. However, after treatment by lower 15 mg/L concentration such effect within terminal umbel fruit samples has not observed. X-ray analysis revealed that application by GA₃ induced seedless fruit development: in 2018 season the hormone effect was striking it diminished well-developed seed fraction by 97%, whilst seeds collected in following two seasons were not malformed. Furthermore, seed germination in field revealed GA₃ impact to disrupt invasive Sosnowsky's hogweed seeds germination. In 2018 season experiment after 150 mg/L GA₃ treatment the germination of seeds from satellite umbels dropped by 99%, despite well-developed seeds in 2019 and 2020 seasons seed germination decreased by 60% and 31%, respectively. Surprisingly, lower 15 mg/L GA₃ concentration reduced more seed germination by 38% and 71% within seeds collected from terminal and satellite umbels respectively. Our findings show that application by exogenous GA₃ significantly impacts Sosnowsky's hogweed dry-fruit morphometry, it may induce seedlessness of the fruit and disrupts seed germination in field conditions. Thus, it could be assumed that GA₃ could be a possible measure to mitigate the invasion of this nasty plant species. However, further studies are needed to figure out the GA₃ effect for non-target plant species.

Key words: Sosnowsky's hogweed, invasive species, gibberellic acid, seedless fruit, primary inflorescence, secondary inflorescence.

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TOPIC 7: OTHER TOPICS RELATED TO IAS

General aspects related to the quality of the aquatic and terrestrial environments and associated biological communities, which may influence the introduction and spread of IAS, as well as the application of prevention and management measures; forest fires and IAS; mucilage and IAS

The effects of fipronil on the freshwater snails

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Most freshwater bodies around the world have been contaminated by industrial, agricultural, and domestic wastes. Fipronil (C₁₂H₄Cl₂F₆N₄OS; CAS No: 120068-37-3), one of the insecticide types, has been widely applied in agriculture and veterinary medicine. It is known that fipronil has a persistent residue in the aquatic environment and adverse effects on non-target organisms. However, slight information is known about its effects on freshwater snails. Therefore, the present study was investigated the oxidative stress effect of fipronil on these animals. The freshwater snails (*Viviparus contectus* Millet, 1813) were collected from Eğirdir Lake (Isparta, Turkey). After acclimation period in the laboratory conditions for two weeks, snails were exposed to fipronil at concentrations of 1, 10 and 100 mg/L for 7 days. There were control and solvent control groups. The experiments were carried out duplicate. Each aquarium contained ten snails. The oxidative stress was investigated by using glutathione assay. Compared to control groups and other fipronil applied groups, the glutathione activity significantly increased in the 1 mg/L fipronil applied group (p<0.05). The present study concluded that fipronil can induce oxidative stress in terms of glutathione activities of aquatic animals and the *V. contectus* can be used as good bioindicator model species in terms of assessment of the quality of water.

Key words: *Viviparus contectus*, freshwater snails, Eğirdir Lake, fipronil.

Modification studies to reduce the impact on the benthic ecosystem of beam trawling, which is predominantly used in sea snail (*Rapana venosa*) fishing

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This study was carried out in 2014 on the coasts of Samsun, which constitutes the Yeşilirmak and Kızılırmak shelf areas, where rapana fishing is the most productive, representing the Southeastern Black Sea coast. In Black Sea, the rapa whelk fishery by beam trawls is banned in summer period. Even though it is illegal, the fishers continue to fish and obtained the highest catch throughout a year in this period. All experimental studies carried out to test the modified beam trawl pointed out that it is possible to reduce the fishing impact on benthic ecosystem by using sledges and removing the steel wire stretched on the mouth of the gear in traditional beam trawl. Additionally, reduction of the fuels needed can be achieved by this modified type of beam trawl. Therefore, a double benefit can be provided in terms of economy and ecology. In case of the use of modified gears, the impact on benthic habitat will be reduced during period which coincides with the reproduction and the recruitment period of some fish species. It is determined that especially the modified gear of sledges without steel wire has a significant reduction in bycatch quantity. The modified gear reveal a significant effect in bycatch composition by means of species variety

Key words: Traditional beam trawl, modified beam trawl, rapa whelk, fuel consumption, steel wire, sledge, benthic impact.

POSTERS

TOPIC 1: INVASIVE ALIEN SPECIES TRAITS AND TRENDS

Invasive alien species introduction and spread, biological and ecological traits; characteristics of recipient environment; invasive alien species and climate change; viruses, bacteria and other small organisms as IAS

Current and predicted distribution of the invasive and potentially toxic species *Raphidiopsis raciborskii* (Cyanoprokaryota, Nostocales) in stagnant water bodies in Bulgaria

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Raphidiopsis raciborskii (Woloszynska) Aguilera et al. is cyanobacterial species with high invasive potential, thanks to which it reached cosmopolitan spread in less than a century. It is currently established on all continents except Antarctica. In the temperate climate of Europe, *R. raciborskii* has been reported in many countries, but there is still a lack of detailed information on the current status of its distribution in Bulgarian lakes, as part of the southeastern distribution range in Europe. The analysis of data from 122 lakes in Bulgaria, studied for 13 years' period (2009–2022) show a significant increase of the number of lakes occupied by *R. raciborskii* and its contribution to the total phytoplankton biomass in the last decade. We found the species in 33 lowland lakes (up to 324 m a.s.l.), representing ¼ of all surveyed and colonization of new 14 localities. The species has successfully adapted and dominated in 9 lakes, causing a bloom in 7 of them. We applied two different algorithms: Generalized Linear Model (GLM) and Generalized Boosted Models (GBM) to evaluate the importance of different variables, including bioclimatic and local variables, for the presence of the species and also created species distribution models (SDMs) to predict the future occurrence of the species in suitable habitats. We found that the most important predictors for the occurrence of *R. raciborskii* were the maximum temperature of the warmest month and the water transparency. The other variables: pH, TP, TN, max depth, and conductivity had the lower predictive power. The most suitable habitats for *R. raciborskii* development were small-area, shallow polymictic or medium-deep lakes, with low transparency in areas with high summer temperatures. The SDM model predicted high probability of occurrence for four lakes, where the species was not found, but they are at risk of future invasion. Future colonization of lakes above 500 m a.s.l. is also likely. In areas with a suitable climate, with low probability of occurrence of *R. raciborskii* are large and deep dams, with high water transparency and macrophyte-dominated lakes.

Key words: *Raphidiopsis raciborskii*, SDMs, distribution, climate change.

New data on the distribution of the Far-Eastern shrimp, *Macrobrachium nipponense* (Malacostraca: Palaemonidae) in the southwestern Ukraine

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The Far-Eastern shrimp, *Macrobrachium nipponense* (De Haan, 1849) (Malacostraca: Palaemonidae) is known as an invasive alien species in several localities in Ukraine and Romania. We studied the distribution of this shrimp in the Lower Danube and Dniester Estuary in southwestern Ukrainian region during June-September 2022. In the Lower Danube the shrimp was sampled using 10-mm mesh fyke-nets installed for 8-12 hours in three localities near the cities of Vylkove and Kiliya (Mashenka Branch, Solomonov Branch and Bazarchuk Bay). In total of 456 shrimps (3285 g total weight) were caught by 174 fyke-net installations. 72.3% of the catches were males, 25.7% were females, and 2.0% were juveniles. In addition, 6 trawl samplings were provided in the Kiliya Branch (21-17th km) and Pryamiy Branch (24-22th km), where only 25 shrimps (90.8 g total weight) were caught. In the Dniester Estuary the 6-mm mesh fyke-nets were installed two times and 24 shrimps (90.8 g total weight) were sampled. The male/female/juvenile percentage was equal, 33.3%. The data from fishermen catches in the Dniester Estuary confirms about 10-15 shrimps (maximum 40) per a fyke-net per diem. Taking into account the current spread of this species in the southwestern Ukraine, and the growth of its population density, the shrimp could be a perspective commercial fisheries species.

Key words: Dniester Estuary, invasive species, Lower Danube, Palaemonidae, range expansion.

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Is zebra mussel a potential threat for native fauna in Alpaslan II Reservoir watershed

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Zebra mussel, *Dreissena polymorpha*, is considered as a harmful invasive epibiont species for hydroelectric and nuclear power plants due to its rapid infestation on the water supply systems clogging pipes, hydraulic structures in freshwaters. Investigations on zebra mussels problems are focused on technical and economic damages and, there are limited ecological assessments about zebra mussel on the native fauna.

Alpaslan II Dam is recently constructed on Murat River, a tributary to the Euphrates River for mainly power generation and irrigation purposes. During the construction period (2004), zebra mussels were predicted to pose a technical risk for the HEPP and precautions to be taken were evaluated. However, after impoundment period, we observed dense populations of zebra mussel both in the upstream and downstream sections of the Alpaslan II reservoir.

In the present study mussel samples were collected between 2020 and 2022. Physical and chemical parameters of water including temperature, pH and salinity that may be affected were measured during the field studies. We observed co-occurrence of zebra mussel and native bivalve *Unio* sp. in the same habitats both in upstream and downstream of the reservoir, and the abundance of zebra mussels was markedly higher than *Unio* sp. We measured water temperature between 5.2-9.4°C in the downstream and 6.8-17°C in the upstream sections. Although the threshold temperatures for larval development and reproduction of zebra mussel on the Euphrates River are reported to be 8.5°C and 11.5°C, respectively, and high water velocity is considered a limited factor for zebra mussel colonization, our results suggest that the zebra mussel appears to be able to reproduce at lower temperatures and high flow especially in the downstream. In the literature, there are some evidence about negative impacts of zebra mussel on the population and size of some fish and other aquatic species. The high colonization success of the zebra mussel in the Alpaslan II reservoir watershed may be considered a potential threat for the native fauna. However, detailed observations and analysis on ecological impacts of the zebra mussel should be carried out.

Key words: *Dreissena polymorpha*, *Unio* sp., colonization, Murat River Basin.

***Acanalonia conica* (Say, 1830) (Hemiptera: Acanaloniidae) –
a new alien species in Bulgaria**

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A new alien species, *Acanalonia conica* (Say, 1830), is found to occur in Malko Tarnovo, Strandja Mountain, Southeastern Bulgaria. It is the first record for this species in Bulgaria. The species is native to North America. In Europe it has been registered for France, Italy, Switzerland, Hungary, Slovenia, Romania and Serbia. Although the species has not been reported for Turkey, we assume that it was introduced from Turkey. This is based on the close proximity of the site to the Bulgarian-Turkish border, to the international road and intensive cross-border transport, as well as iNaturalist/GBIF data on the presence of the species in Istanbul. *Acanalonia conica* is the first member of the family Acanaloniidae in Bulgaria. Established habitats, food plants and eggs laid are also briefly presented.

Key words: Plant-hoppers, alien species, Europe, Bulgaria, Turkey, new records.

Invasive species and protection of freshwater native biodiversity in Georgia

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Within the 36 "hot spots", as being the richest and at the same time most threatened reservoirs of plant and animal life on Earth, defined by the Conservation International, territory of Georgia included in two - The Caucasus and Iran-Anatolian hotspots. Invasive species have a special risk in such regions, as they can have a large-scale negative impact on local biodiversity.

The papers published during 2017–2022 on invasive and alien species in Georgia were analysed, as were the data from the implemented international projects. Our focus was on fish, mollusks, and crustaceans; an initial inventory of non-native fish species was done, and 23 non-native extant and horizon fish species were screened for their risk of invasiveness under current and predicted climate conditions for Georgia. Four new freshwater invasive mollusks species were detected.

In some cases, alien species have had a negative impact on local species and played an important role in habitat modification. The Georgian National Biodiversity Strategy and Action Plan (2014, 2020) prioritised the research and monitoring of invasive alien species (IAS), however, no any significant progress has ever been made. Invasive alien species are the hidden and underappreciated treats to local biodiversity and economy and the urgent actions are needed to unravel the alien species introduction tendencies, evaluate existing and potential risks, increase public awareness and plan monitoring/mitigation measures. Effective measures for the control of introduction/ distribution of invasive species should be activated, as well as inventory and monitoring of IAS.

Key words: Invasion, biodiversity, risk assessment, monitoring, Georgia.

Phenotypic plasticity of *Arundo donax* L. (Giant reed) in Mediterranean ecosystems

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Phenotypic plasticity is the ability of an organism to show different appearances in response to the environment in which it is located. This plasticity allows the plant to adapt to specific circumstances, thus favouring its development and local adaptation to specific environmental conditions. This flexibility is the key to many of the alien species that colonize new ecosystems presenting invasiveness behaviour. In the research presented, we have studied different populations of the plant *Arundo donax*, an alien species in the Iberian Peninsula that presents invasive behaviour, especially in Mediterranean riparian ecosystems where it reproduces clonally. The objective of the experiment was to study the phenotypic plasticity that present the most representative populations of the Iberian Peninsula to determine the relationships that can exist between morphological traits that are expressed and the environmental characteristics of each studied environments and to what degree. This allows us to clarify what are the features that allow adapt and optimally to colonize different environmental situations to which the plant is subjected, delving into their evolutionary ecology and biological fitness. The results have shown that the species is able to adapt favourably to a wide range of environmental conditions on the Iberian Peninsula, showing significant differences in the expressed morphological features (height, diameter and density growth), being able to withstand various water stress conditions in its early stages and high concentrations of nutrients.

Key words: Evolutionary biology, exotic, invasive species, Poaceae, adaptation.

**New fishes in the fauna of the Sukhyi Lyman,
North-Western Black Sea, Ukraine**

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The Sukhyi Lyman is a brackish water bay southward from the City of Odessa, Ukraine. This is an estuarine system of two small steppe rivers, Akkarzhanka and Dalnyk, which has unique hydrochemical conditions. The central and south-eastern parts of the estuary are under the influence of the Port of Chornomorsk, almost lost the fishery importance because of intensive anthropogenic pressing. The hydrochemical regime of the Sukhyi Lyman is under the strong influence of the neighboured sites of the sea, therefore has typical for the North-Western Black Sea salinity, with exception of the desalinated north-western part of the estuary. The fish fauna of this water body at present time consists of up to 58 species. During the last two decades (1997-2021) three new fish species were registered in the fauna of this water body. The North American freshwater pumpkinseed sunfish, *Lepomis gibbosus* (Linnaeus, 1758), occurred in the central part of the estuary (46.349941N, 30.640842E) in 1997. The fish was found in the macrophyts at the 1-m depth. The Boreal-Atlantic species, rock goby, *Gobius bucchichi* Steindachner, 1870, were caught in the lower part of the estuary in June 1998 (44.334356N, 30.663461E) which is first registration of this fish in the North-Western Black Sea. In September 2021, during a snorkelling observations of the bottom dwelling fauna, an individual of the Atlanto-Mediterranean peacock blenny, *Salaria pavo* (Risso, 1810), was pictured at the depth 0.4 m (46.332944N, 30.661555E). It was observed at the mussel bed on the rocky bottoms. The presence of the marine port and intensive human usage of the water body makes the perspectives of the further Mediterraneanisation and colonisation of the Sukhyi Lyman by invasive alien species.

Key words: Invasive species, Mediterraneanisation, brackish waters, pumpkinseed.

The parasite of the big-scale sand-smelt (*Atherina boyeri*) in native and acquired range in Ukraine

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The big-scale sand-smelt (*Atherina boyeri* Risso, 1810) (Actinopterygii: Atherinidae) is one of the neolimnetic component in the Ukrainian fish fauna. This is an Atlanto-Mediterranean species, which was recorded as introduced in several freshwater localities, i.e. Santo André lagoon (Iberian Peninsula) and Lake Trichonis (Greece), Lake Trasimeno (Italy), central Anatolia (Turkey), Kakhovka and Dnipro Dam Reservoirs (Ukraine). We studied the parasites of this fish in its native range in the Danube Delta, Gulf of Odesa and Dnieper estuary, and compared this with the acquired range in two reservoirs of the Dnipro River (Kakhovka and Dnipro dam reservoirs). The parasite fauna of the sand-smelt comprised 11 parasite species, including of one microsporidian, one ciliate, one monogenean, one cestode, 4 digeneans, one acanthocephalan and two nematode species. No parasites occurred in the Dnipro Reservoir. The parasite community of the big-scale sand-smelt in the natural range is higher, than in the places of expansion. Thus, inside the natural range (the Gulf of Odessa, Danube delta, Cape Adzhivask) it was from 5 to 8 species. In contrast, in the places of expansion the parasite community was very poor, presented by two sporadic species (Kakhovka Reservoir), of the parasite were absent (Dnipro Reservoir). This is in correspondence with the ‘enemy release hypothesis’, when the non-native species escape from parasite in new habitats, which force them to establish the stable population. This trend is commonly observed in the non-native fish species which invaded the freshwater ecosystems, as well as in marine waters.

Key words: Neolimnetics, Black Sea basin, Dnipro River, range expansion, enemy release.

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***Corytucha arcuata* (Say, 1832) (Heteroptera, Tingidae) in alpine habitats from the Romanian Carpathians**

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The species of the genus *Corytucha* (Heteroptera, Tingidae) – *Corytucha arcuata* and *Corytucha ciliata* are invasive aliens for Europe, both species expanding their range very rapidly in the last 10 years. The first species - *C. arcuata* - is found on oak species, and the second - *C. ciliata* - mainly on plane trees. Both species are native to North America, and after being introduced to Western Europe (Italy) they spread to most of Europe. In Romania, both species experienced a rapid expansion, especially after 2015. *Corytucha arcuata* was reported for the first time in 2016, and in an extremely short time it spread over the entire surface of Romania. In 2020, it was present everywhere, in important populations. Its presence in areas with oak forests is not surprising, but, the species proved capable of surviving in alpine meadow and pasture habitats, even at over 2000 m altitude. In 2020, we encountered this species for the first time in the area of the Făgăraș Mountains, both in valleys and in pastures at altitudes of over 1800 m. In the same habitats, we also found it in 2021 in the Făgăraș Mountains and in the Apuseni Mountains, in isolated specimens, and in 2022 we encountered it in the insect associations in the area of the glacial lakes and the peaks of the Retezat Mountains. The presence of this species into alpine habitats can be attributed to a spread with the help of the wind, but the large number of specimens identified in such areas raises another problem, namely that of adaptation to other host plants. In the Făgăraș Mountains and in the Apuseni Mountains, the species was identified in areas where oaks are absent. In the Retezat Mountains, it is also present in alpine meadows, being identified on moss species. Taking into account the differences in altitude compared to the areas where the oak usually grows, *C. arcuata* proved its ability to adapt to different conditions, and the study of populations in mountain areas represents more than a scientific curiosity.

Key words: *Corytucha arcuata*, expanding range, alpine area.

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**New data on the presence of *Sceliphron curvatum* (F. Smith, 1870)
(Hymenoptera, Sphecidae) in Romania**

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Sceliphron curvatum is one of the species of hymenoptera species from the Sphecidae family that build their nests out of mud for their larvae, which have recently spread in Europe as well. In the last 20 years, the fauna of Europe has been enriched with at least seven alien species of sphecid wasps, both of Asian and North or Central American origin. *Sceliphron cementarium*, of North American origin, *Sceliphron curvatum* and *Sceliphron deforme*, both of Asian origin, were added to the only European species of the *Sceliphron* genus - *S. destillatorium*. The same group of predatory wasps, that feed their larvae with spiders or grasshoppers, also include other alien species that were mentioned in last years across Europe – *Isodontia mexicana*, originating in Central America, *Chalybion zimmermanii* and *Ch. californicum* both of North American origin, and *Chalybion bengalense* of East Asian origin.

Sceliphron curvatum is a species native to India, Nepal and Central Asia, inhabiting mountainous areas. It was accidentally introduced into Europe, the first mention being from the southeastern part of Austria, in 1979. Later it spread in Europe, also inhabiting mountainous areas. In Romania, it was mentioned only from the north-east of the country, in 2014, although photos of this species have appeared on websites since 2008.

In the summer of 2020 (10.07.2020) a specimen of this species was collected in the north of Arges County, on the territory of ROSCI 0122 Făgăraş Mountains. Two years later, in July 2022, other specimens of *S. curvatum* were identified in the same area – Valea Râului Doamnei and Basa – Zănoguşa – Furfuiescu alpine zone. We appreciate that at least in the area of the Făgăraş and Iezer Păpuşa Mountains this species is present. In other mountain areas where field investigations were carried out between 2020 and 2022 – the Apuseni Mountains, the Retezat Mountains National Park – no specimens of this species have been identified so far.

Key words: *Sceliphron curvatum*, new mentions, Romania.

Acknowledgements: This work was supported by two grants of the Romanian Ministry of Education and Research – CCCDI – EUFISCDI, project number PN-III-P2-2.1-PED-2019-2584, within PNCD III, PN-III-P4-PCE2021-0818 AlpChange – Evaluation of the response of alpine communities to global changes, and by the project Services for monitoring the impact of ecological reconstruction activities on the diversity and abundance of terrestrial arthropods (2021–2024) in the area of ROSCI0122 Făgăraş Mountains, part of the project “Creation of a wilderness reserve in the Southern Carpathians, Romania” (Endangered Landscape Programme), implemented by Foundation Conservation Carpathia.

Prospects for the distribution of the North American species signal crayfish *Pacifastacus leniusculus* in Europe

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In the current context of accelerating climate change and biodiversity erosion, invasive aquatic species are carving out ecological niches in new areas of Europe. This is facilitated by the popularity of some species for aquaculture and aquarist amateurs. As a study case, the signal crayfish *P. leniusculus* (Dana, 1852) has been reported in 28 European territories since the 1960s. This species originated from North America and has been introduced into Europe on purpose to counteract the decline in catch per unit effort of native crayfish species. Until today, the signal crayfish has expanded its range throughout Southern and Central Europe, where it has caused the further extinction of a large number of native crayfish species populations by bringing the crayfish plague, an disease induced by the pathogen *Aphanomyces astaci* (Schikora, 1906), but also by accelerating the deterioration of environmental conditions for other local aquatic species and conflicting reintroduction efforts for species such as the European pond turtle *Emys orbicularis* (Linnaeus, 1758). Using GIS modeling (Maxent software, 25 replicates, test 25%, AUC=0.907), we forecast the shift of the signal crayfish range by more than 500 km to Northern Europe (to the Baltic countries, where this species was already recorded in several localities) by 2050. Out of 35 known factors provided by CliMond database to such distribution shift, the most significant factors were associated with solar radiation – bio23 (radiation seasonality (C of V; percent contribution – 30%; permutation importance – 32%) and humidity - bio35 (mean moisture index of coldest quarter (percent contribution – 17%; permutation importance - 1%). This being said, the signal crayfish is known to be quite sensitive to water quality and, as for most freshwater invasive species, areas in Southern Europe will be less suitable for the signal crayfish compared to areas in the Baltic countries, where humidity will remain at a high level. Thus, using the obtained prediction of trends and threats, it is possible to develop the necessary management plan for the protection of native species in Northern Europe.

Key words: Invasive species, signal crayfish, conservation, GIS-modelling, *P. leniusculus*, freshwater fauna.

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Alien insect species in areas with rich biodiversity in Sofia Municipality

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Sofia is one of the green capitals of Europe. Its territory includes 7 protected areas, which are part of the European ecological network Natura 2000, protected under the Biological Diversity Act, 13 protected areas covered under the Protected Areas Act, and 33 areas with rich biological diversity. As the capital, Sofia is a center of attraction for locals and tourists. The active movement of people and goods, the presence of rich ornamental vegetation, and numerous areas for recreation and tourism in urban and suburban areas are prerequisites for introducing invasive alien species (IAS). The aim of the study was the threat to biodiversity and ecosystem services for areas with high biodiversity posed by IAS to be assessed.

The analysis was made on the basis of published and unpublished data and field surveys of all 33 areas with rich biodiversity in Sofia Municipality during the period September-November 2022.

As a result of the study, it was found that 32 species have been reported as established on the territory of the Sofia Municipality. From them 16 species was detected in 32 of the surveyed areas. All species are associated with the vegetation in the respective areas and their distribution depends on the available vegetation in the respective area. As a result, the parks in the urban area was found to be with the highest species diversity of IAS.

Four species related to *Robinia pseudoacacia* L. – *Obolodiplosis robiniae* (Haldeman) and its parasitoid *Platygaster robiniae* Buhl & Duso, *Parectopa robiniella* Clemens and *Phyllonorycter robiniella* Clemens were detected in low population density in 24 of surveyed areas, followed by *Coptodisca lucifluella* (Clemens) found on *Juglans regia* L. in 14 areas. A decline of populations of *Metcalfa pruinosa* (Say) because of its parasitoid *Neodryinus typhlocybae* (Ashmead) was observed. Outbreak of two species was observed in urban areas only – *Corythucha arcuata* (Say) on *Quercus* sp. in six areas and *Cameraria ohridella* Deschka & Dimic on *Aesculus hippocastanum* L. in nine areas.

Key words: Alien, insects, distribution, capital, Bulgaria.

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**Occurrence of *Cacopsylla pulchella* (Löw, 1877)
(Hemiptera, Psyllidae) in Bulgaria**

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Cacopsylla pulchella is a monofagous species, feeding on the Judas tree *Cercis siliquastrum* L. and probably with Mediterranean origin. In Europe it has been recorded in Albania, Austria, Croatia, France, Greece, Great Britain, Hungary, Italy, Switzerland, Slovenia, Serbia and Ukraine. The presence of the species in Bulgaria is not mentioned in publications concerning *C. pulchella* in Europe and data bases FAUNA EUROPEA, EU-NOMEN, GBIF etc. It seems that information of its presence in Bulgaria is not published yet despite its detection at least 20 years ago (personal communication). In the framework of a monitoring program for alien species of the Faculty of Agronomy in Sofia, a survey for the actual distribution of *C. pulchella* in Bulgaria was conducted in the period May-July 2022.

The species was detected in region of Sandanski, Petrich, Gotse Delchev, Malko Turnovo, Sosopol, Burgas, Varna, Sofia, Pazardzhik and Plovdiv were heavy infested *C. siliquastrum* L. plants were observed in 2022. Single specimens were observed in Troyan.

The large amount of produced honeydew by *C. pulchella* reduces the decorative value of *C. siliquastrum* L. The species was detected in urban areas only and is spreading to the North part of Bulgaria. Most probably the spreading of the species is human mediated.

Key words: Judas tree, distribution.

Acknowledgements: This study was conducted in the framework of the National Science Programme 'Environmental Protection and Reduction of Risks of Adverse Events and Natural Disasters', approved by Resolution of the Council of Ministers № 577/17.08.2018 and supported by the Ministry of Education and Science of Bulgaria (Agreement № DO-230/06-12-2018).

TOPIC 2: VECTORS AND PATHWAYS FOR INVASIVE ALIEN SPECIES INTRODUCTIONS

Analysis, prioritisation, action plans

Waterfowl and wetland birds as a factor of distribution of invasive fish species on the territory of Ukraine

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Modern changes in the composition of the fauna are caused both by global changes in the environment and direct or indirect impact on it by human activity and other living organisms. In particular, expansion of alien animals often bring negative changes and damages to the natural ecosystems of waterbodies. In addition to other pathways, birds of the wetland complex can also contribute to their distribution. Although there is little direct evidence of birds transport fish and their eggs from one waterbody to another, recent publications confirm the survival of some fish eggs, that have passed through the digestive system of some Anseriformes (such as Mallard *Anas platyrhynchos*). Fish eggs can also accidentally attached to the feathers and feet of birds together with fragments of aquatic plants. Most likely, that birds can transport such invasive fish species as Stone moroko (*Pseudorasbora parva*) and Chinese sleeper (*Perccottus glenii*), which now be found in many waterbodies. This process is possible due to seasonal migrations of birds and their local movements to places of feeding and rest. According to our research, we have some indirect data concerning the colonization of waterbodies by these invasive fish species with the help of birds. For example, in the north and west of the country we found these fish species in ponds and lakes isolated from other waterbodies, where fish farming are not carried out and which are difficult for peoples access, but some birds as ducks, herons and others were often observed there. We also found Three-spined stickleback (*Gasterosteus aculeatus*) in fresh waterbodies formed near permanent artesian wells in the southern steppe regions, which also could not get there by watercourses, as they are absent there. There is also a possibility of the spread of biological material Pumpkinseed (*Lepomis gibbosus*) by birds, which, like the previous species, has recently spread quite widely across the territory of Ukraine.

Key words: Invasions, alien fish species, waterfowl and wetland birds, distributions pathways.

Introduced fish species in Romanian alpine lakes: Retezat National Park case study

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Physical boundaries usually separate mountain lakes from downstream habitats, preventing natural fish colonization. Predatory fish have been introduced into various alpine areas to expand recreational fishing in formerly fishless habitats. Their presence impacted native biota, such as macroinvertebrates and amphibians and require important conservation measures.

Established in 1935, Retezat National Park, located in the Southern Carpathians, contains over 50 lakes, representing almost 40% of Romania's alpine lakes.

Several of these lakes were inhabited by native trout (*Salmo trutta morpha fario*), either naturally colonised or from historical introductions. A fish introduction campaign was started after 1960 and lasted for almost 30 years in mountain lakes. Introductions were made with native trout originating from roe transported from Austria, a variety adapted to lake conditions (*Salmo trutta morpha lacustris*). The resulting adults are easier to raise in captivity than the native trout variety, and are more adapted to lake life. In addition, in about 12 of these lakes, were introduced North American salmonids *Oncorhynchus mykiss* and *Salvelinus fontinalis*.

In addition to the official, documented introductions, recently the presence of minnows (*Phoxinus phoxinus*), was reported from at least six lakes with introduced salmonids. Probably they were accidentally introduced as live bait by fishermen.

All these repeated introductions, followed often by local extinctions of the introduced populations, resulted in a mosaic of lakes with a mixture of fish species, interspersed with fishless lakes, providing an excellent study site for assessing fish impact.

Key words: Retezat National Park, fish introduction, alpine lakes, minnow, salmonids.

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Prevalence and pathways for introduction of small hive beetle (*Aethina tumida*)

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The exotic alien species *Aethina tumida*, commonly known as the small hive beetle (SHB) is a parasite and predator of honey bees and bee products. It is native to South Africa. SHB inhabit almost all colonies of honey bees in South Africa, but is generally not considered significant problems. However, over the past few decades the beetle has been found in various regions of the world. The aim of this study was to collect and summarize information from research and official documents from European institutions on the prevalence and control of SHB. The first published estimates of the economic damages of the SHB are those resulting from the invasion of the United States of America in 1996, when SHB spread in Florida, causing losses of more than 3 million USD. Since then it has spread to Portugal, Jamaica, Mexico, Hawaii, Cuba, El Salvador, Nicaragua, Italy, Brazil, the Philippines, Belize, Canada, South Korea, Mauritius, Colombia and China. In recent years the small hive beetle is studied increasingly for its economic importance and biological significance. The risk pathways of entry for SHB are import of bees and bee products, that are used in beekeeping on the one hand, and accidental import of bees, unintended presence of bees in a non-bee consignment, on the other hand. SHB also can survive and reproduce on a variety of ripe fruits. The SHB is a notifiable pest according to the World Organization for Animal Health (OIE). In Bulgaria and the neighboring countries, no small hive beetle has been found so far.

Key words: *Aethina tumida*, honey bees (*Apis mellifera*), distribution, import risk assessment, monitoring.

TOPIC 4: INVASIVE ALIEN SPECIES IMPACT

Impact on biodiversity and ecosystem services, impact on human health, safety and the economy; pests and pathogens; adverse impact on protected areas, endangered species and habitats

Domestic cat part-wild hybrid identification using diagnostic molecular methods

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Cross-breeding between wild and free-ranging domestic species is one of the main conservation problems for some threatened species. Every country has legislations at the national level specifically prohibiting or restricting the private possession of wild animals and their hybrids, by regulating certain species; a family or subfamily that animal belongs to; or rare or endangered species. As wildcat populations are foremost threatened by hybridization with the domestic cat. In Lithuania, private persons are prohibited from possessing protected wildlife, including members of Felidae family wild cats, except where the person owned such animal before the current wildlife protection law became effective in 2018. As the increasing awareness of wild-hybrids has led to a renewed interest in rapid diagnostic assays. During this research a suspected Asian Leopard Cat (ALC – *Felis bengalensis*) hybrid was tested to identify the lineage. Molecular identification characterized by PCR and sequence analysis of the ATP-8 mitochondrial gene. After comparing the obtained gene sequence variants of the ATP-8 gene fragment in the studied cat with the foreign sequences published in the Gene Bank between the domestic cat *Felis catus* and the Afroasis *Felis silvestris*, *Felis libyca*, we obtained genetic changes. The relative percentage of sequence changes was 1/3 between the tested cat and the domestic cat *F. catus* and the Afroasis *F. silvestris*, *F. libyca*, allowing the identification of the test object as a second-generation hybrid of Afroasis cat.

Key words: *Felis libyca*, domestic cats, molecular detection, Lithuania.

TOPICS 5 & 6: INVASIVE ALIEN SPECIES PREVENTION AND MANAGEMENT; MANAGEMENT AND SHARING OF IAS DATA

Early detection and rapid eradication, surveillance systems; risk assessment and horizon scanning; control and containment measures; restoration of damaged ecosystems; education, citizen science, strategies, policy and legislation; IAS networks and information systems, databases, data planning and management

Monitoring of spreading of invasive plant *Erigeron annuus* (L.) Pers. (daisy fleabane) in cereals crops in southeast Romania

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Erigeron annuus (L.) belonging to the Asteraceae family is the most frequent invasive plant which is found both in semi-natural and disturbed habitats in Romania. Due to unendingly expansion, eastern daisy fleabane is now one of the most harmful weeds in crops and it reduces biodiversity by dominating fields and eliminating the native species. *E. annuus* likely has a competitive and aggressive potential, because of the increased survival of its seeds, fast seedling and rosette growth or allelopathic activity. Because in recent years more farmers have reported the massive presence of this species in cereal crops, during this study, the authors have developed measures in order to eradicate and limit the spread of the invasive species *E. annuus* by integrating agrotechnical measures with products for plant protection, in cereals crops in the southeastern region of Romania.

Key words: Invasive species, wheat, herbicides, agrotechnical measures.

Effects of selective removal of the black bullhead (*Ameiurus melas*) on other non-native fish populations in the Ponjavica Nature Park (Serbia)

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North American black bullhead (*Ameiurus melas*) is an ictalurid species that has become widespread outside of its native range, causing undesirable ecological impacts. Numerous studies have suggested that its physical removal could be a way to reduce any potential detrimental effects of this species. This study measured the effects on population dynamics of both native and non-native fish species following the removal of 20,145 black bullheads from the Ponjavica Nature Park. The most significant changes between the zero-point state and the post-removal state have been recorded among the populations of non-native fish species: the abundances of topmouth gudgeon (*Pseudorasbora parva*), pumpkinseed (*Lepomis gibbosus*), and Prussian carp (*Carassius gibelio*) increased 25.5, 4.9, and 4.2 times, respectively. Previous research has shown that smaller black bullhead individuals enter into competitive relationships with the topmouth gudgeon, while larger individuals use the topmouth gudgeon as prey. By removing black bullhead individuals from the ecosystem, a part of the ecological niche used by both species was freed. Also, the predatory pressure on topmouth gudgeon decreased by removing larger black bullhead individuals. All these factors led to an increase in the abundance of topmouth gudgeon. Black bullhead and pumpkinseed have overlapping diets and are therefore considered competitors for food. Moreover, research on the black bullhead's feeding ecology showed that this species feeds on the pumpkinseed. When a greater number of black bullhead individuals were removed from the ecosystem, it led to an increase in the abundance of pumpkinseed. The abundance of Prussian carp also increased after the removal of the black bullhead. The Prussian carp and the black bullhead are quite similar in terms of diet habits, habitat preferences, and reproductive characteristics. Since these two species are in direct competition, the decline in the black bullhead population contributed to an increase in the Prussian carp population. These results point to the fact that management programs must include multiple species and methods, and one of them is the removal of all undesirable, invasive non-native species. Further research should also focus on possible diet shifts in allochthonous fishes after removing the black bullhead.

Key words: Fish management, fish population dynamics, mass removal, community diversity.

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Potential of the mycoinsecticide Naturalis® for use in strategies of crop protection against *Diabrotica virgifera virgifera* LeConte, 1858

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Entomopathogenic fungi are important and promising bio-control agents for controlling insect pests. *Beauveria bassiana* strain ATCC 74040 (Naturalis®) was selected for testing because it is commercially available to farmers in EU for use against pests of different crops in greenhouses and in the open field. In laboratory conditions, the effect of different conidial concentrations ($2.3 \times 10^3 - 2.3 \times 10^7$ conidia/ml) of *B. bassiana* strain was evaluated on the western corn rootworm, *Diabrotica virgifera virgifera*, (WCR) mortality in Petri dishes. Ten days post treatment the mean corrected mortality of WCR adults in response to the conidia concentrations reached 19% to 92% for the lowest to the highest conidia concentration, respectively. In 2022, a monitoring of the seasonal flight activity of WCR adults was conducted using Csalomon® KLP traps baited with dual attractant lures in maize fields near Knezha and Dolni Dabnik (northern Bulgaria). At both localities, two baited traps were set up in maize fields with biological seed treatment containing Naturalis® (200 ml/100 kg seeds) and one baited trap was set up in maize fields, where the seeds were treated with Gaucho FS 600 (700 ml/100 kg seeds). In Knezha, catches of the target species were recorded from the end of June to the beginning of September while the period of the flight in Dolni Dabnik was recorded from the beginning of July to the beginning of August. Catches of the adults in traps in crops with biological seed treatment were somewhat lower than those in fields treated with the chemical insecticide. The two-factorial ANOVA (treatment and locality as factors) revealed a significant interaction between the type of seed treatment and locality/maize hybrid on the grain yield of maize.

Key words: Western corn rootworm, *Beauveria bassiana*, mortality, biological seed treatment, seasonal flight.

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TOPIC 7: OTHER TOPICS RELATED TO IAS

General aspects related to the quality of the aquatic and terrestrial environments and associated biological communities, which may influence the introduction and spread of IAS, as well as the application of prevention and management measures; forest fires and IAS; mucilage and IAS

First record of *Pomphorhynchus bosniacus* (Kiškarolj et Čanković, 1969) (Paleacanthocephala: Pomphorhynchidae) in some cyprinid fish from Belčišta wetland (North Macedonia)

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The representatives of the phylum Acanthocephala are of great importance in fish pathology. *Pomphorhynchus bosniacus* (Kiškarolj et Čanković, 1969) (Paleacanthocephala: Pomphorhynchidae) is an intestinal parasite of many freshwater fishes confined to limited geographical areas of southeastern Europe (waters of Balkan), including Bosnia and Herzegovina and North Macedonia. In our case study, a total of 33 specimens of 3 cyprinid fish species (*Squalius squalus*, *Phoxinus lumaireul*, and *Pelasgus minutus*) from Belčišta wetland (southwest Macedonia) were subjected to a parasitological investigation, by seasons. Only fresh fish were subjected to routine identification, dissection, and observation methods. Parasite identification was performed morphologically, based on the character of the proboscis with hooks and the reproductive system, using a referent key for determination. Thereby, infestation by the parasite was determined in all fish species, so the prevalence was the highest in *Phoxinus lumaireul* (80.0%), followed by *Pelagius minutus* (75.0%) and *Squalius squalus* (66.67%). The highest mean intensity was determined in *Squalius squalus* (5.40), followed by *Phoxinus lumaireul* (4.75) and *Pelagius minutus* (3.0).

This parasite species can lead to heavy impairment of fish health status because the parasite penetrates the bulb and proboscis through the gut wall into the peritoneal lumen and even attach to abdominal organs.

The record of *Pomphorhynchus bosniacus* in all three cyprinid fish species in the present study is considered the first in Belčišta wetland. At the same time, *Phoxinus lumaireul* and *Pelagius minutus* represent new hosts for this parasite worldwide.

Key words: *Pomphorhynchus bosniacus*, cyprinid fish, Belčišta wetland.

***Pheidole* sp. and *Tapinoma* sp. (Hymenoptera: Formicidae)
changing food preferences**

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Pheidole sp. and *Tapinoma* sp. are the ant species that are naturally found in the Mediterranean region and are dominant in their environment. In order to provide a natural environment for the colonies formed in the test tube, 2 separate vivariums were created in the laboratory and a feeding area was placed inside. Humidity and heat balance was kept constant in both colonies. In the first month, the colonies were fed with a previously accustomed flourworm and 25% glucose-water solution until they got used to the new area and settled down. In the following weeks, *Helicoverpa armigera* (green worm) was given instead of the flour worm, and the first 15 minutes were observed. Colony members that came to the food area and fed each week were counted, and analysis was made according to the Mann-Whitney U test, one of the non-parametric tests. Considering the analysis methods, food was accepted by both groups. Since $p < 0.05$, there is a significant difference between the groups in terms of nutrition. The mean value is *Pheidole* sp. colony was found to be in favor. *Pheidole* sp. and *Tapinoma* sp. can be used as a predator of agricultural pests, and the natural populations of the species can be preserved in the ecosystem's own balance by avoiding the use of chemical pesticides.

Key words: *Helicoverpa armigera*, *Tapinoma* sp., *Pheidole* sp., wolfworm, food preferences.

Introduced fruit crops as a way of floral enrichment (on the example of Jostaberry plants)

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The controlled use of introduced low-growing fruit plants in functional nutrition for the sake of economic health and ecological attractiveness of consumers plays an important role in enriching the local flora of the right bank of the Dnipro River in Ukraine. Jostaberry (*Ribes nigrum* x *R. grossularia*) x (*R. nigrum* x *R. divaricatum*) is one of the representatives of low-growing fruit plants.

The aim of the work was to study the accumulation and composition of phenolic compounds with antioxidant capacity in the fruits of Jostaberry plants growing in the steppe zone to determine the prospects for cultivation and locavores use in the region.

Plant extracts for the secondary metabolites content and antioxidant activity determination were prepared using 80 % isopropanol. Briefly, 2.0 g weighed portion of fresh fruit (peel and pulp as the separated samples) was triturated with 20 ml of isopropanol and kept for 24 hours at room temperature in dark with occasional shaking. Then, extracts were filtered through the paper filters, and the total volume was divided into two parts intended for different studies. Total polyphenols content (TPC), Total flavonoids content (TFC), Free Phenolic acids content (FPAC), Total antioxidant capacity (TAC), and ferric-reducing power (FRP) were determined in the crude extracts obtained.

The Jostaberry plants variety (*Ribes nigrum* x *R. grossularia*) x (*R. nigrum* x *R. divaricatum*) shows resistance to American powdery mildew and anthracnose, has sufficient winter hardiness of vegetative organs, however, cases of damage to flowers by spring frosts have been noted in the conditions of Transcarpathia, according to I. Y. Fogel. The jostaberry hybrid combines the phytochemical characteristics of two fruit species with high antioxidant capacity, namely black currant and gooseberry. This hybrid is among the rare fruit crops. Moreover, the study of the secondary metabolites chemical composition and antioxidant capacity of the fruits and other parts of plants has practically not been carried out.

The skin of jostaberry fruits contained significantly more phenolic compounds compared to the pulp and had a higher antioxidant capacity. Strong positive correlations between all studied parameters were observed in the peel of jostaberry fruits from both sites.

In Ukraine, currant-gooseberry hybrids have not received industrial distribution. Information about the peculiarities of their cultivation on the territory of Ukraine and neighboring states is scarce and contradictory. The successful cultivation of the non-traditional currant-gooseberry fruit hybrid Jostaberry plants in the steppe zone of Ukraine presupposes the observance of the optimal agro-technical regime. Optimal agricultural technology is necessary for a more complete realization of the phytochemical potential of the currant-gooseberry hybrid Jošta in the steppe zone. The less common currant-gooseberry Jostaberry plants hybrid can be recommended for cultivating and using fruit products in human functional nutrition

Key words: Phytochemicals, polyphenols, antioxidant capacity, secondary metabolites, Jostaberry.

First record of *Acanthocephalus lucii* (Müller, 1776) Lühe, 1911 (Paleacanthocephala: Echinorhynchidae) in minnow (*Phoxinus lumaireul* Linnaeus, 1758) from Belčišta wetland, North Macedonia

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The representatives of the phylum Acanthocephala are of great importance in fish pathology. *Acanthocephalus lucii* (Müller, 1776) Lühe, 1911 (Paleacanthocephala: Echinorhynchidae) is a common pathogenic acanthocephalan parasite in many freshwater predatory fish or those that feed on large benthos, in Euroasia. In our study, a total of 33 specimens of 3 cyprinid fish species (*Squalius squalus*, *Phoxinus lumaireul* and *Pelasgus minutus*) from Belčišta wetland (Southwest N. Macedonia) were subjected to a parasitological investigation, by seasons. Only fresh fish were subjected to routine identification, dissection, and observation methods. Parasite identification was performed morphologically, based on the character of proboscis with hooks and the reproductive system, using referent key for determination. One specimen of *Acanthocephalus lucii* was found in autumn, in intestines of minnow (*Phoxinus lumaireul* Linnaeus, 1758). This parasite species would lead to impairing of fish health status.

The record of *Acanthocephalus lucii* in minnow in the present study is considered as the first in N. Macedonia. At the same time, minnow represents a new host for this parasite worldwide. This emphasizes the danger of the spread of parasites through stocking with newly introduced fish species.

Key words: *Acanthocephalus lucii*, minnow, Belčišta wetland, first record.

Fish population on Belcista wetland - risk assessment, prevention and management

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Belcista wetland, 20 km distance from Ohrid Lake, is a relict remnant of the ancient Desaret Lake, which existed in this area since the Pliocene. The present investigation is a part of a detailed study entitled - „ Ecological status of fish population in Belcista wetland”.

Belcista wetland (Blue swamps) is the largest wetland habitat in R. North Macedonia and it is the habitat to many species of flora and fauna. This region hosts an endemic freshwater species of the Balcan Peninsula, Ohrid minnows (*Pelagus minutus*), which is threatened by habitat loss.

There are intention of artificial introduction of salmonid fishes in Belcista wetland to develop the recreative fishery and turism in this area. Introduction and spread of salmonids is a great risk factor to survilence the ohrid minnows (*Pelagus minutus*).

One of the biggest pressures and threats to habitats and species is the modification (the drainage) of the wetland. In the last decades of 20-th century more melioratuve works have been carried out, so that the surface of the wetland has to been significantly reduced. Recently, many efforts are being made to prevent the hydrological modification of the wetland.

Perspective on Belcista wetland is his promotion as protected area – Park of nature in the future.

Key words: Belcista wetland, fish population, Ohrid minnows (*Pelagus minutus*).

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Yoğurtçuoğlu Baran - 3
Yuryshynets Volodymyr
Žalnierius Tautvydas
Zdraveski Konstantin
Zengin Mustafa