Project funded by
EUROPEAN UNION

IASON BSB-1121

Common IAS monitoring protocols and risk assessment

03.2021

Project funded by
EUROPEAN UNION

Output number:	**D.T1.6.1**	Date:	04.2021
Title:	**Common IAS monitoring protocols and risk assessment methodology guide**		
Authors:	Mikhail O. SON (IMB), contributions from all project partners		

Project:	**IASON** - *Invasive Alien Species Observatory and Network Development for the Assessment of Climate Change Impacts in Black Sea Deltaic Protected Areas*		
Programme:	**BSB**	Project Number:	**1121**
Start date:	07.2020	End date:	13.2022
Lead Partner:	LP - Danube Delta National Institute for Research and Development (DDNI), Romania		
Project Partners:	PP - Danube Delta Biosphere Reserve Authority (DDBRA), PP - Institute of Marine Biology of the National Academy of Sciences of Ukraine (IMB), PP - International Hellenic University (IHU), PP - Karadeniz Technical University (KTU-MSF), PP - International Business and Economic Development Center (IBEDC)		
Contact:	Mikhail O. SON malacolog@ukr.net Yuriy KVACH yuriy.kvach@gmail.com Gabriel LUPU gabriel.lupu@ddni.ro		

Project funded by
EUROPEAN UNION

Contents

1. Introduction

In order to classify species with respect to their potential negative impacts, a specific risk index is used.

Species-specific **B**io **P**ollution **R**isk **(SBPR)** index (Panov et al. 2009, 2010), which is based on the general assessment of the level of invasiveness of the specific alien species according to the estimates of three such descriptors of the species as High risk for dispersal (HRD), High risk for establishment in a new environment (HRE), and High risk to cause ecological and negative socio-economic impacts (HRI).Each of these descriptors is evaluated using expert inference (see below).

The knowledge on **HRD** (**H**igh **R**isk of **D**ispersal), **HRE** (**H**igh **R**isk for **E**stablishment in a new environment) and **HRI** (**H**igh **R**isk to cause ecological and negative socio-economic **I**mpacts) of the alien species is generally available from scientific reports and publications associated with a particular species introduction. This approach to the risk-based assessment of invasiveness of the alien species, established in the aquatic ecosystem (assessment units), was further used in the formal procedure of listing of alien species into the Grey, White and Black Lists. Further, the gray list is a priority for research and clarification of the status of species, and the black list - for environmental management.

This procedure should be carried out during the monitoring process, as a result of which the current situation will be shown.After modeling the climatic niches, if the potential distribution of the species turns out to be much wider than that observed during monitoring, the reevaluation of the SBPR index based on the modeling results will show predictive indicators of risks.

2. IAS monitoring protocols

The monitoring protocol might is prepared as table proposed by each partner depending on what is the list of species is used for monitoring. During the monitoring, the protocol would be used for each particular IAS.

The table might include of the most important items related to IAS, e.g. IAS scientific name, IAS name vernacular name [optimal], taxonomy, description, photograph [optimal]. The protocol might to consist of the answers to next questions:

1. Is the species found in the investigated habitat?
2. What is the observable level of invasiveness?
3. What is the level of pressure on native species or habitats?
4. Is there a management plan to combat the negative effects of the presence of the species in the investigated area?

For each particular IAS, the information concerning the human usage of IAS in the region might be provided. The justification - monitoring of these indicators is needed to:

1. Investigation methods used
2. Period of data collection
3. Equipment needed for species monitoring.

Here we provide an example of the monitoring protocol, which could be used as a tamplate for all the partners (Table 1).

Table 1. A template of the monitoring protocol

IAS scientific name	Provide the scientific name with author and year of description: *Faxonius limosus* (Rafinesque, 1817)			
IAS name vernacular name [optimal]	Provide the English common name if available: Spinycheek crayfish			
Taxonomy	Kingdom: Animalia	Phylum: Arthropoda	Ordo: Decapoda	Family: Cambaridae
Description	Provide main morphological characteristics, which distinguish the particular IAS from the closely related local ones.			
Photograph [optimal]				
Criteria of the species in the investigated area	Provide the criteria due to Roy et al. (2015), i.e.: A. likelihood of arrival B. likelihood of establishment C. likelihood of spread post invasion D. potential impact on biodiversity			
Habitat	The list of habitats, typical for the species distribution according to the published data.The habitat classification please provide due to EUNIS: https://eunis.eea.europa.eu/habitats-code-browser.jsp			
Is the species found in the investigated habitat?	List of habitats observed. Mark yes/no: A1 : No A2 : No C1 : Yes C2 : No C3 : Yes			
What is the observable level of invasiveness?	The invasiveness level could be classified in accordance to the **R**isk **A**ssessment **P**rotocol (RAP), provided bellow.			
What is the level of pressure on native species or habitats?	Provide the cases of habitat changes caused by IAS: overgrowing, competition with local species, predation cases, etc.			
Is there a management plan to combat the negative effects of the presence of the species in the investigated area?	Optimal for the cases of already established IAS populations. Provide the short description of the existing management plans.			
Human usage of IAS in the region	If existing, provide the type of the human usage, e.g. resource using, fisheries, hunting, beekeeping, cultivation, etc.			

Justification - monitoring of these indicators is needed to:	Choose the necessary: - early detection of IAS and range spread. - establishing the population dynamics; - impact assessment; - evaluating the efficiency of management measures; - proposals regarding the adaptation / revision of the management measures;
Investigation methods used	Provide the methods used for the species monitoring, e.g. transect method, surface method, traps, hydrobiological and ichthyological sampling methods. Provide the details for each particular case.
Period of data collection	Provide the periods period, optimal for the data collection. The particular dates could be corrected depending on the phenological properties of each particular taxonomic group.
Equipment needed for species monitoring.	Each species/expert group could provide the list of equipment necessary for the sampling/observations with its parameters.

The field sheet model is proposed as common for all partners, with possible clarifications and additions available for each particular country/region. During the monitoring, the data must be provided in separated excel file using the next model (Table 2).

Table 2. Field sheet model, which finally could be used for the final Excel dataset

Date of sampling/observation	Coordinates	Phenological stage	Abundance
DD-MM-YYYY	coordinates might be provided in decimals standard	larvae, juveniles, adults, migratory, nesting, flowering, etc.	depending on taxonomic or ecological group

The maps and the sampling stations for the monitoring might be proposed by each partner in the form of graphical files for each taxonomic/ecological group of IAS.

2.1 - Danube Delta - Romania

The monitoring protocol for IAS species involves highlighting descriptive elements or criteria based on scientific evaluation:

1. List of EUNIS habitat classification from DDBR. The list of habitats according to EUNIS is necessary to indicate the type of habitat in which the investigated taxon can be observed.

2. List of species (IAS) investigated in the project for DDBR.

3. For each of the species (IAS) considered, a number of elements will be necessary in terms of general description of the species and their taxonomic classification:
- the current scientific name of the taxon - approved by the scientific community, the author of the scientific name and the year in which it was accepted;
- synonyms;
- the English common name (if available);
- general description of the taxon;
- image (if available);
- general description of the specific habitat of the taxon in the investigated area DDBR (Danube Delta Biosphere Reserve).

4. Period of data collection for each species (IAS) investigated.

5. Investigation methods:
- used in the field - investigation methods, equipment needed for species monitoring;
- used in the laboratory: species determination, processing and interpretation of data;
- methods for assessing the status of species populations (IAS) investigated: population size, spatial distribution;
- methods for assessing the weight of investigated species (IAS) populations: abundance (A), dominance (D) and constancy (C).

6. Assessing the level of invasiveness of the species.It can be highlighted by:
- assessing the level of pressure on native species or habitats;
- indicating the existence of a management plan to combat the negative effects of the presence of the species in the investigated area;
- human usage of IAS in the region.

7. Field sheet:
- will collect a series of data on the presence in the field of the investigated species (IAS), based on the criteria stated above;
- identifying elements of the period in which the investigation was carried out;

- the geographical coordinates of the investigation points;
- the phenological stage of the individuals belonging to the species (IAS) investigated;
- other elements characteristic of the taxonomic group to which the investigated species (IAS) belongs;
- remarks.

A Standard Sheet containing descriptive elements has been developed for the characterization of the IAS, in which components of the monitoring protocol are highlighted (Table 3).

Table 3. IAS Standard Sheet provided by the Romanian part.

STANDARD Sheet – Invasive Alien Species (IAS)		
Name of species	**Scientific**	**Synonyms**
Origin		
Geographical spread		
Distribution	**Romania**	**RBDD**
Habitat description / Ecology		
Dispersion mode / mechanism of action of the species		
Habitat type in which IAS is present	**According to EUNIS**	
The evolution trend of the species / competition	**Romania**	**RBDD**
Species status / blacklist	**International**	**National - Romania**
Management and control measures		
Bibliographical references		

IAS monitoring protocols and risk assessment methodology were applied on the selected IAS list (Table 4)/

Table 4. IAS selected for the monitoring in the Romanian part of the Danube delta

No.	Latin name	Common name	Clasification
1	*Amorpha fruticosa* L.	desert false indigo	vascular plants Family Fabaceae
2	*Xanthium strumarium* L.	common cocklebur	vascular plants Family Asteraceae
3	*Elodea nuttallii* (Planch.) H. St. John	western waterweed	vascular plants Family Hydrocharitaceae
4	*Leptinotarsa decemlineata* Say, 1824	Colorado potato beetle	Insects (Order Coleoptera) Family Chrysomelidae
5	*Perccottus glenii* Dybowski, 1877	Amur sleeper	fish Family Odontobutidae

A. Plant species:

Kingdom	Plantae – Vegetal, plants
Subkingdom	Viridiplantae – green plants
Infrakingdom	Streptophyta – land plants
Superdivision	Embryophyta
Division	Tracheophyta – vascular plants, tracheophytes
Subdivision	Spermatophytina – spermatophytes, seed plants
Class	Magnoliopsida
Superorder	Rosanae
Order	Fabales
Family	Fabaceae – peas, legumes
Genus	Amorpha L. – false indigo, indigobush
Species	***Amorpha fruticosa* L.** (desert false indigo, dullleaf indigo, false indigobush, leadplant, desert indigobush, indigobush, false indigo)

STANDARD Sheet – Invasive Alien Species (IAS)		
Name of species	**Scientific**	**Synonyms**
	Amorpha fruticosa L.	*Amorpha angustifolia*F.E.Boynton *Amorpha arizonica*Rydb. *Amorpha bushii*Rydb. *Amorpha croceolanata* Watson *Amorpha curtissii*Rydb. *Amorpha dewinkeleri* Small *Amorpha emarginata*Eastw. *Amorpha fragrans* Sweet *Amorpha humilis*Tausch *Amorpha occidentalis* Abrams *Amorpha pendula* Carriere *Amorpha tennesseensis*Kuntze *Amorpha virgata* Small
Origin	Native to North America.	

Geographical spread	Has spread across Asia and Europe, likely through its use as an ornamental plant. It is now generally accepted to be among the most invasive alien species in Europe.	
Distribution	**Romania**	**RBDD**
	It is also found in localities and their vicinity, the Danube meadow and islands, the Great Island of Brăila, the Dobrogea Plateau, the Bărăgan Plain, the Moldavian Plateau, the lower sector of the Danube tributaries, generally in the steppe and forest-steppe area, the oak floor. As a cultivated plant, the species is found in botanical gardens, parks and gardens	Shrub cultivated, in the past, along the modified / dredged canals in the Danube Delta. It is a species present in all types of habitats, especially in the river delta sector where it is very common. In the poplar forest plantations, it develops very well, occupying the shrub layer and thus, causing damage to these crops.
Habitat description / Ecology	As a growth medium, *Amorpha fruticosa* is frequently found in wetlands, having a high resistance in the flooding conditions of the Danube Delta (Şofletea, 2001), but not flood periods longer than three months. The areas where we meet this species are the banks of canals, ponds and sometimes in meadow forests, bright and semi-shady forest edges (Anastasiu et al, 2008). The plant prefers clay soils; it also has requirements for a well-drained soil, but can also grow in poor (sandy) conditions. Although its development requires well-drained soils, it can withstand drought.The growth rate and lifespan of the species in the conditions of the Danube Delta is high (Doroftei, 2009a). From the seedling stage (10 cm) it reaches a height of 75-100 cm in a month, most of the seedlings being connected by the well-developed root system of a large specimen in the immediate vicinity. The vitality of the species is very high in the conditions of the fluvial delta. The oldest individuals were found in the Danube - Dranov area. This is the area where the first plantings of this species were made along the regularized canals. Specimens with stems up to 30-40 cm in diameter have been found in this area. An experiment conducted in stationary 3 of the Dranov Depression shows the speed of the species in the formation of new roots. The young stems that were previously cut were left on the ground or stuck in the ground. After a season of vegetation, all the stems formed new roots. It also has no water retention in the canopy, and tolerance to salinization is low (Huxley, 1992). Amorpha fruticosa does not need a soil with a certain pH to grow and withstands pH variations between 5 and 8.5. The nutritional value of the seeds is low, with low protein potential. It is not included in the normal trophic spectrum of animals, being consumed only in special conditions by tit species (Parus sp.). However, there are data showing that the seeds of *Amorpha fruticosa*, which reach 50,000 per plant (Doroftei, 2009a) (figure 1b), are consumed by some granivorous birds with a wide spectrum of	

	feeding, such as some species of the order Anseriformes (Kiss, 1997), *Phasianuscolchicus* (Kiss, 1976, 1985) or *Columba oenas*(Kiss, 1995).	
Dispersion mode / mechanism of action of the species	A large number of seeds are carried by water currents to new areas where they colonize aggressively. There are situations in which, due to the inflorescence, it is planted as a decorative species. The nutritional value of the seeds is low, with low protein potential. It is not included in the normal trophic spectrum of animals, being consumed only in special conditions by tit species (*Parus* sp.). However, there are data showing that the seeds of *Amorpha fruticosa*, which reach 50,000 per plant (Doroftei, 2009a), are consumed by some granivorous birds with a wide spectrum of feeding, such as some species of the order Anseriformes (Kiss, 1997), *Phasianuscolchicus* (Kiss, 1976, 1985) or *Columba oenas* (Kiss, 1995).	
Habitat type in which IAS is present	**According to EUNIS**	
	Broadleaved deciduous woodland (G1 level 2), Constructed, industrial and other artificial habitats (J level 1), Inland surface water habitats (C level 1), Littoral zone of inland surface waterbodies (C3 level 2), Rock cliffs, ledges and shores, including the supralittoral (B3 level 2), Woodland fringes and clearings and tall forb stands (E5 level 2)	
The evolution trend of the species / competition	**Romania**	**RBDD**
	Expanding area	Area in aggressive expansion
Species status / blacklist	**International**	**National - Romania**
	The species assessed in the European Red Lists prepared by the IUCN for the European Commission	Species mentioned in Romania's blacklist as invasive
Management and control measures	Cutting at the same time as planting native species (example: reforestation with *Salix alba*).	

Kingdom	Plantae – plants
Subkingdom	Tracheobionta – vascular plants
Superdivision	Spermatophyta – seed plants
Division	Magnoliophyta – flowering plants
Class	Magnoliopsida – dicotyledons
Subclass	Asteridae
Order	Asterales
Family	Asteraceae
Genus	Xanthium L. – ash
Species	***Xanthium strumarium L.*** (common cocklebur)

STANDARD Sheet – Invasive Alien Species (IAS)		
Name of species	**Scientific**	**Synonyms**
	Xanthium strumarium	*Xanthium canadense* Mill. *Xanthium chinense*Mill. *Xanthium glabratum* *Xanthium indicum* *Xanthium occidentale* Bertol. *Xanthium orientale*L. *Xanthium pennsylvanicum*Gand. *Xanthium sibiricum*Patrin ex Widder
Origin	There has been considerable controversy regarding the origin of cocklebur. Though first described from Europe, it is probably of American origin. Love and Dansereau (1959) suggest that the cocklebur subspecies most abundant in North America originated in Central America. The dates of its introduction to California are not known, but it may be pre-Columbian.	
Geographical spread	Albania, Austria, Bulgaria, Croatia, Czechoslovakia, Federal Republic of Yugoslavia, France, Germany, Greece, Hungary, Italy, Poland, Portugal, Azores, Romania, Russia, Central Russia, Northern Russia, Southern Russia, Spain, Switzerland	
Distribution	**Romania**	**RBDD**
	Very common	Very common: on the Sulina arm, in areas with woody vegetation, usually in the second line; Litcov Canal - in clusters of several dozen specimens along the canal; on the Perivolovca Canal, the species has a low presence; The island near the Erenciuc canal; CiobanGârlă canal; The Old Danube, both loops of the great M, the arm of Saint George; the Chilia arm, Periteaşca, at the end of the canal; coastal cordon area; on the connecting channel between the Sfântu Gheorghe and Melea arm, at Cherhana - a few specimens; in the Tudor Vladimirescu area, on the edge of the poplar plantation; at Pătlăgeanca; in the Carasuhat and Rusca forest arrangements; at Ivancea, on the Ivanova Canal; at Băltenii de jos; on the Pardina and

		Ciamurlia canals from the Pardina agricultural precinct; on Tataru's arm; in the Belciug area, identified in several specimens; on Gârlalui Palade; at Ilganii de sus and in the Ceatal area.
Habitat description / Ecology	*X. strumarium* tolerates a wide variety of soil types and textures and a soil pH range of 5.2 to 8.0, as well as frequent flooding and saline conditions (Weaver and Lechowicz, 1983). It occurs in cultivated fields, along beaches, coastal dunes, watercourses, railway embankments, roadsides, field edges, and waste places. It prefers open communities and will disappear if shaded or crowded (Kaul, 1971). It is not common in mountainous regions.	
Dispersion mode / mechanism of action of the species	Seed germination and emergence of *X. strumarium* generally occurs in late spring or early summer. The two seeds within each bur often differ in size and dormancy status, with the larger seed germinating in the spring following production, and the smaller seed germinating a year later (Kaul, 1965). Light is not required for germination and seedlings seldom emerge from seeds lying on the soil surface or from those buried 15 cm or more below the soil surface (Stoller and Wax, 1974). Seed production is strongly correlated with above-ground biomass at the time of floral initiation. Vigorous, open-grown plants can produce from 500 to 2300 burs per plant (Weaver and Lechowicz, 1983). The spiny burs are readily dispersed by adhering to animals, human clothing or other materials, as a contaminant of wool, and by water. Viability of seeds buried in the soil does not generally exceed five years (Weaver and Lechowicz, 1983).	
Habitat type in which IAS is present	**According to EUNIS**	
	Roadsides, wasteland, disturbed land, fallow land, crops, plantations, drainage ditches, savannahs, water courses, lowlands, floodplains and sandy dry riverbeds.	
The evolution trend of the species / competition	**Romania**	**RBDD**
	Species present everywhere in stable populations	Species present everywhere in stable populations
Species status / blacklist	**International**	**National - Romania**
	According to EUNIS - Not listed in legal texts	Not listed in legal texts
Management and control measures	Cultural Control: Seedlings of *X. strumarium* can be controlled by cultivation, but older plants often produce shoots from axillary buds if the root has not been severed. Adoption of zero or reduced tillage systems can potentially reduce *Xanthium* populations, because burs seldom germinate on the soil surface (Vencill and Banks, 1994). Chemical Control: *X. strumarium* is controlled by many soil-applied and foliar	

	herbicides. In France, Mamarot and Rodriguez (1997) give recommendations for a range of treatments including sulcitrone in maize, amitrole directed in maize, bentazon and fomesafen in soyabeans. Biological Control: Biological control of *X. strumarium* has been attempted with *Alternaria helianthi* (Abbas and Barrentine, 1995), and the rust *Puccinia xanthii* (Julien et al., 1979).

Up to the Kingdom	Kingdom
	Plantae – plants
Subkingdom	Tracheobionta – vascular plants
Superdivision	Spermatophyta – seed plants
Division	Magnoliophyta – flowering plants
Class	Liliopsida – monocotyledons
Subclass	Alismatidae
Order	Hydrocharitales
Family	Hydrocharitaceae – tape-grass family
Genus	Elodea Michx. – waterweed
Species	***Elodea nuttallii* (Planch.) H. St. John** (western waterweed)

STANDARD Sheet – Invasive Alien Species (IAS)		
Name of species	**Scientific**	**Synonyms**
	Elodea nuttallii	*Anacharisnuttallii* Planch. *Elodea columbiana*H.St.John *Elodea minor* (Engelm. ex Casp.) Farw. *Philotria minor* (Engelm. ex Casp.) Small *Philotrianuttallii* (Planch.) Rydb. *Udoraverticillata* var. minor Engelm. ex Casp.
Origin	*E. nuttallii* is native to temperate North America common throughout most of the USA and south Canada	
Geographical spread	Austria, Belgium, Bulgaria, Czechia, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Luxembourg, Norway, Poland, Romania, Slovakia, Slovenia, Sweden, Switzerland, United Kingdom, Channel Islands, Northern Ireland	
Distribution	**Romania**	**RBDD**
	In Romania it is found in the lakes of the Delta and in the southern central area, including the lakes of Bucharest	The species was observed in Popina Development (ponds 21 -22), Gorgovăţ, Potcoava, Uzlina lakes; Perivolovca Canal, Taranova Canal; Candura canal (at Scăunele) - Durnoi terminal (Nebunu); Erenciuc Lake; in the place

		called DunăreaVeche near Tulcea, in MeleauaSahalin; at Portiţa in the canals behind the resort, on the connecting canal between the Sfântu Gheorghe and Melea arm; on the Dranov canal; on the Leahova canal; Ciamurlia area in the loan channel; next to Mile 28 in the loan channel, at Mile 26 in the fishing arrangement. Generally, in areas with stagnant or smoothly flowing waters and shallow depths of the Danube Delta Biosphere Reserve.
Habitat description / Ecology	*E. nuttallii* has been found growing in a wide range of water bodies, in general in quiet water such as shorelines of lakes, reservoirs and ponds, along rivers and streams, and also in wetlands, canals and ditches (Hickman, 1993). Waterweeds are competitive and well adapted to a broad array of environmental conditions (Cook and Urmi-König, 1985; Simpson, 1990). *E. nuttallii* is able to grow in turbid, highly eutrophic waters (Cook and Urmi-König, 1985; Ozimek et al., 1993; Thiébaut and Muller, 1999), as well as in clear oligo-mesotrophic waters (Thiébaut et al., 1997; Barrat-Segretain, 2001; Nagasaka, 2004) with a certain degree of organic pollution (Best et al., 1996). Growth of *E. nuttallii* is stimulated by fertilization with nitrogen and benefits from an excess of ammonia (Dendène et al., 1993). It can occur to depths of 3 m (Simpson, 1990) and 5 m (Ikusima, 1984) where it develops into dense pure stands, but it is most frequently found in shallow water. Optimum pH has been found to be between 7 and 9 (Jones et al., 1993). It is tolerant of disturbance, oil pollution and is typically found in calcareous water, from fresh to slightly brackish coastal water (St John, 1965) up to 14 ppt salinity, and in fine sediment soil, where it is particularly successful. It is found at altitudes from 0 to 275 m, and in its eastern area of distribution in the USA between 1372-2742 m (Missouri Botanic Garden, 2009). All regions in which it is present are characterized by a temperate climate.	
Dispersion mode / mechanism of action of the species	Vegetatively propagated. *E. nuttallii* is dioecious; sexual reproduction occurs on the water surface, when the female flowers, like those of *E. canadensis*, are borne on long hypanthia and float on the water surface. The male flower, however, is released by abscission of the pedicel when still in bud. The bud contains a gas bubble and floats to the surface, where it opens to release the pollen (Bowmer et al., 1995; Preston and Croft, 1997). Fruiting specimens are very rare in North America (Lawrence 1976) and very few fully mature fruits were recorded in Canada (Catling and Wojtas, 1986). Although *E. nuttallii* reproduces both sexually and	

	asexually by vegetative clonal propagation in its native range, in Europe the majority of plants are female, with the exception of a male colony known in Germany (Preston and Croft, 1997). In Japan all plants are male (Kunii 1984), so vegetative reproduction seems to be the dominant method of propagation - essentially by fragmentation and division of the stems and the production of winter buds from stem tips (Preston and Croft, 1997). It has been observed that, when introduced to a new habitat, the establishment of Elodea buds is rapid, since the propagules sink into the sediment and grow rapidly (Barrat-Segretain et al., 2002).	
Habitat type in which IAS is present	**According to EUNIS**	
The evolution trend of the species / competition	**Romania**	**RBDD**
	Expanding area	Expanding area
Species status / blacklist	**International**	**National - Romania**
	EU Regulation 1143/2014 on Invasive Alien Species (The IAS Regulation). Annex - List of Invasive Alien Species of Union concern, second update	The IAS Regulation
Management and control measures	Prevention: EPPO (2009) strongly recommends that countries in the EPPO region, endangered by this species, take measures to prevent its introduction and spread, or manage unwanted populations (for example with publicity, restrictions on sale and planting, and controls). Control Physical/mechanical control; Cutting is best carried out before July, and a second cut will be required later in the season. However, cutting very early in the season, from mid-February onwards, using trailing knives, or chains, will limit the early season growth, and if regular treatments are made in this way during the summer, at 6-8 week intervals, then maximum biomass should not be reached. This also limits the amount of floating material produced late in the season. During this process it is essential to prevent the spread of plant fragments by creating filters downstream before any mechanical treatment is carried out. All plants removed must be carefully disposed of to prevent dissemination of fragments (Newman, 2009). Di Nino et al. (2005) have reported that harvesting causes a drastic reduction of biomass of *E. nuttallii* and that two harvests causes almost total disappearance. Another mechanical option is creating shade, which can be	

	achieved by planting trees on the south side of water bodies or by using a floating sheet of opaque material. Care must be taken when using the latter to prevent sudden deoxygenation (Newman, 2009). Biological control: The use of herbivorous Chinese grass carp is appropriate as a control method for this plant. Common carp, and other bottom-feeding fish, which create turbid water, can also be effective in preventing regrowth of the plant after mechanical removal or chemical control (Newman, 2009).

B. Animal species

Insects

Kingdom	Animalia – animals
Subkingdom	Bilateria
Infrakingdom	Protostomia
Superphylum	Ecdysozoa
Phylum	Arthropoda – arthropods
Subphylum	Hexapoda – hexapods
Class	Insecta – hexapoda, insectes
Subclass	Pterygota – winged insects
Infraclass	Neoptera – modern, wing-folding insects
Superorder	Holometabola
Order	Coleoptera Linnaeus, 1758 – beetles
Suborder	Polyphaga Emery, 1886
Infraorder	CucujiformiaLameere, 1938
Superfamily	ChrysomeloideaLatreille, 1802
Family	ChrysomelidaeLatreille, 1802 – leaf beetles
Subfamily	ChrysomelinaeLatreille, 1802
Tribe	ChrysomeliniLatreille, 1802
Genus	Leptinotarsa Chevrolat in Dejean, 1836
Species	***Leptinotarsa decemlineata*** Say, 1824 (Colorado potato beetle)

STANDARD Sheet – Invasive Alien Species (IAS)		
Name of species	**Scientific**	**Synonyms**
	Leptinotarsa decemlineata	*Doryphoradecemlineata*Say, 1824 *Stilodesdecemlineata*
Origin	North America	
Geographical spread	Europe & Northern Asia (excluding China), Middle America, North America	
Distribution	**Romania**	**RBDD**
	Widespread throughout Romania, in the cultivation areas of potatoes and other nightshades	The species comes from areas cultivated with potatoes and other nightshades. It is currently widespread in and

		around localities. No data are known on the distribution of the species throughout the territory of the R.B.D.D.
Habitat description / Ecology	It has 2-3 generations per year. It winters as an adult in the soil, at depths of 10-90 cm. Hibernating adults appear at the end of March, when the average daily temperatures are 14-21^{o}C. After an intense flight they spread over long distances. Parallel to feeding, sexual maturation, copulation and spawning take place. Eggs are laid on the underside of the leaves in groups of 10-100. Incubation lasts 4-5 days, and the larvae appear in the second decade of May and feed on the foliar apparatus of the host plants. The larva develops in 15-30 days, then enters the soil where it turns into a stern, so that the first-generation adults appear in the second decade of June. Then the stages of development overlap. The insect has 3 generations per year in the steppe and forest-steppe areas and 2 generations in the more northern areas of the country. In October - November, adults retreat to the ground for hibernation. Adults and larvae bite the leaves from the outside to the inside, leaving the veins and vines intact. It prefers potatoes, but consumes the foliar apparatus of various plants grown in the Solanaceae family. Eggplant fruits are often damaged by second-generation adults.This beetle can thus go from egg to adult in as little as 21 days. Depending on temperature, light conditions, and host quality, the adults may enter diapause and delay emergence until spring. They then return to their host plants to mate and feed; overwintering adults may begin mating within 24 hours of spring emergence. In some locations, three or more generations may occur each growing season	
Dispersion mode / mechanism of action of the species	Because of its capacity for adaptation to different climatic conditions (Ushatinskaya and Ivanchik, 1982) and different host plants (Hsiao, 1982), *L. decemlineata* is constantly moving into fresh areas and crossing international borders. The beetle has obviously not reached the extent of its possible geographic range in the EPPO region but its spread has slowed considerably in recent years, almost entirely due to international collaborative action, for example, between France and the Channel Islands, with EPPO support (Portier, 1980). The British Isles, the Nordic countries, and some other European islands, maintain themselves free through the EU system of 'protected zones'. In Russia and other CIS countries, where *L. decemlineata* has spread eastwards to reach the Pacific, an attempt was made (Vlasova, 1978) to estimate the potential final distribution; it was assumed that the requirement for one full generation would be a period in summer of at least 60 days of temperature over 15°C and winter temperatures not falling below -8°C. Establishment is not likely in colder areas of the EPPO region where only one partial generation could develop. Similarly, Worner (1988) tried to predict where *L. decemlineata* could establish in New Zealand. Potential distribution has been discussed by Jolivet (1991)	

	for Asia and by Sutherst (1991) for the world.	
Habitat type in which IAS is present	**According to EUNIS**	
	Regularly or recently cultivated agricultural, horticultural and domestic habitats (I level 1)	
The evolution trend of the species / competition	**Romania**	**RBDD**
	Invasive species - stable population	Invasive species - stable population
Species status / blacklist	**International**	**National - Romania**
	According to EUNIS -Not listed in legal texts This species has not yet been assessed for the IUCN Red List	Not listed in legal texts
Management and control measures	Crop rotation is, however, the most important cultural control of *L. decemlineata*. Rotation may delay the infestation of potatoes and can reduce the build-up of early-season beetle populations because the adults emerging from diapause can only disperse to new food sources by walking. One 1984 study showed that rotating potatoes with nonhost plants reduced the density of early-season adults by 95.8%. Other cultural controls may be used in combination with crop rotation: Mulching the potato crop with straw early in the growing season may reduce the beetle's ability to locate potato fields, and the mulch creates an environment that favors beetle's predators; Plastic-lined trenches have been used as pitfall traps to catch the beetles as they move toward a field of potatoes in the spring, exploiting their inability to fly immediately after emergence; flamethrowers may also be used to kill the beetles when they are visible at the top of the plant's foliage.	

Fish

Kingdom	Animalia – animals
Subkingdom	Bilateria
Infrakingdom	Deuterostomia
Phylum	Chordata – chordates
Subphylum	Vertebrata – vertebrates
Infraphylum	Gnathostomata
Superclass	Actinopterygii – ray-finned fishes, spiny rayed fishes
Class	Teleostei
Superorder	Acanthopterygii
Order	Perciformes – perch-like fishes
Suborder	Gobioidei – gobies
Family	Odontobutidae
Genus	Perccottus Dybowski, 1877
Species	***Perccottus glenii* Dybowski, 1877** (Amur sleeper)

STANDARD Sheet – Invasive Alien Species (IAS)		
Name of species	**Scientific**	**Synonyms**
	Perccottus glenii Dybowski, 1877	*Eleotrisdybowskii*Herzenstein&Warpachowski, 1887 *Eleotrispleskei*Warpachowski, 1887
Origin	Asia (Eastern Russia, Northeast China, Amur River, Korean Peninsula)	
Geographical spread	Central, Eastern and South-Eastern Europe and Asia	
Distribution	**Romania**	**RBDD**
	Introduced in series in 1916, 1950 and 1960 as an ornamental fish (Russia) or accidentally mixed with Chinese carp eggs and larvae (in other countries such as Ukraine, Poland), it spread in the wild, reaching the Danube basin to Romania. (2006) and the Suceava River (2001).	Accidentally introduced in other countries, it also reached the Danube basin, and since 2007 in the DDBR
Habitat description / Ecology	Escaped from fish farms in the natural environment, the species has spread rapidly adapting to the climatic conditions in Europe, found especially in waters rich in macrophyte aquatic vegetation with muddy substrate, but also in slow areas of running water. It is more and more numerous feeding on eggs, fish larvae or even amphibians, so it is considered harmful, it is very resistant to harsh conditions or climate change, and the male guards the eggs and larvae. The Amur sleeper is a limnophilic species, inhabiting freshwater canals, gravel pits, natural and fish ponds. It lives in the littoral zone of these waterbodies. It prefers rather stagnant waters with dense aquatic vegetation and muddy substrate; in rivers it avoids the main current and is common in flood plains and oxbow lakes. It tolerates low oxygenation of water, so it can be found also in drying, shallow waterbodies	
Dispersion mode / mechanism of action of the species	Accidentally introduced with the eggs and larvae of Chinese carps in countries close to Romania, the species spread in the Danube basin, reaching Romania in 2001. It is not a species of commercial value, but at the same time the resistance and ecological plasticity of the species led to the spread in a relatively fast time of the populations until RBDD (2007)	
Habitat type in which IAS is present	**According to EUNIS**	
	Lentic pelagic (C11 level 3)	
The evolution trend of the	**Romania**	**RBDD**
	Invasive alien species	Invasive alien species - expanding population

species / competition	- expanding population	
Species status / blacklist	**International**	**National - Romania**
	Competition - monopolizing resources; Predation	Competition - monopolizing resources; Predation
Management and control measures	In the case of the present invasion, effective management policies should urgently be developed and implemented by the appropriate authority to stop dispersal of Amur sleeper. Otherwise, the establishment and spread of this invasive alien species and an increase in abundance and appearance in new watercourses can be expected in the coming years. The small running water with confirmed Amur sleeper occurrence is directly connected with the rivers which flows into the Danube. Because this species is not a strong swimmer, it might be expected that its dispersal within the Danube river system would be mainly downstream and thereby threatening not-yet-invaded habitats along the upper and middle Danube in Germany, Austria, the western part of Slovakia and central Hungary (cf. Reshetnikov&Schliewen 2013).	

2.2 - Danube Delta - Ukraine

The common monitoring protocol will be used during the field works in the Ukrainian part of the Danube delta. Among 51 invasive or potencially invasive species, which occurred in the Danube delta, or may established in nearest time, 7 species are chosen for the standard protocol description, as most common and invasive in the monitoring area.

IAS scientific name	*Elodea canadensis* Michx.			
IAS name vernacular name	American or Canadian Waterweed, or Pondweed, Елодея канадська (ukr.)			
Taxonomy	Kingdom: Plantae	Division: Magnoliophyta	Ordo: Hydrocharitales	Family: Hydrocharitaceae
Description	*Elodea canadensis* is a dioecious, perennial, submerged aquatic macrophyte with elongated flexuous stems and long internodes which are clothed with whorls of sessile, minutely-serrate leaves and rooted from their nodes, typically in mud substrates. The middle and upper leaves, typically three per whorl, are elliptic, approximately 2-5 mm wide; leaves in the upper whorls grow closely together. Male flowers are pedunculate by the elongate, filiform base of the floral tube, not released from the plant at anthesis; sepals 3.5-5.0 mm long, petals 5 mm long. The staminate spathe has a pedunculate base, inflated, 7 mm long, 4 mm wide. The female flower stalk is approximately 15 cm long; sepals and petals 2-3 mm long. Petals white. Pistillate spathe cylindrical.			

Photograph	 
Criteria of the species in the investigated area	A. likelihood of arrival B. likelihood of establishment C. likelihood of spread post invasion: ✔ D. potential impact on biodiversity: ✔
Habitat	C1.6: Temporary lakes, ponds and pools C2.5: Temporary running waters
Is the species found in the investigated habitat?	Will be completed based on the monitoring results
What is the observable level of invasiveness?	Will be calculated after monitoring implemented
What is the level of pressure on native species or habitats?	Will be completed based on the monitoring results
Is there a management plan to combat the negative effects of the presence of the species in the investigated area?	No management plan
Human usage of IAS in the region	No human usage
Justification - monitoring of these indicators is needed to:	- establishing the population dynamics; - impact assessment; - evaluating the efficiency of management measures;
Investigation	Generally accepted phytocoenological methods for assessing aquatic

methods used	vegetation(Petrov, 1962; Eremenko, 1980; Kalugina-Gutnik, 1969), which determine the floristic composition, the percentage of projective bottom cover by macrophytes, and the biomass of thickets, a set of indicators based on the active surface of aquatic vegetation was also used (Minicheva, 1989).
Period of data collection	Twice per year (I. End of March - beginning of April II. End of October - beginning of November)
Equipment needed for species monitoring.	Boat with an outboard motor, dry suit, rubber boots, rubberized jacket, wading boots, frames, scrapers

IAS scientific name	*Amorpha fruticosa* L.			
IAS name vernacular name [optimal]	Desert false indigo, False indigo-bush, Bastard indigo-bush, Аморфа кущова (ukr.)			
Taxonomy	Kingdom: Plantae	Division: Spermatophyta	Subphylum: Angiospermae	Family: Fabaceae
Description	Amorpha fruticosa is a fast-growing, deciduous shrub that grows in wetlands and disturbed habitats. It is native to North America but has spread across Asia and Europe, likely through its use as an ornamental plant. It is now generally accepted to be among the most invasive alien species in Europe. It has a high reproductive capacity, forms dense thickets and outcompetes native flora, changing successional patterns and reducing biodiversity. Repeated cutting and mowing can help to control populations of this species and in disturbed habitats, some herbicides have been successful in controlling its spread. A. fruticosa is a fast growing shrub, that produces a high number of viable seeds. Pollination is performed by insects (mainly bees, belonging to the genus Andrena). Pollen is small (10-25 µm), isopolar, oblate, with three colporous apertures (PalDat, 2000). A. fruticosa also spreads vegetatively by sprouting, and stems can root at the nodes (Szigetvári, 2002). A. fruticosa is associated with species that form coastal or riparian communities. Amorpha fruticosa L. is a species which is found in the riparian forests of Ukraine. Rivers as waterways for the transport of genetic material help and often accelerate the spread of invasive species to surrounding ecosystems. It grows in medium to wet, well-drained soils and is tolerant of partial shade and occasional flooding. Although it prefers to grow along river banks, it can tolerate dry soils. Its well-developed root system means it is relatively wind tolerant (Kozuharova et al., 2017). Szigetvári (2002) describes A. fruticosa as a			

	transformer species that colonizes disturbed areas, particularly floodplain pastures and meadows. Through rapid growth, it forms dense thickets and outcompetes native flora, changing successional patterns and reducing biodiversity (Szigetvári, 2002). It is known to be particularly invasive in riparian and alluvial habitats and is generally accepted to be among the most invasive alien species in Europe (Protopopova et al., 2006; Kozuharova et al., 2017). Allelopathic effects of A. fruticosa have also been reported (Csiszár, 2009).Brigić et al. (2014) demonstrated that changes to the vegetation structure and microclimate of habitats, caused by the invasion of A. fruticosa, have a significant effect on the composition of soil invertebrates.
Photograph	
Criteria of the species in the investigated area	A. likelihood of arrival B. likelihood of establishment C. likelihood of spread post invasion: ✔ D. potential impact on biodiversity: ✔
Habitat	C1.6: Temporary lakes, ponds and pools C2.5: Temporary running waters E3: Seasonally wet and wet grasslands F9: Riverine and fen scrubs G1.2: Mixed riparian floodplain and gallery woodland
Is the species found in the investigated habitat?	Will be completed based on the monitoring results
What is the observable level of invasiveness?	Will be calculated after monitoring implemented
What is the level of pressure on	Will be completed based on the monitoring results

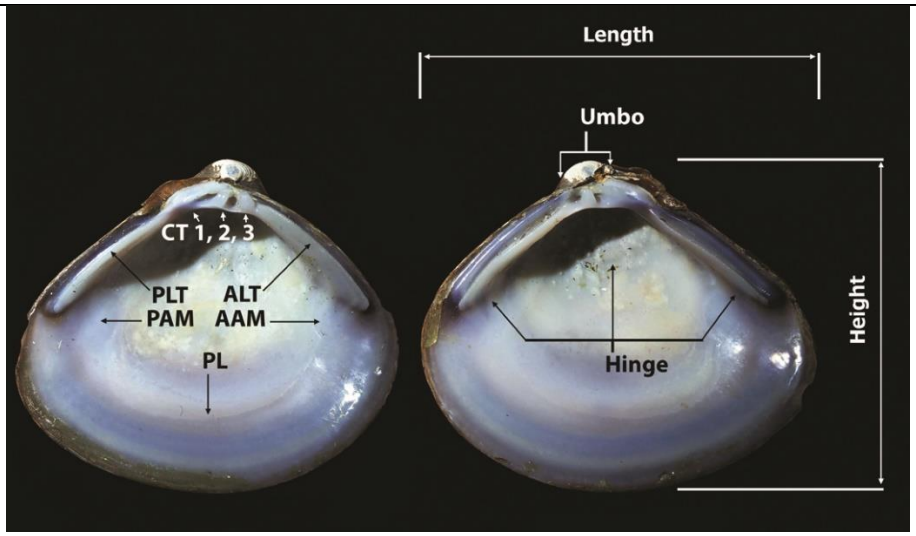
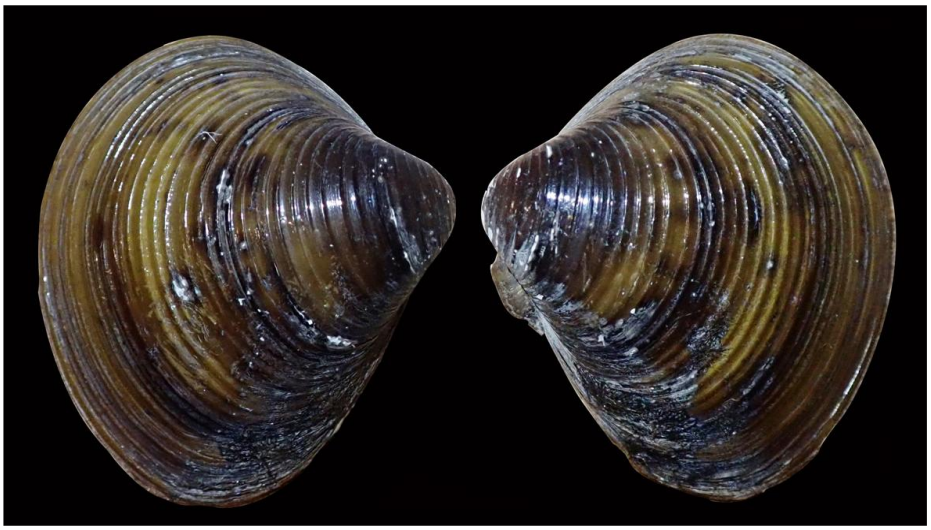
native species or habitats?	
Is there a management plan to combat the negative effects of the presence of the species in the investigated area?	No management plan
Human usage of IAS in the region	The specific species is being used as a forage by the grazing animals (goats, sheep), beekeeping, pharmacology
Justification - monitoring of these indicators is needed to:	- establishing the population dynamics; - impact assessment;
Investigation methods used	Standard geobotanical methods
Period of data collection	June, September
Equipment needed for species monitoring.	Motor boat, photocamera, GPS device

IAS scientific name	*Oithona davisae* Ferrari F.D. & Orsi, 1984			
IAS name vernacular name				
Taxonomy	Kingdom: Animalia	Phylum: Arthropoda	Ordo: Cyclopoida	Family: Oithonidae
Description	*Oithona davisae* has a shield-shaped prosome and four tapering thoracic segments. The final (5th) thoracic segment is conical and truncated, bearing much reduced P5 swimming legs (pereiopods). The urosome is slender, consisting of five segments (Ferrari and Orsi 1984). Adult females have a rostrum, which is pointed ventrally. The forehead is rounded dorsally. On the 1st urosome segment, there is a knob near the genital opening with one long and one short seta. The caudal rami have a length 3X the width, and are armed with one outward seta near the base and five seta at the tip. From the outward side inward, setae 2 and 3 are longer, with 2 being the longest. All the caudal setae are plumed and the antennules have 13 segments. The female, like other Oithonidae, often carries two symmetrical egg masses attached to the			

	genital segment. The adult male lacks a rostrum, and the forehead is somewhat squared off. The posterior-lateral edges of the cephalon are drawn into fingerlike projections. The length of the caudal rami is 2X the width, with setae like a female's. Both antennules are symmetrical and digeniculate (having two hinged joints), with 13 segments, and end in a thick subterminal projection (called an aesthete). The swimming legs (pereiopods) P1-P5 are slightly reduced in size relative to a female's.
Photograph [optimal]	 Photo: http://www.sevin.ru/top100worst/priortargets/arthropods/davisae_pr.html
Criteria of the species in the investigated area	A. likelihood of arrival : B. likelihood of establishment: C. likelihood of spread post invasion: ✔ D. potential impact on biodiversity: ✔
Habitat	A7 : Pelagic water column
Is the species found in the investigated habitat?	Will be completed based on the monitoring results
What is the observable level of invasiveness?	Will be calculated after monitoring implemented
What is the level of pressure on native species or habitats?	Will be completed based on the monitoring results
Is there a management plan to combat	No management plan

the negative effects of the presence of the species in the investigated area?	
Human usage of IAS in the region	No human usage
Justification - monitoring of these indicators is needed to:	- early detection of IAS and range spread. - establishing the population dynamics; - impact assessment; - evaluating the efficiency of management measures; - proposals regarding the adaptation / revision of the management measures;
Investigation methods used	Standard Juday plankton net with the mouth area of 0.1 m^2 and mesh size 150 µ. Samples should be fixed with buffered formaldehyde solution (4% final concentration).
Period of data collection	The sampling will be provided two times per a year, in warm and cold seasons.
Equipment needed for species monitoring.	Juday plankton net with the mouth area of 0.1 m^2 and mesh size 150 µ. 4% formaldehyde solution, binocular microscope

IAS scientific name	Provide the scientific name with author and year of description: *Corbicula leana* (O.F. Muller, 1774)			
IAS name vernacular name [optimal]	Provide the English common name if available: Asian clam, Japanese clam			
Taxonomy	Kingdom: Animalia	Phylum: Mollusca	Ordo: Venerida	Family: Cyrenidae
Description	Externally shells are mostly asymmetrical (the posterior vs. anterior margin), and their length visibly exceeds their height giving an oval appearance. Species had coarse, widely and irregularly spaced ribs. Shell hinge has long lateral and closely spaced cardinal teeth. The color of the outer side of the shell has a wide range of transitions from greenish yellow to olive. The internal coloration of an adult shell is purple, however, this may differ in juvenile shells.Fresh shells clearly show adductor muscle and pallial line. In the Danube Delta, adult specimens have length 2-4 cm.Frequently misidentified in European literature as *C. fluminea.* Diagnostic signs: coarse, widely and irregularly spaced ribs vs. regular,			

	closely-spaced ribs of *C. fluminalis*; asymmetrical oval shell (adult specimens) vs. symmetrical round shell of *C. fluminea* (additionally, last species in Europe has mostly light-milk internal coloration).
Photograph	 PL, PAM, AAM – pallial line with scar of posterior and anterior adductor muscles; CT 1-3 – cardinal teeth; PLT, ALT – posterior and anterior lateral teeth. 
Criteria of the species in the investigated area	A. likelihood of arrival – yes B. likelihood of establishment – yes C. likelihood of spread post invasion – yes D. potential impact on biodiversity – yes
Habitat	In the Lower Danube basin and adjacent areas are distributed in habitats: C2.32: Metapotamal and hypopotamal streams A5.224: Pontic mobile sands of the Danube mouths

	C1.21 : Benthic communities of mesotrophicwaterbodies C3.2111: Freshwater Phragmites beds J5.41: Non-salinewaterchannelswithcompletelyman-madesubstrate X01: Estuaries X03: Brackishcoastallagoons
Is the species found in the investigated habitat?	Will be completed based on the monitoring results
What is the observable level of invasiveness?	Will be calculated after monitoring implemented
What is the level of pressure on native species or habitats?	Will be completed based on the monitoring results
Is there a management plan to combat the negative effects of the presence of the species in the investigated area?	No management plan
Human usage of IAS in the region	If existing, provide the type of the human usage, e.g. resource using, fisheries, hunting, beekeeping, cultivation, etc.
Justification - monitoring of these indicators is needed to:	- early detection of IAS and range spread. - establishing the population dynamics; - impact assessment; - evaluating the efficiency of management measures; - proposals regarding the adaptation / revision of the management measures;
Investigation methods used	Provide the methods used for the species monitoring, e.g. transect method, surface method, traps, hydrobiological and ichthyological sampling methods. Provide the details for each particular case.
Period of data collection	Provide the periods period, optimal for the data collection. The particular dates could be corrected depending on the phenological properties of each particular taxonomic group.
Equipment needed for species monitoring.	Each species/expert group could provide the list of equipment necessary for the sampling/observations with its parameters.

IAS scientific name	*Perccottus glenii* Dybowski, 1877			
IAS name vernacular name [optimal]	Chinese sleeper, Amur sleeper, ротань-головешка (ukr.)			
Taxonomy	Kingdom: Animalia	Phylum: Chordata	Ordo: Centrarchidae	Family: Odontobutidae
Description	Dorsal spines (total): 6 - 8; Dorsal soft rays (total): 9-11; Anal spines: 1-3; Anal soft rays: 7 - 10. Distinguished from other European freshwater species by the following characters: 2 dorsals with the first with 6-8 simple rays, and the second with 2-3 simple and 8-12 branched rays; no spines on first dorsal; no barbels; pelvics not fused into a disc; no lateral line canals; males during spawning period, develop a hump on nape and become black with bright green spots on body and unpaired fins (Kottelat and Freyhof, 2007).			
Photograph [optimal]				
Criteria of the species in the investigated area	A. likelihood of arrival B. likelihood of establishment C. likelihood of spread post invasion: ✔ D. potential impact on biodiversity: ✔			
Habitat	C1.1 : Permanent oligotrophic lakes, ponds and pools C1.2 : Permanent mesotrophic lakes, ponds and pools C1.3 : Permanent eutrophic lakes, ponds and pools C1.6 : Temporary lakes, ponds and pools			
Is the species found in the investigated habitat?	Will be completed based on the monitoring results			
What is the observable level of invasiveness?	Will be calculated after monitoring implemented			
What is the level of pressure on native species or	Will be completed based on the monitoring results			

habitats?	
Is there a management plan to combat the negative effects of the presence of the species in the investigated area?	No management plan
Human usage of IAS in the region	No human usage
Justification - monitoring of these indicators is needed to:	- establishing the population dynamics - impact assessment
Investigation methods used	EN 14962:2006 Water quality – Guidance on the scope and selection of fish sampling methods, EN 14757:2015 Water quality – Samplingof fish with multimesh gillnets
Period of data collection	Spring, summer, autumn
Equipment needed for species monitoring.	Multimesh gillnets, dip nets, seine nets, traps

IAS scientific name	*Canis aureus* Linnaeus, 1758			
IAS name vernacular name	Golden jackal, Шакал звичайний (ukr.)			
Taxonomy	Kingdom: Animalia	Phylum: Chordata	Ordo: Carnivora	Family: Canidae
Description	The body length of the golden jackal is 70 to 85 cm., with a tail length of about 25 cm. Its standing height is approximately 40 cm. The fur is generally coarse and not very long. Its coat is usually yellow to pale gold and brown-tipped, but the color can vary with season and region. On the Serengeti Plain in Northern Tanzania, golden jackals are brown-tipped yellow in the rainy season (December-January), changing to pale gold in the dry season (September-October) (Jhala & Moehlman, 2004)			

Photograph	
Criteria of the species in the investigated area	A. likelihood of arrival : B. likelihood of establishment: C. likelihood of spread post invasion: ✔ D. potential impact on biodiversity: ✔
Habitat	E : Grasslands and lands dominated by forbs, mosses or lichens
Is the species found in the investigated habitat?	List of habitats observed. Mark yes/no: B1 : Yes B2 : No E1 : Yes E2 : No E3 : Yes
What is the observable level of invasiveness?	Will be completed based on the monitoring results
What is the level of pressure on native species or habitats?	Will be calculated after monitoring implemented
Is there a management plan to combat the negative effects of the presence of the species in the investigated area?	Will be completed based on the monitoring results
Human usage of IAS in the region	No human usage
Justification -	- establishing the population dynamics;

monitoring of these indicators is needed to:	- impact assessment; - evaluating the efficiency of management measures;
Investigation methods used	The observation will be provided by transects, also the traps plan to be installed. Field records accounting on a route method.
Period of data collection	The observations planned to be provided by season, 4 times per a year.
Equipment needed for species monitoring.	Binoculars 10X42, camera traps (if available), thermal imaging scope (if available), camera with telephotolens

2.3 - Nestos Delta - Greece

During our field work, we will use specific monitoring protocols. The most crucial information of this protocol have to do with the method that will be used to map each IAS distribution, the season of the sampling, and the equipment that should be used to obtain and record all necessary information. As the three IAS that have been selected for the study area of Nestos are shrubs and trees, we suggest in using for the mapping procedure a grid of a specific grid cell size. We will use a grid cell size of 200 m and the study area will be divided using the specific grid (Figure 1). Based on this grid we will try to map in detail the current distribution of each species and this process will be followed for two successive years (2021-2022). In this way, we will be able to detect differences in the spatial distribution of those three species, which in turn, will provide information about the invasiveness of each one species.

As stated above, the IAS species that will be monitored in Nestos areas are trees and shrubs and based on their phenological information all are in flower during spring and summertime. Consequently, all efforts towards their mapping will be accomplished during this period of the year. During the fieldwork, at each site where we will be finding any of the three IAS, we will record the geographical coordinates of the site, the altitude, the habitat according to the EUNIS codes and specific information regarding the impacts of the invasive alien species to the different components of the environment (e.g. local biodiversity, human activities). In more detail, the information that will be recorded for each species at each site are shown in the respective monitoring sheets of those species. After accomplishing the yearly field survey, we will have adequate information to assess the impacts of these three species (*Amorpha fruticosa, Acer negundo* and *Robinia pseudoacacia*) in Nestos area. Moreover, we will set the basis for their future monitoring as we will have their current detailed distribution. Such data will be very useful to local authorities (Management Body of Nestos Delta - Vistonida – Ismarida) which will try to assess future impacts of IAS in the study area and they will try to decrease them.

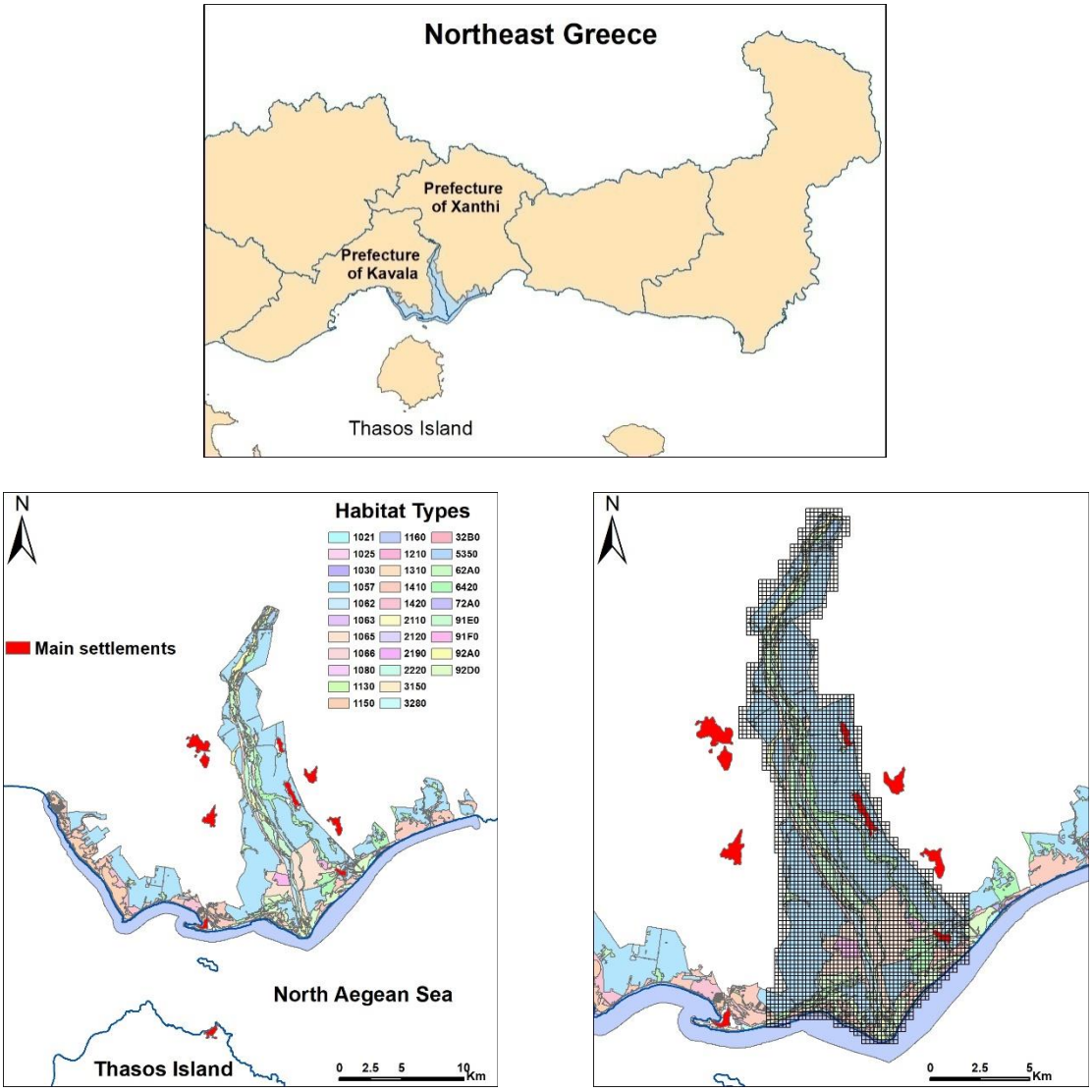


Figure 1. Map of the study area (Nestos delta) and the grid of 200 × 200 m that will be used for monitoring *Amorpha fruticosa, Acer negundo* and *Robinia pseudoacacia*.

Monitoring sheets of the IAS that will be monitored at Nestos area.

IAS scientific name	Provide the scientific name with author: *Amorpha fruticosa*L.			
IAS name vernacular name [optimal]	Provide the English common name if available: false indigo-bush			
Taxonomy	Kingdom: Plantae	Phylum: Spermatophyta	Subphylum: Angiospermae	Family: Fabaceae
Description	Deciduous shrubs, 1-4(-6) m tall. Stems pubescent, glabres-cent. Leaves 10-15-(30) cm; stipules bristlelike; petiole 1-2 cm; leaflets 11-25, ovate to elliptic, 1-4 x 0.6-2 cm, abaxially white puberulent, adaxially glabrous or sparsely pubescent, black glandular-dotted, base broadly cuneate or rounded, apex acute, obtuse, or retuse, with a shortly curved spinose tip. Racemes 1 to many, terminal or subterminal, 7-15 cm, densely pubescent; bracts 3-4 mm. Calyx 2.5-3.0 mm long; teeth triangular, unequal, shorter than tube. Standard purple, obcordate, ca 6 mm; wings and keel absent. Style puberulent. Legume dark brown, oblong, curved, 6-10 x 2-3 mm, apex beaked, strongly glandular-dotted, 1-seeded. Seed lustrous, reniform, ca 5 mm, curved upward (Flora of China Editorial Committee, 2010).			
Photograph [optimal]				
Criteria of the species in the investigated area	E. likelihood of arrival F. likelihood of establishment G. likelihood of spread post invasion H. potential impact on biodiversity			
Habitat	The list of habitats according to the typology of EUNIS where *Amorphafruticosa* is found in southern Europe are the following: C1.6: Temporary lakes, ponds and pools; C2.5: Temporary running waters; E3: Seasonally wet and wet grasslands; F9: Riverine and fen scrubs; G1.2: Mixed riparian floodplain and gallery woodland; G1.3: Mediterranean riparian woodland			
What is the observable level of invasiveness?	The invasiveness level could be classified in accordance to the **R**isk **A**ssessment **P**rotocol (RAP), provided bellow.			
What is the level of pressure on native species or habitats?	Provide the cases of habitat changes caused by IAS: overgrowing, competition with local species			
Is there a	None			

management plan to combat the negative effects of the presence of the species in the investigated area?	
Human usage of IAS in the region	The specific species is being used as a forage by the grazing animals (goats, sheep).
Justification - monitoring of these indicators is needed to:	- establishing the population dynamics; - impact assessment;
Investigation methods used	Transect method. A grid will cover the study area. The size of each grid cell is set to 200 x 200 m.
Period of data collection	Spring - Summer
Equipment needed for species monitoring.	Tablet for fieldwork, GPS device

IAS scientific name	Provide the scientific name with author: *Acer negundo* L.			
IAS name vernacular name [optimal]	Provide the English common name if available: box elder			
Taxonomy	Kingdom: Plantae	Phylum: Spermatophyta	Subphylum: Angiospermae	Family: Sapindaceae
Description	*A. negundo* is an often multi-stemmed tree reaching a height of no more than 20 m and a stem diameter of up to 1 m (Rosario, 1988). In more open vegetation the canopy usually exhibits a broad and open crown and may even become shrubby, whereas in the face of competition in a forest stand the trunk tends to be single-stemmed and straighter. Shoots are green and turn violet in the second year. The bark is grey-brown becoming dark grey and is shallowly cracked. Buds are opposite, small, 2-5 mm, two-scaled and silky white. The leaves are 15-35 cm long, pinnate with 3-5 (or 7) leaflets and light green but paler below. The leaflets are lobed and serrated. Leaflet shape is variable, for instance in var. interior the first pair of leaflets is 3-lobed. Male flowers are born in corymbs with pendent stamens whilst female flowers are in small pendent racemes. Both types of flowers are small and pale yellowish-green in colour. There is much variation in the morphology of			

	pistillate flowers with the presence of stamens on a proportion of the flowers (Hall, 1951). The fruit consists of two fused winged samaras to 4 cm long, diverging at an angle of less than 60 degrees. The samaras separate when shed and contain a single wrinkled seed.
Photograph [optimal]	
Criteria of the species in the investigated area	A. likelihood of arrival B. likelihood of establishment C. likelihood of spread post invasion D. potential impact on biodiversity
Habitat	The list of habitats according to the typology of EUNIS where *Acer negundo* is found are the following: G1.2: Mixed riparian floodplain and gallery woodland; G1.3: Mediterranean riparian woodland
What is the observable level of invasiveness?	The invasiveness level could be classified in accordance to the **R**isk **A**ssessment **P**rotocol (RAP), provided bellow.
What is the level of pressure on native species or habitats?	Provide the cases of habitat changes caused by IAS: overgrowing, competition with local species, changes in the dominant tree species due to vegetation succession
Is there a management plan to combat the negative effects of the presence of the species in the investigated area?	None
Human usage of IAS in the region	None. In urban areas it is being used as an ornamental.
Justification - monitoring of these indicators is needed to:	- establishing the population dynamics; - impact assessment;
Investigation methods used	Transect method. A grid will cover the study area. The size of each grid cell is set to 200 x 200 m.
Period of data collection	Spring - Summer
Equipment needed for species monitoring.	Tablet for fieldwork, GPS device

IAS scientific name	Provide the scientific name with author: *Robinia pseudoacacia* L.			
IAS name vernacular name [optimal]	Provide the English common name if available: black locust			
Taxonomy	Kingdom: Plantae	Phylum: Spermatophyta	Subphylum: Angiospermae	Family: Fabaceae
Description	*R. pseudoacacia* is a medium-sized tree, generally 12-18 m tall and 30-76 cm in stem diameter, with an open, irregular crown. On better sites it may reach 30 m tall and 122 cm or more in diameter. It is generally a crooked tree and often has a tendency to fork. The bole of open-grown trees is usually short and separates at 3 to 5 m above the ground into several stout branches, but in stands on good sites the bole is often clear and straight (Harlow et al. 1979; Harrar et al. 1962). *R. pseudoacacia* usually produces a shallow and wide-spreading root system that is excellent for soil binding but is also capable of producing deep roots (5-7 m deep). Radial root spread is about 1 to 1.5 times tree height (Cutler 1978). The smooth bark becomes reddish-brown and deeply furrowed with age, becoming 4 cm thick. It has sharp spines or thorns at the nodes of young branches and twigs that cause difficulties when handling seedlings, harvesting saplings and mature trees, and when feeding animals. The leaves are alternate, deciduous, compound and imparipinnate, 20-45 cm long and consist of 7-19 small, oval, alternate leaflets, 3.8-5 cm long, 1.2-1.8 cm wide, broadest near the middle to uniformly wide, dull dark green in colour. The fragrant, whitish flowers, less than 20 mm long, are borne in lax to pendent inflorescences (racemes), with perfect flowers originating in the axils of current year leaves. The fruit is a small, flattened, oblong pod with a narrow wing along the ventral margin, containing 4-8 hard-coated seeds			
Photograph [optimal]				
Criteria of the species in the investigated area	A. likelihood of arrival B. likelihood of establishment C. likelihood of spread post invasion D. potential impact on biodiversity			
Habitat	The list of habitats according to the typology of EUNIS where *Robiniapseudoacacia*is found are the following: E1 : Dry grasslands; E2: Mesic grasslands; G1: Broadleaved deciduous woodland; I1: Arable land and market gardens; I2: Cultivated areas of gardens and parks			

What is the observable level of invasiveness?	The invasiveness level could be classified in accordance to the **R**isk **A**ssessment **P**rotocol (RAP), provided bellow.
What is the level of pressure on native species or habitats?	Provide the cases of habitat changes caused by IAS: overgrowing, competition with local species, changes in the dominant tree species due to vegetation succession
Is there a management plan to combat the negative effects of the presence of the species in the investigated area?	None
Human usage of IAS in the region	None. In the past it was used for timber production.
Justification - monitoring of these indicators is needed to:	- establishing the population dynamics; - impact assessment;
Investigation methods used	Transect method. A grid will cover the study area. The size of each grid cell is set to 200 x 200 m.
Period of data collection	Spring - Summer
Equipment needed for species monitoring.	Tablet for fieldwork, GPS device

2.4 - Kızılırmak Delta - Turkey

IAS monitoring protocols and risk assessment methodology were applied on the selected IAS list shown in Table 4.

Table 4. Selected IAS for the monitoring in the Kızılırmak Deltaic area

Number	Latin Name	Common Name	Vernacular Name	Classification
1	*Cyprinus carpio* (Linnaeus, 1758)	Mirror carp	Pullu sazan; Aynalı sazan	Fish
2	*Carassius gibelio* (Bloch, 1782)	Prussian carp	İsrail sazanı	Fish
3	*Gambusia holbrooki* (Girard, 1859)	Eastern Mosquitofish	Sivrisinek balığı	Fish

4	*Gambusia affinis*(Baird and Girard, 1853)	Mosquitofish	Sivrisinek balığı	Fish
5	*Lithognathus mormyrus* (Linnaeus, 1758)	Striped seabream or Sand steenbras	Mırmır balığı	Fish
6	*Liza haematocheil* (Temminck andSchlegel, 1845)	Mugil, Haarder	Kırmızı dukalı kefal	Fish
7	*Parablennius incognitus* (Bath, 1968)	Mystery blenny	Horozbina	Fish
8	*Syngnathus acus* (Linnaeus, 1758)	Greater pipefish	Deniz iğnesi	Fish
9	*Oncorhynchus mykiss* (Walbaum, 1792)	Rainbow trout	Gökkuşağı alabalığı	Fish
10	*Gobius cruentatus* (Gmelin, 1789)	Red-mouthed goby	Kırmızı ağızlı kaya balığı	Fish
11	*Callinectes sapidus* (Rathbun, 1896)	Blue crab	Mavi yengeç	Crustacea/Decapoda
12	*Pseudosolenia calcar-avis (Schultze) (Sundström, 1986)*	*Pseudosolenia calcar-avis*	*Pseudosolenia calcar-avis*	Diatom
13	*Thalassiosira nordenskioeldii* (Cleve, 1873)	*Thalassiosira nordenskioeldii*	*Thalassiosira nordenskioeldii*	Diatom
14	*Alexandrium minutum* (Halim, 1960)	*Alexandrium minutum*	*Alexandrium minutum*	Dinophylagellate
15	*Oxyphysis oxytoksoides (*Kofoid 1926*)*	*Oxyphysis oxytoksoides*	*Oxyphysis oxytoksoides*	Dinophylagellate
16	*Scrippsiella trochoide (Stein)*	*Scrippsiella trochoide*	*Scrippsiella trochoide*	Dinophylagellate
17	*Ulva lactuca Linnaeus, 1753 = Ulva fasciata (*Delile, 1813)	Sea lettuce	*Deniz marulu*	*Cholorophyta*
18	*Mnemiopsis leidyi* (Agassiz, 1865)	Warty comb jelly	*Deniz Cevizi*	*Ctenophora*
19	*Beroe ovata (*Mayer 1912)	Brown comb jelly	*Hıyar Medüsü*	*Ctenophora*
20	*Acartia tonsa (Dana, 1849) (*)*	*Acartia tonsa*	*Acartia tonsa*	*Arthropoda*
21	*Balanus improvisus* (Darvin 1854)	*Oithona davisae*	*Oithona davisae*	Arthropoda

22	*Oithona davisae* (Ferrari F.D. and Orsi, 1984)	Bay barnacle, Acorn barnacle	Balanus	Arthropoda
23	*Rapana venosa* (Valenciennes, 1846)	Veined rapa whelk	Deniz salyangozu	Gastropoda
24	*Anadara kagishimensis* (Tokunaga, 1906)	Blood cockle	Kulaklı ark midye	Bivalve
25	*Potamopyrgus antipodarum* (J. E. Gray, 1843)	New Zealand mud snail	Yeni Zelanda çamur salyangozu	Gastropoda
26	Astacus leptodactylus (Eschscholtz, 1823)	Freshwater crayfish	Tatlısu kereviti	Crustacea

Selected IAS species protocols are listed below;

IAS scientific name	***Cyprinus carpio***(Linnaeus, 1758)			
IAS name vernacular name [optimal]	Mirror carp, Common carp, European Carp, Bayağı sazan (Turkish)			
Taxonomy	Kingdom: Animalia	Phylum: Chordota	Ordo: Cypriniformes	Family: Cyprinidae
Description	25-36 cm average length (120 cm maximum recorded) **Diagnostic characters:**2 pairs of barbels; dorsal fin with 15-20% branched rays; caudal fin deeply Emarginated (Kottelat and Freyhof, 2007). Large and thick scales.			
Photograph [optimal]	 *Photograph taken by Rafet Çağrı ÖZTÜRK*			

	
Criteria of the species in the investigated area	Provide the criteria due to Roy et al. (2015), i.e.: A. likelihood of arrival : B. likelihood of establishment: C. likelihood of spread post invasion: ✔ D. potential impact on biodiversity: ✔
Habitat	Lower and middle streams of rivers, inundated areas, shallow confined waters suchj as lakes and water reservoirs (FAO 2021). C-Inland surface waters
Is the species found in the investigated habitat?	List of habitats observed. Mark yes/no: A1 : No A2 : No C1 : Yes C2 : Yes C3 : Yes
What is the observable level of invasiveness?	The invasiveness level could be classified in accordance to the **R**isk **A**ssessment **P**rotocol (RAP), provided bellow. Competition with local species
What is the level of pressure on native species or habitats?	The common carp turns the clear waters into phytoplankton rich waters after the population density of carp reaches high density (Zamnbrano et al. 2001). Presence of common carp suppress growth of perch when prey is limited (Waber and Brown, 2017).
Is there a management plan to combat the negative effects of the presence of the species in the investigated area?	The species is not necessarily considered as an invasive species in the Kızılırmak Delta. The species formed reproducible population in the region and became one of the target fish species for fisherman. Fishing pressure on the species is the only management plan on the species.
Human usage of	As previously mentioned in upper section, presence of the species in

IAS in the region	the region is turned into profit by local fisherman.
Justification - monitoring of these indicators is needed to:	- impact assessment; - evaluating the efficiency of management measures;
Investigation methods used	Ichthyological sampling methods should be implemented. Gill nets and hand-line fishing methods could be used to evaluate current population status in the region.
Period of data collection	Seasonal sampling could give us a better idea of the seasonal spatial distribution of the species in the Kızılırmak delta.
Equipment needed for species monitoring.	Gill nets, dissecting equipment for age and sex determination, (bisturi, tweezer and scissors), scale, measuring rod.

IAS scientific name	***Carassius gibelio*** (Bloch, 1782)			
IAS name vernacular name [optimal]	Prussian carp, silver carp, gibel carp, İsrail sazanı (Turkish)			
Taxonomy	Kingdom: Animalia	Phylum: Chordota	Ordo: Cypriniformes	Family: Cyprinidae
Description	body in silvery-brownish color; last simple anal and dorsal rays strongly serrated; 37-52 gill rakers; lateral line with 29-33 scales; freed edge of dorsal concave or straight; anal fin with 5½ branched rays; and peritoneum black (Kottelat and Freyhof, 2007).			
Photograph [optimal]	 *Photograph taken by Rafet Çağrı ÖZTÜRK*			

Criteria of the species in the investigated area	Provide the criteria due to Roy et al. (2015), i.e.: A. likelihood of arrival : B. likelihood of establishment: C. likelihood of spread post invasion: ✔ D. potential impact on biodiversity: ✔
Habitat	Inhabits a wide variety of still water bodies and lowland rivers (FAO 2021). C-Inland surface waters
Is the species found in the investigated habitat?	List of habitats observed. Mark yes/no: A1 : No A2 : No C1 : Yes C2 : Yes C3 : Yes
What is the observable level of invasiveness?	The invasiveness level could be classified in accordance to the **R**isk **A**ssessment **P**rotocol (RAP), provided bellow. Competition with local species
What is the level of pressure on native species or habitats?	Prussian carp have been responsible for degradation and alteration of habitat quality by disturbing sediment during foraging, furthering declines in native fish species (Richardson et al., 1995; Crivelli, 1995; Veer and Nentwing, 2015). Differences in the abundance of native species before and after Prussian carp invasion demonstrated significant declines in the abundance of native species (Ruppert et al. (2017)
Is there a management plan to combat the negative effects of the presence of the species in the investigated area?	The Prussian carp is one of the worst invasive species in Kızılırmak Delta. It is currenty the most dominant invasive species in the region. The highest proportion of each fish catch in the Delta consist of the Prussian carp. Beside fishing pressure, there is not any management plan in effect.
Human usage of IAS in the region	Although, the Prussian carp is edible, it is not the consumers first choice.
Justification - monitoring of these indicators is needed to:	- establishing the population dynamics - impact assessment - evaluating the efficiency of management measures
Investigation methods used	Ichthyological sampling methods should be implemented. Gill nets and hand-line fishing methods could be used to evaluate current population status in the region.
Period of data collection	Seasonal sampling could give us a better idea of the seasonal spatial distribution of the species in the Kızılırmak delta.
Equipment	Gill nets, dissecting equipment for age and sex determination, (bisturi,

needed for species monitoring.	tweezer and scissors), scale, measuring rod.

IAS scientific name	***Gambusia holbrooki*** (Girard, 1859)			
IAS name vernacular name [optimal]	Eastern mosquitofish, Sivrisinek balığı (Turkish)			
Taxonomy	Kingdom: Animalia	Phylum: Chordota	Ordo: Cyprinodontiformes	Family: Poeciliidae
Description	Semi-transparent fins, superior mouth shape, small size (avergage size of males 3,8 cm and females 6.4 cm), black stripe near eye area. 7-8 dorsal and 10-11 anal fins.			
Photograph [optimal]	 *Photograph taken by Gunther Schmida (Url,3)*			
Criteria of the species in the investigated area	Provide the criteria due to Roy et al. (2015), i.e.: A. likelihood of arrival : B. likelihood of establishment: C. likelihood of spread post invasion: ✔ D. potential impact on biodiversity: ✔			
Habitat	Inhabits standing and slow-flowing waters, mostly in vegetated areas (Page et al. 1991). They are also encountered in brackish waters C-Inland surface waters			
Is the species found in the investigated habitat?	List of habitats observed. Mark yes/no: A1 : No A2 : No C1 : Yes C2 : Yes C3 : Yes			
What is the	The invasiveness level could be classified in accordance to the **R**isk			

observable level of invasiveness?	**A**ssessment **P**rotocol (RAP), provided bellow. Competition with local species and Predation cases
What is the level of pressure on native species or habitats?	Through predation and competition, mosquito fish negatively affect small fish populations. They are known to prey on eggs, larvae and juveniles of various fishes including carp species. (Courtenay and Meffe, 1989)
Is there a management plan to combat the negative effects of the presence of the species in the investigated area?	There is no management plan to combat any possible negative effect.
Human usage of IAS in the region	Due to similar size, shape and reproductive strategy, mosquito fish is mostly mistaken for a guppy. Thus in local scale mosquito fish are considered as ornamental fish.
Justification - monitoring of these indicators is needed to:	- establishing the population dynamics - impact assessment - evaluating the efficiency of management measures
Investigation methods used	Ichthyological sampling methods should be implemented. Scoop nets with small mesh size could be used to evaluate current population status in the region.
Period of data collection	Seasonal sampling could give us a better idea of the seasonal spatial distribution of the species in the Kızılırmak delta.
Equipment needed for species monitoring.	Scoop nets, scale, and measuring rod.

IAS scientific name	***Gambusia affinis*** (Baird and Girard, 1853)			
IAS name vernacular name [optimal]	Western mosquitofish, Sivrisinek balığı (Turkish)			
Taxonomy	Kingdom: Animalia	Phylum: Chordota	Ordo: Cyprinodontiformes	Family: Poeciliidae
Description	Semi-transparent fins, superior mouth shape, small size (avergage size of males 3.9 cm and females 6.2 cm), 6-7 dorsal and 9-10 anal fins. Length of anal nase much less than half distance from caudal fin. 8			

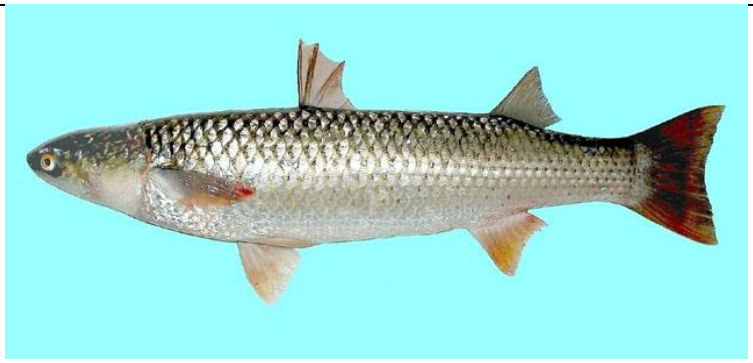
	horizontal scale rows.
Photograph [optimal]	 *Photographed by Aland Glynn (Fishbase)*
Criteria of the species in the investigated area	Provide the criteria due to Roy et al. (2015), i.e.: A. likelihood of arrival : B. likelihood of establishment: C. likelihood of spread post invasion: ✔ D. potential impact on biodiversity: ✔
Habitat	Inhabits standing and slow-flowing waters, mostly in vegetated areas (Yamamoto and Tagawa, 2000). They are also encountered in brackish waters C-Inland surface waters
Is the species found in the investigated habitat?	List of habitats observed. Mark yes/no: A1 : No A2 : No C1 : Yes C2 : Yes C3 : Yes
What is the observable level of invasiveness?	The invasiveness level could be classified in accordance to the **R**isk **A**ssessment **P**rotocol (RAP), provided bellow. Competition with local species, predation cases, etc.
What is the level of pressure on native species or habitats?	Through predation and competition, mosquito fish negatively affect small fish populations. They are known to prey on eggs, larvae and juveniles of various fishes including carp species. (Courtenay and Meffe, 1989)
Is there a management plan to combat the negative effects of the presence of the	There is no management plan to combat any possible negative effect.

species in the investigated area?	
Human usage of IAS in the region	Due to similar size, shape and reproductive strategy, mosquito fish is mostly mistaken for a guppy. Thus in local scale mosquito fish are considered as ornamental fish.
Justification - monitoring of these indicators is needed to:	- establishing the population dynamics - impact assessment - evaluating the efficiency of management measures
Investigation methods used	Ichthyological sampling methods should be implemented. Scoop nets with small mesh size could be used to evaluate current population status in the region.
Period of data collection	Seasonal sampling could give us a better idea of the seasonal spatial distribution of the species in the Kızılırmak delta.
Equipment needed for species monitoring.	Scoop nets, scale, and measuring rod.

IAS scientific name	***Lithognathus mormyrus*** (Linnaeus, 1758)			
IAS name vernacular name [optimal]	Sand steenbras, Streaped seabream, Mırmır Balığı (Turkish)			
Taxonomy	Kingdom: Animalia	Phylum: Chordota	Ordo: Perciformes	Family: Sparidae
Description	The species have moderately deep body that can grow up to 55 cm and weight around 1 kg. Eleven spines in dorsal fin, twelve to thirteen soft rays. The anal fin has three spines and 10-11 soft rays. Body marked with vertical dark bands.			

Photograph [optimal]	 *Streaped seabream photo captured in Civic Aquarium, Milan.*
Criteria of the species in the investigated area	Provide the criteria due to Roy et al. (2015), i.e.: A. likelihood of arrival : ✔ B. likelihood of establishment: C. likelihood of spread post invasion: D. potential impact on biodiversity:
Habitat	Distributed mainly in sandy and muddy bottoms and estuaries. C-Inland surface waters
Is the species found in the investigated habitat?	List of habitats observed. Mark yes/no: A1 : Yes A2 : Yes B1 : Yes C2 : No C3 : No
What is the observable level of invasiveness?	The invasiveness level could be classified in accordance to the **R**isk **A**ssessment **P**rotocol (RAP), provided bellow. Competition with local species
What is the level of pressure on native species or habitats?	The pressure level on native species is not considered for possibly being economically important.
Is there a management plan to combat the negative effects of the presence of the species in the	There is no management plan to combat any possible negative effect.

investigated area?	
Human usage of IAS in the region	Streaped seabream begin to form colonized loca populations in central and eastern Black Sea coast of Turkey. Streaped seabream is an economically valuable commercial fish species there is a demand for it in the market.
Justification - monitoring of these indicators is needed to:	-early detection of IAS and range spread. - establishing the population dynamics; - impact assessment;
Investigation methods used	Ichthyological sampling methods should be implemented. Scoop nets could be used to evaluate current population status in the region.
Period of data collection	Seasonal sampling could give us a better idea of the seasonal spatial distribution of the species in the Kızılırmak delta.
Equipment needed for species monitoring.	Scoop nets, scale, and measuring rod.

IAS scientific name	***Liza haematocheila*** (Temminck & Schlegel, 1845)			
IAS name vernacular name [optimal]	So-iuy mullet,Rus Kefali (Turkish)			
Taxonomy	Kingdom: Animalia	Phylum: Chordata	Ordo: Mugiliaformes	Family: Mugilidae
Description	Distinguished from other species of Liza in Europe, posterior extremity of upper jaw reaching beyond anterior rim of eye, predorsal scales with longitudinal groove 41–42 lateral line scales (not including scales on caudal base), 24 circumpeduncular scale rows.			
Photograph [optimal]	 *Photographed by Vasile Otel*			

	https://www.fishbase.se/photos/PicturesSummary.php?StartRow=2&ID=13000&what=species&TotRec=6
Criteria of the species in the investigated area	Provide the criteria due to Roy et al. (2015), i.e.: A. likelihood of arrival ✔ B. likelihood of establishment C. likelihood of spread post invasion D. potential impact on biodiversity
Habitat	Adults inhabit shallow coastal waters as well as freshwaters occasionally A7, C1, C2 https://eunis.eea.europa.eu/habitats-code-browser.jsp
Is the species found in the investigated habitat?	List of habitats observed. Mark yes/no: A7 : Yes C1 : Yes C2 : Yes
What is the observable level of invasiveness?	Competition with local species
What is the level of pressure on native species or habitats?	Overgrowing, Competition with local species for food and habitat
Is there a management plan to combat the negative effects of the presence of the species in the investigated area?	This species is under fishing pressure from the local fishermen.
Human usage of IAS in the region	Fisheries.
Justification -	- early detection of IAS and range spread.

monitoring of these indicators is needed to:	- establishing the population dynamics; - impact assessment;
Investigation methods used	Ichthyological sampling methods should be implemented. Fishing nets and hand-line fishing methods and traps could be used to evaluate current population status in the region.
Period of data collection	Seasonal sampling could give us a better idea of the seasonal spatial distribution of the species in the Kızılırmak delta.
Equipment needed for species monitoring.	Fishing nets, Electrofishing equipments, scale, measuring rod.

IAS scientific name	***Parablennius incognitus*** (Bath, 1968)			
IAS name vernacular name [optimal]	Mystery blenny, Horozbina (Turkish)			
Taxonomy	Kingdom: Animalia	Phylum: Chordata	Ordo: Perciformes	Family: Blenniidae
Description	The coloration of the body and head is olive-green, the territorial males are darker. On the upper part of the body there are 8–9 dark brown transverse unevenly outlined X-shaped stripes in the form of dumb-bells, with the first of them on the level of III–IV spinal ray; the last three stripes are usually blurred. Body dense, naked. Dorsal fin with well notched between spiny and soft parts (length of last spiny ray equal to 1/3–1/4 length of first soft ray). Beginning of dorsal fin just behind head in front of insertion of pectoral fin and on the level of insertion of ventral fin. Head big, length 3.4–3.8 in SL. Branchiostegal membranes connected by fold along the lower surface of head. The rear edge of upper jaw is at the level of rear edge of eye. Upper lip is big, it hangs out over lower jaw. Eye big, oval; its upper profile coincides with front contour of head. Horizontal diameter of eye 4.0–4.5 times length of head.			

Photograph [optimal]	 Photographed by Patzner, R. https://www.fishbase.in/photos/ThumbnailsSummary.php?Genus=Parablennius&Species=incognitus
Criteria of the species in the investigated area	Provide the criteria due to Roy et al. (2015), i.e.: A. likelihood of arrival ✔ B. likelihood of establishment ✔ C. likelihood of spread post invasion D. potential impact on biodiversity
Habitat	Coastal waters A1, A2 https://eunis.eea.europa.eu/habitats-code-browser.jsp
Is the species found in the investigated habitat?	List of habitats observed. Mark yes/no: A1 : Yes A2 : Yes
What is the observable level of invasiveness?	Competition with local species
What is the level of pressure on native species or habitats?	Competition with local species, predation,
Is there a management plan to combat the negative effects of the	There is not a management plan to combat the negative effects of the presence of the species in the investigated area.

presence of the species in the investigated area?	
Human usage of IAS in the region	No.
Justification - monitoring of these indicators is needed to:	- early detection of IAS and range spread. - establishing the population dynamics. - impact assessment;
Investigation methods used	Underwater observations, sampling with hand-net, traps, hydrobiological and ichthyological sampling methods.
Period of data collection	All seasons
Equipment needed for species monitoring.	Fishing nets, Traps, Hand-net, ruler for measuring, scales for weighing.

IAS scientific name	***Syngnathus acus*** (Linnaeus, 1758)			
IAS name vernacular name [optimal]	Greater pipefish, Deniz iğnesi (Turkish)			
Taxonomy	Kingdom: Animalia	Phylum: Chrdata	Ordo: Syngnathiformes	Family: Syngnathidae
Description	The greater pipefish has a long segmented armoured body, angular in cross section and stiff appearance. It ranges a color brown to green in with broad alternating light and dark hue along it. Its customized by a long snout with mouth on end and a slight hump on the top of the body just behind the eyes.			

Photograph [optimal]	 Photographed by Patzner, R. https://www.fishbase.se/photos/ThumbnailsSummary.php?Genus=Syngnathus&Species=acus
Criteria of the species in the investigated area	Provide the criteria due to Roy et al. (2015), i.e.: A. likelihood of arrival B. likelihood of establishment ✔ C. likelihood of spread post invasion D. potential impact on biodiversity
Habitat	Inshore waters, often amongsy seaweeds and seagrass. A1 : Yes A2 : Yes https://eunis.eea.europa.eu/habitats-code-browser.jsp
Is the species found in the investigated habitat?	List of habitats observed. Mark yes/no: A1 : Yes A2 : Yes
What is the observable level of invasiveness?	The invasiveness level could be classified in accordance to the **R**isk **A**ssessment **P**rotocol (RAP), provided bellow. Competition with local species.
What is the level of pressure on native species or habitats?	Competition with local species.
Is there a management	There is not a management plan to combat the negative effects of the presence of the species in the investigated area.

plan to combat the negative effects of the presence of the species in the investigated area?	
Human usage of IAS in the region	No,
Justification - monitoring of these indicators is needed to:	- early detection of IAS and range spread. - establishing the population dynamics; - impact assessment;
Investigation methods used	Underwater observations, sampling with hand-net, traps, hydrobiological and ichthyological sampling methods.
Period of data collection	All seasons
Equipment needed for species monitoring.	Fishing nets, Traps, Hand-net, ruler for measuring, scales for weighing.

IAS scientific name	***Oncorhynchus mykiss*** (Walbaum , 1792)			
IAS name vernacular name [optimal]	Rainbow trout, Gökkuşağı alabalığı (Turkish)			
Taxonomy	Kingdom: Animalia	Phylum: Chordata	Ordo: Salmoniformes	Family: Salmonidae
Description	Coloration varies widely between regions and subspecies. Adult freshwater forms are generally blue-green or olive green with heavy black spotting over the length of the body. Adult fish have a broad reddish stripe along the lateral line, from gills to the tail, which is most pronounced in breeding males. The caudal finis squarish and only mildly forked. Lake-			

	dwelling and anadromous forms are usually more silvery in color with the reddish stripe almost completely gone. Juvenile rainbow trout display parr marks (dark vertical bars) typical of most salmonid juveniles. In some red band and golden trout forms parr marks are typically retained into adulthood.
Photograph [optimal]	 Photographed by McDowall, R.M. https://www.fishbase.de/photos/ThumbnailsSummary.php?Genus=Oncorhynchus&Species=mykiss
Criteria of the species in the investigated area	Provide the criteria due to Roy et al. (2015), i.e.: A. likelihood of arrival B. likelihood of establishment C. likelihood of spread post invasion ✔ D. potential impact on biodiversity ✔
Habitat	Lakes, rivers, costal zones of seas A7, C1, C2
Is the species found in the investigated habitat?	List of habitats observed. Mark yes/no: A7 : Yes C1 : Yes C2: Yes
What is the observable level of invasiveness?	The invasiveness level could be classified in accordance to the **R**isk **A**ssessment **P**rotocol (RAP), provided bellow. Competition with local species

What is the level of pressure on native species or habitats?	Rainbow trout have been introduced throughout the world, negatively impacting species of native freshwater fishes and, therefore, native fisheries. Carrying and transmitting diseases, Predation, Competition with local species for food and habitat.
Is there a management plan to combat the negative effects of the presence of the species in the investigated area?	There is not a management plan to combat the negative effects of the presence of the species in the investigated area. However, this species is under fishing pressure from the local fishermen.
Human usage of IAS in the region	Fisheries, aquaculture.
Justification - monitoring of these indicators is needed to:	- early detection of IAS and range spread. - establishing the population dynamics. - impact assessment. - proposals regarding the adaptation / revision of the management measures;
Investigation methods used	Ichthyological sampling methods should be implemented. Fishing nets and hand-line fishing methods and traps could be used to evaluate current population status in the region.
Period of data collection	Seasonal sampling could give us a better idea of the seasonal spatial distribution of the species in the Kızılırmak delta.
Equipment needed for species monitoring.	Fishing nets, Electrofishing equipments, scale, measuring rod.

IAS scientific name	***Gobius cruentatus*** (Gmelin, 1789)
IAS name vernacular name	Red-mouthed goby, Kaya balığı (Turkish), Kırmızı yanaklı kaya balığı

[optimal]	(Turkish)			
Taxonomy	Kingdom: Animalia	Phylum: Chordata	Ordo: Perciformes	Family: Gobiidae
Description	This is a relatively large and stout bodied goby which is easily recognized by its distinctive coloration. The body is reddish-brown with lighter and darker blotches and the lips and cheeks have vivid red markings, hence its common name. Lines of black sensory papillae are visible on the head. Adult fish can be up to 18cm in length.			
Photograph [optimal]	 https://inpn.mnhn.fr/espece/cd_nom/70129?lg=en			
Criteria of the species in the investigated area	Provide the criteria due to Roy et al. (2015), i.e.: A. likelihood of arrival ✔ B. likelihood of establishment C. likelihood of spread post invasion D. potential impact on biodiversity			
Habitat	Inshore waters at depths up to 40 meters , areas with rocky and/or sandy substres A1, A2 https://eunis.eea.europa.eu/habitats-code-browser.jsp			
Is the species found in the investigated habitat?	List of habitats observed. Mark yes/no: A1 : Yes A2 : Yes			

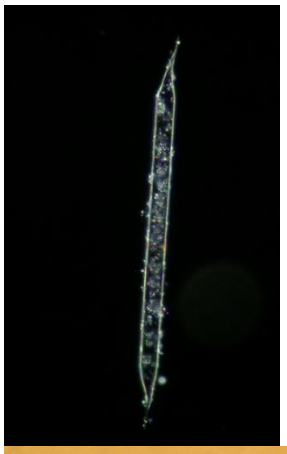
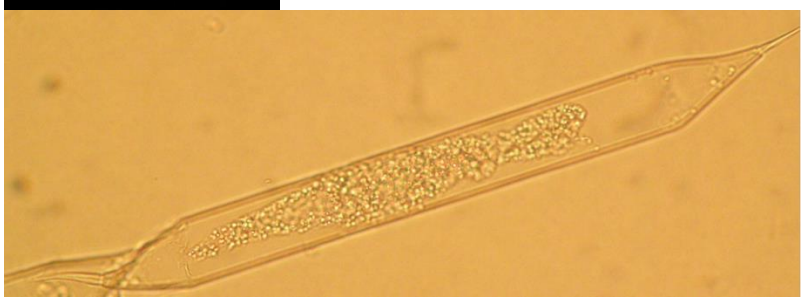
What is the observable level of invasiveness?	The invasiveness level could be classified in accordance to the **R**isk **A**ssessment **P**rotocol (RAP), provided bellow. Competition with local species
What is the level of pressure on native species or habitats?	Competition with local species
Is there a management plan to combat the negative effects of the presence of the species in the investigated area?	There is not a management plan to combat the negative effects of the presence of the species in the investigated area.
Human usage of IAS in the region	No,
Justification - monitoring of these indicators is needed to:	Choose the necessary: - early detection of IAS and range spread. - establishing the population dynamics; - impact assessment;
Investigation methods used	Underwater observations, sampling with hand-net, traps, hydrobiological and ichthyological sampling methods..
Period of data collection	All seasons.
Equipment needed for species monitoring.	Fishing nets, Traps, Hand-net, ruler for measuring, scales for weighing.

IAS scientific name	***Callinectes sapidus*** (Rathbun, 1896)

IAS name vernacular name [optimal]	Blue crab, Atlantic blue crab, Chesapeake blue crab, Mavi Yengeç (Turkish)			
Taxonomy	Kingdom: Animalia	Phylum: Arthropoda	Ordo: Decapoda	Family: Portunidae
Description	Carapace more than twice as broad as long. 9 blunt to acuminate teeth, front bearing 2 obtyse to acuminate. Fifth length flattened in form of paddles Greyish, bluish or brownish color.			
Photograph [optimal]	 *Photographed by Yahya TERZİ and Rafet Çağrı ÖZTÜRK*			
Criteria of the species in the investigated area	Provide the criteria due to Roy et al. (2015), i.e.: A. likelihood of arrival : ✔ B. likelihood of establishment: C. likelihood of spread post invasion: D. potential impact on biodiversity:			
Habitat	Inhabits standing and slow-flowing waters, mostly in vegetated areas (Yamamoto and Tagawa, 2000). They are also encountered in brackish waters A-Marine habitats, B-Coastal habitats			
Is the species found in the investigated habitat?	List of habitats observed. Mark yes/no: A1 : Yes A2 : Yes B1 : Yes C2 : No C3 : No			
What is the observable level of invasiveness?	The invasiveness level could be classified in accordance to the **R**isk **A**ssessment **P**rotocol (RAP), provided bellow. Competition with local species			
What is the level of pressure on native species or habitats?	The blue crab is an opportunistic benthic omnivore that feeds on whatever is available in the habitat (Mancinelli et al., 2017). If food is scarce, they even exhibit cannibalism (Hill et al., 1989). The blue crabs are aggressive towards other species and compete for food and space (Nehring et al., 2008). Presence or			

	establishment of this species in Kızılırmak Delta is unknown but it would surely affect the benthic community structure.
Is there a management plan to combat the negative effects of the presence of the species in the investigated area?	Currently, there is not any management plan to combat the negative effects of the species in the Black Sea. Moreover, the presence of the species in Kızılırmak Delta is not validated.
Human usage of IAS in the region	The blue crab is an economically important crab species. Their colonized populations in Mediterranean Sea and Aegean Sea formed an important fishery resource for local fisherman.
Justification - monitoring of these indicators is needed to:	- early detection of IAS and range spread. - establishing the population dynamics; - impact assessment;
Investigation methods used	Traps with bait would be the best equipment to catch specimens.
Period of data collection	Seasonal sampling could give us a better idea of the seasonal spatial distribution of the species in the Kızılırmak delta.
Equipment needed for species monitoring.	Crab traps, scale, and measuring rod.

IAS scientific name	***Pseudosolenia calcar-avis (Schultze) B.G.Sundström 1986***			
IAS name vernacular name [optimal]	*Pseudosolenia calcar-avis*			
Taxonomy	Kingdom: Chromista	Phylum: Bacillariophyta	Ordo: Rhizosoleniales	Family: Rhizosoleniaceae
Description	Diameter, 4.5-190 µm; process, 28-52 µm; areolae onbands 28-32 in 10 µm measured with TEM. **Remarks:** The shape of the valve and the external as well as the internalparts of process and the poroid areolae distinguish the genus from*Rbizosolenia sensu stricto*. **How to identify:** Most of the *Rbizosolenia* species as well as *Proboscia* and *Pseudosolenia* may be identified in girdle view in water mounts. In			

	criticalcases in which information on the otaria is urgent, valves cleaned of organicmatter and mounted in a medium of a high refractive index may beexamined in valve view.A portion of the frustule of *Pseudosolenia calcar-avis*, the largest planktonic diatom in the Black Sea.
Photograph [optimal]	  *Photographs taken by Ali Muzaffer Feyzioğlu*
Criteria of the species in the investigated area	Provide the criteria due to Roy et al. (2015), i.e.: E. likelihood of arrival : F. likelihood of establishment: G. likelihood of spread post invasion: ✔ H. potential impact on biodiversity: ✔
Habitat	Warm water region, occasionally in temperate waters; Near the mouth of river (Kaiser et al., 2018) A - Marine habitats
Is the species found in the investigated habitat?	List of habitats observed. Mark yes/no: A1 : No A2 : No A7: Yes C1 : No C2 : No C3 : No
What is the	The invasiveness level could be classified in accordance to the **R**isk

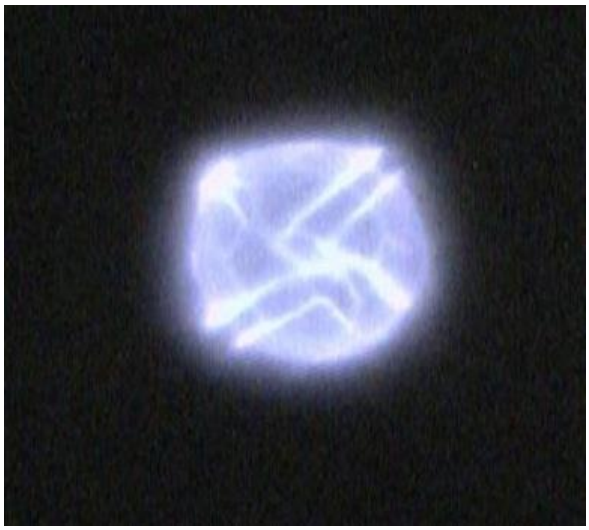
observable level of invasiveness?	**A**ssessment **P**rotocol (RAP), provided bellow. Competition with local species, The dominant diatom specie in this bloom period
What is the level of pressure on native species or habitats?	-*P. calcar-avis*, which previously successfully competed with a nativephytoplankton, owing to the fact that because of its largesize of *P. calcar-avis* zooplanktonorganisms did not feed on it, lost its advantageous position, -*P. calcar-avis*, its mass development, supplant more valuable aboriginal species of trophic phytoplankton.
Is there a management plan to combat the negative effects of the presence of the species in the investigated area?	There is not a management plan to combat the negative effects of the presence of*P. calcar-avis*.
Human usage of IAS in the region	No
Justification - monitoring of these indicators is needed to:	Determination of productivity, Eutrophication in coastal area
Investigation methods used	Phytoplankton sampling methods should be implemented. Taken sampling could be investigated in microscope and used to evaluate current biomass status in the region.
Period of data collection	Seasonal sampling could give us a better idea of the seasonal spatial distribution of the species in the Kızılırmak delta.
Equipment needed for species monitoring.	-The most simple method is tocollect water in a two liter container, add preservative (Lugol's iodine) and then examine under a microscope. -Alternatively a plankton net may be used with a mesh size of not more than 25 µm. Theplankton net should be dragged back and forth just below the surface.

IAS scientific name	***Thalassiosira nordenskioeldii*** (Cleve 1873)			
IAS name vernacular name [optimal]	*Thalassiosira nordenskioeldii*			
Taxonomy	Kingdom:	Phylum:	Ordo:	Family:

	Chromista	Bacillariophyta	Thalassiosirales	Thalassiosiraceae
Description	This species come in a variety of shapes, from box-shaped to cylindrical, discoid or spherical. Some Thalassiosira cells are found alone while others form chains. This genus harbor several discoid plastids and a circular valve, which contains pores arranged in rows or arcs, opening outwards. The valve's mantle edge is pattered with a series of bands. Different species of Thalassiosira can be identified by the morphological characteristics of their areolae and the processes on the valve.			
Photograph [optimal]	*Photograph taken by*			
Criteria of the species in the investigated area	Provide the criteria due to Roy et al. (2015), i.e.: E. likelihood of arrival : F. likelihood of establishment: G. likelihood of spread post invasion: ✔ H. potential impact on biodiversity: ✔			
Habitat	Thalassiosira occupy diverse habitats, both marine and freshwater. Of note, they are a vital primary producers in temperate and polar regions. Thalassiosira can thrive in low temperature and light, as well as mixed waters, and are therefore a large part of diatom blooms during spring in temperate regions (Park et al., 2016) A - Marine habitats			
Is the species found in the investigated habitat?	List of habitats observed. Mark yes/no: A1 : No A2 : No A7: Yes C1 : No C2 : No C3 : No			
What is the observable level of invasiveness?	The invasiveness level could be classified in accordance to the **R**isk **A**ssessment **P**rotocol (RAP), provided bellow. Competition with local species			
What is the level of pressure on native species or habitats?	The occurrence of *T. nordenskioeldii* in the colder waters of the Black Sea is not unexpected.			
Is there a management plan to combat the negative effects of the	The *T. nordenskioeldii* is one of the invasive species in Kızılırmak Delta. It is currently dominant forming bloom phytoplankton species in the region.			

presence of the species in the investigated area?	
Human usage of IAS in the region	This microscopic phytoplankton species is not suitable for human usage.
Justification - monitoring of these indicators is needed to:	- establishing the population dynamics - impact assessment
Investigation methods used	Phytoplankton sampling methods should be implemented. Taken sampling could be investigated in microscope and used to evaluate current biomass status in the region.
Period of data collection	Seasonal sampling could give us a better idea of the seasonal spatial distribution of the species in the Kızılırmak delta.
Equipment needed for species monitoring.	-The most simple method is to collect water in a two liter container, add preservative (Lugol's iodine) and then examine under a microscope. -Alternatively a plankton net may be used with a mesh size of not more than 25 µm. The plankton net should be dragged back and forth just below the surface.

IAS scientific name	***Alexandrium minutum*** (Halim, 1960)			
IAS name vernacular name [optimal]	*Alexandrium minutum*			
Taxonomy	Kingdom: Protista	Phylum: Protozoa	Ordo: Gonyaulacales	Family: Pyrophacaceae
Description	Small species, somewhat irregularly oval, sometimes a little longer than wide. Neither spines nor horns present. Cingulum deeply excavated, its right end displaced posteriorly one cingular width. Apical pore plate (Po) large, with a central foramen shaped like a comma. Rhomboidal first apical plate in direct or indirect contact (by a thread-like process of variable length) with Po. Sixth precingular narrow. Sulcus shallow. Posterior sulcal plate (S.p.) wider than long. Thin thecal walls. A very faint, irregular and incomplete reticulum is often seen in some plates, especially in the S.p. and the 1. Length: usually 17-29 µm (Balech, 1989).			

Photograph [optimal]	 *Photograph taken by Ali Muzaffer Feyzioğlu*
Criteria of the species in the investigated area	Provide the criteria due to Roy et al. (2015), i.e.: E. likelihood of arrival : F. likelihood of establishment: G. likelihood of spread post invasion: ✔ H. potential impact on biodiversity: ✔
Habitat	*Alexandrium minutum* is found in warm, temperate, coastal and estuarine waters. It has been reported over a number of geographical areas and in a wide range of coastal hydrographic regimes (Lilly et al. 2005). They are also encountered in brackish waters A - Marine habitats
Is the species found in the investigated habitat?	List of habitats observed. Mark yes/no: A1 : No A2 : No A7: Yes C1 : No C2 : No C3 : No
What is the observable level of invasiveness?	The invasiveness level could be classified in accordance to the **R**isk **A**ssessment **P**rotocol (RAP), provided bellow. *Alexandrium minutum* produces toxins which are toxic to some zooplankton and fish and can reduce copepod reproduction. The toxins are bioaccumulated in zooplankton, shellfish and crabs, the consumption of which can lead to paralytic shellfish poisoning (PSP) in humans and other mammals. Due to the potential for disease outbreak the occurrence of algal blooms near shellfish farms usually results in their closure, which results in economic losses. Prohibition of wild harvesting will also impact on local tribe or populations that

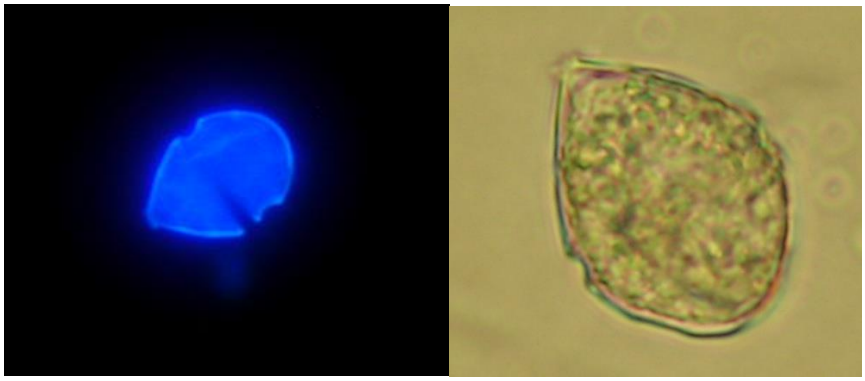
	rely on shellfish as a food source
What is the level of pressure on native species or habitats?	*A. minutum* produces toxins which are toxic to some zooplankton and fish and can reduce copepod reproduction. The toxins are bioaccumulated in zooplankton, shellfish and crabs, the consumption of which can lead to paralytic shellfish poisoning (PSP) in humans and other mammals. Because of forming bloom, cultural/traditional practices, human health, livelihoods, aquaculture/fisheries and tourism.
Is there a management plan to combat the negative effects of the presence of the species in the investigated area?	There is no management plan to combat any possible negative effect. As this species forms a tough resting cyst, it is easily transport by ballast water and in trans located shellfish, and it has been reported from most continents and every ocean. Control appears to be impossible. Highly likely to be transported internationally accidentally, deliberately and illegally. Difficult to identify/detect as a commodity contaminant, in the field and costly to control.
Human usage of IAS in the region	This microscopic phytoplankton species is not suitable for human usage.
Justification - monitoring of these indicators is needed to:	- establishing the population dynamics - impact assessment -Determination of toxin source
Investigation methods used	Phytoplankton sampling methods should be implemented. Taken sampling could be investigated in microscope and used toevaluate current biomass status in the region.
Period of data collection	Seasonal sampling could give us a better idea of the seasonal spatial distribution of the species in the Kızılırmak delta.
Equipment needed for species monitoring.	-The most simple method is to collect water in a two liter container, add preservative (Lugol's iodine) and then examine under a microscope. -Alternatively a plankton net may be used with a mesh size of not more than 25 µm. The plankton net should be dragged back and forth just below the surface.

IAS scientific name	***Oxyphysis oxytoxoides*** (Kofoid, 1926)			
IAS name vernacular name [optimal]	*Oxyphysis oxytoxoides*			
Taxonomy	Kingdom:	Phylum:	Ordo:	Family:

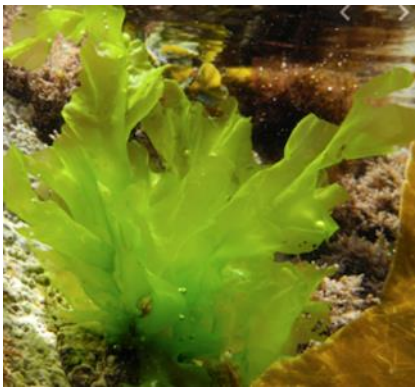
	Chromista	Miozoa	Dinophysales	Oxyphysaceae
Description	Among all the species of Dinophysidae family, Oxyphysis is the only genus having a strongly elongated left ventral epithecal plate. The cell is 49-54 µm long and 15-19 µm wide,the body being fusiform. The epitheca is an asymmetrical cone with different concave sides. The girdle displacement is similar to the one observed in some species of Oxytoxtim. Two hyaline membranes can be seen on the margins of the girdle. The sulcus containsa flagellar pore situated immediately behind girdle and includes the area between the twosulcal lists. SEM observations revealed subpolygonal reticulations all over the surface. Alongthe right and left ipothecal margins scattered pores are regularly distributed.			
Photograph [optimal]	*Photographed by*			
Criteria of the species in the investigated area	Provide the criteria due to Roy et al. (2015), i.e.: E. likelihood of arrival : F. likelihood of establishment: G. likelihood of spread post invasion: ✔ H. potential impact on biodiversity: ✔			
Habitat	Coastal and open ocean, in temperate to subtropical waters. *Oxyphysis oxytoxoides* was earlier thought to live only in the cold coastal waters. It is now known to occur throughout the cold temperate to subtropical water of the Atlantic Ocean and the Mediterranean Sea as well. *O. oxytoxoides* has sometimes been seen in the Indian River lagoon and it is speculated that it might have entered the lagoon via inlets from cool nearshore waters. it is possible in the Kızılırmak Delta. A - Marine habitats			
Is the species found in the investigated habitat?	List of habitats observed. Mark yes/no: A1 : No A2 : No A7: Yes C1 : No C2 : No C3 : No			
What is the observable level of invasiveness?	The invasiveness level could be classified in accordance to the **R**isk **A**ssessment **P**rotocol (RAP), provided bellow. As bloom-forming speciesand competition with local species.			
What is the level	As bloom-forming species			

of pressure on native species or habitats?	
Is there a management plan to combat the negative effects of the presence of the species in the investigated area?	There is no management plan to combat any possible negative effect.
Human usage of IAS in the region	This microscopic phytoplankton species is not suitable for human usage.
Justification - monitoring of these indicators is needed to:	- establishing the population dynamics - impact assessment
Investigation methods used	Phytoplankton sampling methods should be implemented. Taken sampling could be investigated in microscope and used to evaluate current biomass status in the region.
Period of data collection	Seasonal sampling could give us a better idea of the seasonal spatial distribution of the species in the Kızılırmak delta.
Equipment needed for species monitoring.	-The most simple method is to collect water in a two liter container, add preservative (Lugol's iodine) and then examine under a microscope. -Alternatively a plankton net may be used with a mesh size of not more than 25 µm. The plankton net should be dragged back and forth just below the surface.

IAS scientific name	***Scrippsiella trochoide*** ((Stein) Loeblich)			
IAS name vernacular name [optimal]	*Scrippsiella trochoide*			
Taxonomy	Kingdom: Chromista	Phylum: Miozoa	Ordo: Thoracosphaerales	Family: Thoracosphaeraceae
Description	*Scrippsiella trochoide*is pear-shaped, length 16 - 36 µm, width 20 - 23 µm, reddish-green, solitary, covering cellulose theca, two unequal flagella, several discoid chloroplast.			

Photograph [optimal]	 *Photographed by Ali Muzaffer Feyzioğlu*
Criteria of the species in the investigated area	Provide the criteria due to Roy et al. (2015), i.e.: E. likelihood of arrival : F. likelihood of establishment: G. likelihood of spread post invasion: ✔ H. potential impact on biodiversity: ✓
Habitat	Coastal and estuarine waters, cold temperate to tropical waters worldwide A-Marine habitats
Is the species found in the investigated habitat?	A1 : No A2 : No A7: Yes B1 : No C2 : No C3 : No
What is the observable level of invasiveness?	The invasiveness level could be classified in accordance to the **R**isk **A**ssessment **P**rotocol (RAP), provided bellow. *Scrippsiella trochoidea*is Black Sea blooming species,Competition with local species
What is the level of pressure on native species or habitats?	*S. trochoidea* occur bloom in late spring to early winter in warm watersand causes water discoloration. Decreasing oxygen concentration and causing the anoxia.
Is there a management plan to combat the negative effects of the presence of the species in the	Currently, there is not any management plan to combat the negative effects of the species in the Black Sea.

investigated area?	
Human usage of IAS in the region	This microscopic phytoplankton species is not suitable for human usage.
Justification - monitoring of these indicators is needed to:	- establishing the population dynamics; - impact assessment. - Eutrophication;
Investigation methods used	Phytoplankton sampling methods should be implemented. Taken sampling could be investigated in microscope and used to evaluate current biomass status in the region.
Period of data collection	Seasonal sampling could give us a better idea of the seasonal spatial distribution of the species in the Kızılırmak delta.
Equipment needed for species monitoring.	-The most simple method is to collect water in a two liter container, add preservative (Lugol's iodine) and then examine under a microscope. -Alternatively a plankton net may be used with a mesh size of not more than 25 µm. The plankton net should be dragged back and forth just below the surface.

IAS scientific name	***Ulva lactuca Linnaeus, 1753 = Ulva fasciata Delile, 1813***			
IAS name vernacular name [optimal]	Sea lettuce, Deniz Marulu (Turkish)			
Taxonomy	Kingdom: Plantae	Phylum: Chlorophyta	Ordo: Ulvales	Family: Ulvaceae
Description	Thallus sheet-like, light green, rather delicate and translucent, to 250 mm long. Persists throughout the year.			
Photograph [optimal]				
Criteria of the species in the investigated area	Provide the criteria due to Roy et al. (2015), i.e.: E. likelihood of arrival : F. likelihood of establishment:			

	G. likelihood of spread post invasion: ✔ H. potential impact on biodiversity: ✔
Habitat	On rock and in lower-shore rock pools, and in the shallow subtidal. A- Marinehabitats
Is the species found in the investigated habitat?	List of habitats observed. Mark yes/no: A1 : Yes A2 : Yes B1 :No C2 : No C3 : No
What is the observable level of invasiveness?	The invasiveness level could be classified in accordance to the **R**isk **A**ssessment **P**rotocol (RAP), provided bellow. Competition with local species
What is the level of pressure on native species or habitats?	The pressure level on native species is considered for possibly being economically important. Covering surface area and decreasing biodiversity
Is there a management plan to combat the negative effects of the presence of the species in the investigated area?	There is no management plan to combat any possible negative effect.
Human usage of IAS in the region	- Harmless and no commercial usage,
Justification - monitoring of these indicators is needed to:	- establishing the population dynamics; - impact assessment;
Investigation methods used	Seaweed (*U. lactuca*) samples are collectedalong the coast by scuba diving and dredge.These samples are collected at certaindepths (0-3 meters).
Period of data collection	Seasonal sampling could give us a better idea of the seasonal spatial distribution of the species in the Kızılırmak delta.
Equipment needed for species monitoring.	Grap and dredge can use certain depths and can also be collect with scuba diving

IAS scientific name	***Mnemiopsis leidyi*** (A. Agassiz, 1865)			
IAS name vernacular name [optimal]	American comb jelly, comb jelly, comb jellyfish (English), Rippenqualle (German), sea gooseberry, sea walnut (English), Venus' girdle, warty comb jelly, Deniz cevizi (Turkish)			
Taxonomy	Kingdom: Animalia	Phylum: Ctenophora	Ordo: Lobata	Family: Bolinopsidae
Description	*Mnemiopsis ledyi* is a comb jelly with a length up to 100mm. The body is laterally compressed, with large lobes arising near the stomodaeum, generating 4 deep, noticeable furrows that characterize the genus. It has four rows of small, but numerous, ciliated combs which are iridescent by day and may glow green by night. The color is usually transparent or slightly milky, translucent (Shiganova 2003).			
Photograph [optimal]				
Criteria of the species in the investigated area	Provide the criteria due to Roy et al. (2015), i.e.: A. likelihood of arrival : B. likelihood of establishment: C. likelihood of spread post invasion: ✔ D. potential impact on biodiversity: ✔			
Habitat	The native habitat of the ctenophore, Mnemiopsis, is in temperate to subtropical estuaries along the Atlantic coast of North and South America. *M. leidyi* is tolerant of a wide range of salinity, temperature and water quality conditions over a broad range of inshore habitats. Since its unintentional introduction to the Black Sea, Mnemiopsis has spread to adjacent bodies of water, inhabiting waters of salinities ranging from 3% in the Sea of Azov to 39‰ in the eastern Mediterranean, and temperatures ranging from 4°C in winter to 31°C in summer (Vinogradov et al. 1989). A- Marine habitats			
Is the species found in the investigated habitat?	List of habitats observed. Mark yes/no: A1 : No A2 : No A7: Yes C1 : No C2 : No C3 : No			
What is the observable level of invasiveness?	The invasiveness level could be classified in accordance to the **R**isk **A**ssessment **P**rotocol (RAP), provided bellow. -A major zooplankton predator on edible zooplankton (including meroplankton), pelagic fish eggs and larvae			

	- Competition with local species
What is the level of pressure on native species or habitats?	*Mnemiopsis ledyi* is a major zooplankton predator and is associated with fishery collapse (Costello, 2001). A carnivorous predator on edible zooplankton (including meroplankton), pelagic fish eggs and larvae, *M. leidyi* causes negative impacts right through the foodchain of the areas it has invaded. In the Black Sea and the Sea of Azov, the zooplankton, ichthyoplankton and zooplanktivorous fish stocks all underwent profound changes
Is there a management plan to combat the negative effects of the presence of the species in the investigated area?	Currently, there is not any management plan to combat the negative effects of the species in the Black Sea. Eradication may be impossible in practice. A varies predators consume *M. leidyi* in its native regions. After *Beroe ovata* which is predator on *M. leidyi*, was introduced to the region, reduction of *M. leidyi* populations was observed in the Black Sea
Human usage of IAS in the region	There is no usage for human in the region.
Justification - monitoring of these indicators is needed to:	- establishing the population dynamics, - impact assessment,
Investigation methods used	Within research monitoring surveys, two typesof plankton nets could be used for quantitative estimateof *M. leidyi*, a WP2 net (opening area 0.25m² and 200 µm mesh size) and a WP3 net(opening area 1.0 m² and 1.0 mm mesh size).
Period of data collection	Seasonal sampling could give us a better idea of the seasonal spatial distribution of the species in the Kızılırmak delta.
Equipment needed for species monitoring.	Plankton nets,

IAS scientific name	***Beroe ovate***(Bruguière, 1789)			
IAS name vernacular name [optimal]	Brown comb jelly, Pink comb-jelly, Hıyar Medüsü and Medüz (Turkish)			
Taxonomy	Kingdom: Animalia	Phylum: Ctenophora	Ordo: Beroida	Family: Beroidae
Description	Body mitten-shaped. Lateral compression very marked. Four meridional			

	canals of each broad side connected orally by oral forks of paragastric canal. Eight meridional canals interconnected by loose network of numerous diverticulae, with a few anastomoses forming a wide meshwork. Color dull milky, pink or reddish brown. Height: up to 115 mm, usually 60-70 mm.
Photograph [optimal]	 *Photograph by M. Feyzioğlu*
Criteria of the species in the investigated area	Provide the criteria due to Roy et al. (2015), i.e.: E. likelihood of arrival : F. likelihood of establishment: G. likelihood of spread post invasion: ✔ H. potential impact on biodiversity: ✔
Habitat	Naturally inhabits the Atlantic Ocean and coastal waters near both the United States and Canada as well as in the Gulf of Mexico and European waters. Although it observed off-shore and coastal area, small specimens (16–18 mm) werefound only in coastal region with shallow depths. A-Marine habitats
Is the species found in the investigated habitat?	List of habitats observed. Mark yes/no: A1 : No A2 : No A7: Yes C1 : No C2 : No C3 : No
What is the observable level of invasiveness?	The invasiveness level could be classified in accordance to the **R**isk **A**ssessment **P**rotocol (RAP), provided bellow. -*Beroe ovata* is a predator, opening its mouth wide and sucking in prey, sometimes as big as or bigger than itself. Its prey consists mostly of other comb jellies, mainly sea gooseberries such as *Pleurobrachia pileus*. *B. ovata* feeds also on *M. leidyi*, was introduced as a biological control to try to redress the balance (Zaika, 1990). Under optimal conditions, *Beroe ovata* can eat as much as four times its body weight

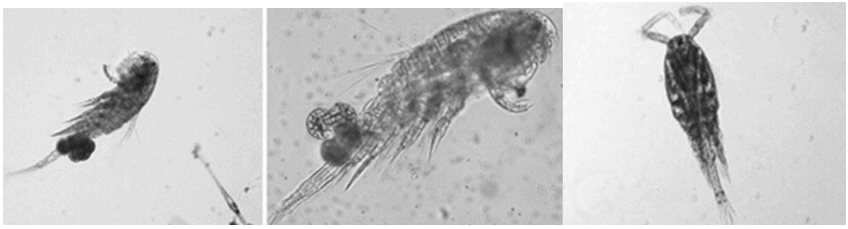
	each day
What is the level of pressure on native species or habitats?	Its prey consists mostly of other comb jellies, mainly sea gooseberries such as *Pleurobrachia pileus. B. ovata* feeds on *M. leidyi*, was introduced as a biological pest control to try to redress the balance (Zaika, 1990). After the introduction of *B. ovata* into Black Sea ecosystem considerably decreased were observed in the numbers of *M. leidyi* which has pressure on the zooplankton - Competition with local species
Is there a management plan to combat the negative effects of the presence of the species in the investigated area?	Currently, there is not any management plan to combat the negative effects of the species in the Black Sea.
Human usage of IAS in the region	There is no usage for human in the region.
Justification - monitoring of these indicators is needed to:	*B. ovata* were predator on other harmful species. It needs to monitor for understanding in controlling level of other organism in ecosystem.
Investigation methods used	- The standard collecting techniques like vertical and horizontal tow by using plankton nets with 500 µm mesh size can be applied.
Period of data collection	Seasonal sampling could give us a better idea of the seasonal spatial distribution of the species in the Kızılırmak delta.
Equipment needed for species monitoring.	Plankton nets

IAS scientific name	***Acartia tonsa*** (Dana, 1849)			
IAS name vernacular name [optimal]	*Acartia tonsa*			
Taxonomy	Kingdom: Animalia	Phylum: Arthropoda	Ordo: Calanoida	Family: Acartiidae

Description	*Acartia tonsa* is translucent, and is usually between about 0.8 and 1.5 mm in length in females, and from about 0.8 to 1.3 mm in males. It can be differentiated from closely related species by their long first antennae (at least half the length of their bodies) and biramous (branched) second antennae, as well as the presence of a joint between their fifth and sixth body segments (Gonzales, 2013).
Photograph [optimal]	
Criteria of the species in the investigated area	Provide the criteria due to Roy et al. (2015), i.e.: A. likelihood of arrival : B. likelihood of establishment: C. likelihood of spread post invasion: ✔ D. potential impact on biodiversity: ✔
Habitat	*Acartia tonsa* is a calanoid copepodspecies that can be found in a largeportion of the world's estuaries, brackishwaters s and areas of upwelling where food concentrations are high. It is commonly found in coastal waters, including brackish estuaries. *A. tonsa* is found year-round in estuaries and coastal waters which are warm throughout the year. It is frequently the dominant zooplankton in the spring and summer samplings. Individuals spend most of the day in deeper waters in order to avoid predators, rising into shallower waters at night A-Marine habitats
Is the species found in the investigated habitat?	List of habitats observed. Mark yes/no: A1 : No A2 : No A7: Yes C1 : No C2 : No C3 : No
What is the observable level of invasiveness?	The invasiveness level could be classified in accordance to the **R**isk **A**ssessment **P**rotocol (RAP), provided bellow. -*A. tonsa* is often predominant zooplankton in Black Sea in spring and summer. It is an important grazer on phytoplankton and also a source of food forseveral marine and estuarine invertebrates and fishlarvae.
What is the level of pressure on native species or habitats?	*Acartia tonsa* appeared in the Black Sea in theearly 1970s and it was supposed that the speciesreplaced the native *Paracartia latisetosa*because it occupied the same ecological niche (Gubanova, 2000).This species play a significant role in the mesozooplankton communitystructure, with maximum abundance in spring-summer for *Acartia tonsa* in the Black Sea. There is no pressure on native habitat

	and species. Beyond this it is very useful food for fish larvae and larger zooplankton.
Is there a management plan to combat the negative effects of the presence of the species in the investigated area?	Currently, there is not any management plan to combat the negative effects of the species in the Black Sea.
Human usage of IAS in the region	There is no usage for human directly in the region.
Justification - monitoring of these indicators is needed to:	*- Acartia tonsa can be used as indicator for calculation of the carrying capacity of region and estimation food source of fish larvae.*
Investigation methods used	Plankton nets can be used for qualitative and quantitative sampling.
Period of data collection	Seasonal sampling could give us a better idea of the seasonal spatial distribution of the species in the Kızılırmak delta.
Equipment needed for species monitoring.	Plankton nets

IAS scientific name	***Oithona davisae*** Ferrari F.D.&Orsi, 1984			
IAS name vernacular name [optimal]	*Oithona davisae*			
Taxonomy	Kingdom: Animalia	Phylum: Arthropoda	Ordo: Cyclopoida	Family: Oithonidae
Description	*Oithona davisae* has a shield-shaped prosome and four tapering thoracic segments. The final (5th) thoracic segment is conical and truncated, bearing much reduced P5 swimming legs (pereiopods). The urosome is slender, consisting of five segments (Ferrari and Orsi 1984). Adult females have a rostrum, which is pointed ventrally. The forehead is rounded dorsally. On the 1st urosome segment, there is a knob near the genital opening with one long and one short seta. The caudal rami have a length 3X the width, and are armed with one outward seta near the base and five seta at the tip. From the outward side inward, setae 2 and 3 are longer, with 2 being the longest. All the caudal setae are			

	plumed and the antennules have 13 segments. The female, like other Oithonidae, often carries two symmetrical egg masses attached to the genital segment. The adult male lacks a rostrum, and the forehead is somewhat squared off. The posterior-lateral edges of the cephalon are drawn into fingerlike projections. The length of the caudal rami is 2X the width, with setae like a female's. Both antennules are symmetrical and digeniculate (having two hinged joints), with 13 segments, and end in a thick subterminal projection (called an aesthete). The swimming legs (pereiopods) P1-P5 are slightly reduced in size relative to a female's.
Photograph [optimal]	 *Photographed by* İlknur Yıldız and Ali Muzaffer Feyzioğlu
Criteria of the species in the investigated area	Provide the criteria due to Roy et al. (2015), i.e.: E. likelihood of arrival : F. likelihood of establishment: G. likelihood of spread post invasion: ✔ H. potential impact on biodiversity: ✔
Habitat	*Oithona davisae* originates in East Asia: Japan and the China Seas, and many coastal areas. It is also a cyclically abundant member of the planktonic fauna in many remote marine and estuary ecosystems.
Is the species found in the investigated habitat?	List of habitats observed. Mark yes/no: A1 : No A2 : No A7: Yes C1 : No C2 : No C3 : No
What is the observable level of invasiveness?	The invasiveness level could be classified in accordance to the **R**isk **A**ssessment **P**rotocol (RAP), provided bellow. -*Oithona davisae* is highest number of adults and copepoditestages at the coastal station at the end of autumn in the Black Sea. This species has also been reported as an important edible planktonic organism for fish larvae, which fills the gap causedby the disappearance of *O. nana* in the Black Seaecosystem (Vdodovich et al. 2017). - Species of genus Oithona are omnivorous with preferences for ciliates and dinoflagellates.

	- Competition with local species for food It is an important grazer on phytoplankton and a source of food for several marine and estuarine invertebrates and fish larvae.
What is the level of pressure on native species or habitats?	The species *O. davisae*, which is a new immigrant in the Black Sea and a representative of Cyclopoida: Copepoda, is indigenous to Japan and the China Seas. During the regular monitoring programme, *O. davisae* was first discovered in the Anatolian continental shelf area (Black Sea) in 2010. Since then it has been observed regularly (Yıldız et al., 2017). The studies show that *O. davisae* has successfully invaded the southern Black Sea and may replace *Oithona nana*, which was regularly observed in coastal areas (Shiganova et al. 2012; Temnykh et al. 2012). Its high abundances also indicate that it may become a key species in the food web of the southern Black Sea. Species of genus Oithona are omnivorous with preferences for ciliates and dinoflagellates (Atkinson 1995; Saiz et al. 2014). Furthermore, they are an important prey for fish larvae in the Black Sea (Tkach et al. 1998). Hence, *O. davisae* would be a key species in the energy transfer from the microbial loop to higher trophic levels, which is very important in the Black Sea. There is no pressure on native habitat and species. Beyond this it is very useful food for fish larvae and larger zooplankton as other copepod species.
Is there a management plan to combat the negative effects of the presence of the species in the investigated area?	Currently, there is not any management plan to combat the negative effects of the species in the Black Sea.
Human usage of IAS in the region	There is no usage for human in the region.
Justification - monitoring of these indicators is needed to:	- Natural succession in the zooplankton community may also be altered as a result of the high rate of spread of *O. davisae*, as has been observed in other areas of the Black Sea. Monitoring studies are required to determine whether such changes affect the fish stocks and to investigate the impacts this may have on the ecosystem.
Investigation methods used	Plankton nets can be used for qualitative and quantitative purposes for sampling of mesozooplankton.
Period of data collection	Seasonal sampling could give us a better idea of the seasonal spatial distribution of the species in the Kızılırmak delta.
Equipment	Plankton nets

needed for species monitoring.	

IAS scientific name	***Balanus improvisus*** (Darwin, 1854)			
IAS name vernacular name [optimal]	Bay barnacle, Barnacle, Balanus (Turkish)			
Taxonomy	Kingdom: Metazoa	Phylum: Arthropoda	Ordo: *Sessilia*	Family: *Balanidae*
Description	*B. improvisus* has a low, cone-shaped or semi-globe shape. It may be cylinder-shaped in crowded populations. The calcareous shell is made up of white to greyish plates. Walls never ribbed or folded longitudinally. Uneroded calcareous shells have a smooth surface and may be covered by a thin yellowish epidermis, which is often more resilient on the radii. The radii are narrow and oblique and do not completely cover the alae that is nearly horizontal. The carina is lower than the rostrum. The operculum situated off centre, so that terga are close to the carina. The operculum is rounded at the rostral end. In water the opening is narrow and diamond shaped with partly- erect tergoscutal flaps.Base of the shell calcareous, flat and thin. Canals inside run radially to the place (approximately centre of the basal plate) where cyprid antennas were attachedforming a star-like pattern. *B. improvisus* normally grows to around 10 mm in diameter.			
Photograph [optimal]	 *Photographed by M. Feyzioğlu*			
Criteria of the species in the investigated area	Provide the criteria due to Roy et al. (2015), i.e.: A. likelihood of arrival : B. likelihood of establishment: C. likelihood of spread post invasion: ✔ D. potential impact on biodiversity: ✔			
Habitat	Brackish water bays and estuaries to shallow marine habitats (max. 6 m depth) with hard substrata (stones, rocky shores and man-made constructions such as breakwaters and ships). Its wide distribution indicate its potential of becoming established from warm temperate to			

	tropical regions.According to the data from literature Balanus can inhabit 0.5 – 90 m of water depth, to the author it was met in the 0.1 – 47 m of depth (the optimum is 0 – 19 m).
Is the species found in the investigated habitat?	List of habitats observed. Mark yes/no: A1 : Yes (Adult) A3 : Yes (Adult) A7: Yes (Balanus Naiplus and Cyprid) C1 : No C2 : No C3 : No
What is the observable level of invasiveness?	The invasiveness level could be classified in accordance to the **R**isk **A**ssessment **P**rotocol (RAP), provided bellow. -common in infralittoral zone. - Competition with local species
What is the level of pressure on native species or habitats?	There is no pressure on native species. Larvae of this species is a food source for other zooplankton and filter feeder in pelagic and benthic ecosystem.
Is there a management plan to combat the negative effects of the presence of the species in the investigated area?	Currently, there is not any management plan to combat the negative effects of the species in the Black Sea.
Human usage of IAS in the region	There is no usage for human in the region. -Fouling of blue mussels and oysters. Fouling of cages, -fouling causes problems are on underwater constructions and ships' hulls, -Can interfere with fisheries, by reducing fish production by influencing the food web of commercial fish species, it is so called dead-end organism that is hardly consumed by fish, - Fouling on aquaculture equipment and cage, -Tourism/Human health. Sharp shells on the beach may cause tourists' injuries
Justification - monitoring of these indicators is needed to:	- Fouling of cages. Fouling causes problems are on underwater constructions and ships' hulls. - Can interfere with fisheries, - Tourism/Human health. Sharp shells on the beach may cause tourists' injuries.

Investigation methods used	Plankton nets can be used for qualitative and quantitative purposes for sampling of Balanus Naiplus and Cyprid. A bottom sampler (Van-Veen grab) can be using benthic samples (Adult) or collected by hand using scuba diving equipment.
Period of data collection	Seasonal sampling could give us a better idea of the seasonal spatial distribution of the species in the Kızılırmak delta.
Equipment needed for species monitoring.	Plankton nets (for Naiplus and Cyprid) Van-Veen grab, Scuba diving equipment

IAS scientific name	***Astacus leptodactylus***(Rathbun, 1896)			
IAS name vernacular name [optimal]	Turkish crayfish, Danube crayfish, Galician cray fish, narrow-clawed crayfish, Kerevit (Turkish)			
Taxonomy	Kingdom: Animalia	Phylum: Arthropoda	Ordo: Decapoda	Family: Astacidae
Description	Can grow up to 30 cm in length. Pale yellow and pale green in color. 2 pairs, long claws, two pairs of post-orbital ridges.			
Photograph [optimal]	 *Astacus leptodactylus with a missing clawphotographed by Rafet Çağrı ÖZTÜRK*			
Criteria of the species in the investigated area	Provide the criteria due to Roy et al. (2015), i.e.: I. likelihood of arrival : J. likelihood of establishment: K. likelihood of spread post invasion: ✔ L. potential impact on biodiversity: ✔			

Habitat	Inhabits standing and slow-flowing waters but favors relatively brackish waters such as deltas and lakes. C-Inland surface waters
Is the species found in the investigated habitat?	List of habitats observed. Mark yes/no: A1 : No A2 : No C1 : Yes C2 : Yes C3 : Yes
What is the observable level of invasiveness?	The invasiveness level could be classified in accordance to the **R**isk **A**ssessment **P**rotocol (RAP), provided bellow. Competition with local species
What is the level of pressure on native species or habitats?	The Turkish crayfish is an opportunistic benthic omnivore that feeds on whatever is available in the habitat (Bolat ve Kaya, 2016). The crayfish have been intentionally introduced to different water sources including Kızılırmak Delta to enhance fishing activity and to provide employment opportunity. (Url 1, Url 2) Their colonized populations formed a fisheries resource in Delta.
Is there a management plan to combat the negative effects of the presence of the species in the investigated area?	Currently, there is not any management plan to combat the negative effects of the species in the Black Sea. There is only a fishing pressure on the species which does not aim for eradicating the species from the Delta.
Human usage of IAS in the region	Turkish crayfish is an economically important species with a high demand from Europe countries which supports the pressure on their invasion.
Justification - monitoring of these indicators is needed to:	- establishing the population dynamics; - impact assessment; - evaluating the efficiency of management measures; - proposals regarding the adaptation / revision of the management measures;
Investigation methods used	Traps with bait would be the best equipment to catch specimens.
Period of data collection	Seasonal sampling could give us a better idea of the seasonal spatial distribution of the species in the Kızılırmak delta.
Equipment needed for	Crab traps, scale, and measuring rod.

species monitoring.	

2.5 - Chorokhi and Kolkheti – Georgia

According to the data of invasive species distributed in Chorokhi and Kolkheti areas there are following species listed below in the table 5. Monitoring protocol has been related to those of species

Table 5. IAS indicated in Chorokhi and Kolkheti area

Number	Latin Name	Common Name	Vernacular Name	Classification
1	*Ambrosia artimisiifolia(Linnaeus, 1758)*	Common ragweed	Ambrosia	Plant
2	*Robinia pseudoacacia (Linnaeus, 1758)*	Black locust	Acacia	Plant
3	*Gambusia affinis*(Baird and Girard, 1853)	Mosquitofish	Gambusia	Fish
4	*Mnemiopsisleidyi*(Agassiz, 1860)	Warty Comb jelly	Mnemiopsis	Ctenophora
5	*Rapana venosa* (Valenciennes, 1846)	Veined rapa whelk	Rapana	Gastropoda

Then we provide the monitoring protocol table for the listed species.

IAS scientific name	*Ambrosia artimisiifolia* (Linnaeus, 1758)			
IAS name vernacular name [optimal]	Common ragweed Ambrosia			
Taxonomy	Kingdom: Plantae	Phylum: Asterids	Ordo: Asterales	Family: Asteraceae
Description	***Ambrosia artimisiifolia***is a multiannual herbaceus plant being of 60-100cm height with specific aromat. A stalk is straight surrounded by branched leaves of silver-greylish colors. Underneath the stick there is often blossomed a short sprout. Flowers are narrow, yellolish with pipelike forms. Seeds are grey of 1mm length. Ambrosia blossoms in June-August and is widespread throughout the country.			
Photograph [optimal]				

	
Criteria of the species in the investigated area	Provide the criteria due to Roy et al. (2015), i.e.: A. likelihood of arrival B. likelihood of establishment C. likelihood of spread post invasion ✔ D. potential impact on biodiversity ✔
Habitat	Ambrosia artimisiifolia is widespread all over the country starting from mixed deciduous and coniferous woods to coastal habitats. It is an ecologically danger specie observed even though within the rural plots as well as alongside the roads, water channels, abandoned areas and especially in corn fields, cultivated lands.
Is the species found in the investigated habitat?	List of habitats observed. Mark yes/no: B1:Yes (coastal dunes and sandy shores) I 1.1: Yes (Intensive unmixed crops) I1.3: Yes (Arable land with unmixed crops) G4:Yes (Mixed deciduous and coniferous woods)
What is the observable level of invasiveness?	The invasiveness level could be classified in accordance to the **R**isk **A**ssessment **P**rotocol (RAP), provided bellow. High risk for an environment, risk of dispersal, high risk for ecological and socio-economic impact.
What is the level of pressure on native species or habitats?	Among 40 species of *Ambrosia* genus, common ragweed (*Ambrosia artemisiifolia* L.) is considered to be the most dangerous invasive alien species of Europe. Common ragweed invasion was preceded by big social changes, which is closely linked to human behavior in various activities, such as agriculture, road work and rural development. Most likely its negative effect is disclosed on the local ecosystems, native species causing their oppression.
Is there a management plan to combat the negative effects	No management plan has been set out up to now

of the presence of the species in the investigated area?	
Human usage of IAS in the region	Due to its harmful nature, no any human usage is obvious. Moreover, it is characterized as an allergenic plant
Justification - monitoring of these indicators is needed to:	Choose the necessary: - early detection of IAS and range spread. - establishing the population dynamics; - impact assessment
Investigation methods used	For implementing the permanent monitoring it should be preferable to conduct botanical survey which enables early identification of invasion species
Period of data collection	For effective investigation, early spring monitoring should be desirable
Equipment needed for species monitoring.	For species monitoring group of experts with high quality knowledge should conduct annual observation. No any specific equipment is needed

IAS scientific name	*Robinia pseudoacacia* (Linnaeus, 1758)			
IAS name vernacular name [optimal]	Black Locust Acacia			
Taxonomy	Kingdom: Plantea	Phylum: Spermatophyta	Ordo: Fabales	Family: Fabaceae
Description	***Robinia pseudoacacia***B lack locust reaches a typical height of 40–100 feet (12–30 m) with a diameter of 2–4 feet (0.61–1.22 m). Exceptionally, it may grow up to 52 metres (171 ft) tall and 1.6 metres (5.2 ft) diameter in very old trees. It is a very upright tree with a straight trunk and narrow crown that grows scraggly with age. The dark blue-green compound leaves with a contrasting lighter underside give this tree a beautiful appearance in the wind and contribute to its grace. Black locust is a shade-intolerant species and therefore is typical of young woodlands and disturbed areas where sunlight is plentiful and the soil is dry. In this sense, black locust can often grow as a weed tree. It also often spreads by underground shoots or suckers, which contributes to the weedy character of this species. Young trees are			

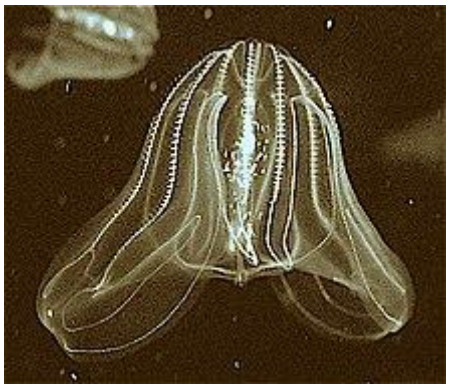
	often spiny, but mature trees often lack spines. In the early summer black locust flowers; the flowers are large and appear in large, intensely fragrant clusters reminiscent of orange blossoms.
Photograph [optimal]	
Criteria of the species in the investigated area	Provide the criteria due to Roy et al. (2015), i.e.: A. likelihood of arrival B. likelihood of establishment C. likelihood of spread post invasion ✔ D. potential impact on biodiversity ✔
Habitat	When growing in sandy areas this plant can enrich the soil by means of its nitrogen-fixing nodules, allowing other species to move in. On sandy soils black locust may also often replace other vegetation which cannot fix nitrogen. Black locust is a typical early successional plant, a pioneer species, and it grows best in bright sunlight and does not handle shade well. It prefers dry to moist limestone soils but will grow on most soils as long as they are not wet or poorly drained. Black locust does not do well on compacted, clayey or eroded soils.
Is the species found in the investigated habitat?	List of habitats observed. Mark yes/no: B1.71:Yes (Coastal brown dunes with natural or almost natural coniferous forest) G1:Yes (Broadleaved deciduous woodland)
What is the observable level of invasiveness?	The invasiveness level could be classified in accordance to the **R**isk **A**ssessment **P**rotocol (RAP), provided bellow. Risk of dispersal, risk for ecological stability
What is the level of pressure on native species or habitats?	Black locust's current range has been expanded by humans distributing the tree for landscaping. Black locust can dominate and shade open habitats. These ecosystems have been decreasing in size, and black locust is contributing to this reduction; when black locust invades an area, it will convert the grassland ecosystem into a forested ecosystem

	where the grasses are displaced. Black locust is a shade-intolerant species and therefore is typical of young woodlands and disturbed areas where sunlight is plentiful and the soil is dry. In this sense, black locust can often grow as a weed tree.
Is there a management plan to combat the negative effects of the presence of the species in the investigated area?	No management plan has been set out up to now
Human usage of IAS in the region	Due to its aromatic flowers this tree is used in beekeeping activities, since bees are very keen to be attracted by the flowers. Also trees are serviceable as firewood and construction materials (for wood houses, wooden fences et c).
Justification - monitoring of these indicators is needed to:	Choose the necessary: - early detection of IAS and range spread. - establishing the population dynamics; - impact assessment
Investigation methods used	For implementing the permanent monitoring it should be preferable to conduct botanical survey which enables early identification of invasion species
Period of data collection	For effective monitoring, spring surveys should be desirable
Equipment needed for species monitoring.	For species monitoring group of experts with high quality knowledge should conduct annual observation. No any specific equipment is needed

IAS scientific name	*Gambusia affinis* (Baird and Girard, 1853)			
IAS name vernacular name [optimal]	Mosquitofish			
Taxonomy	Kingdom: Fish	Phylum: Chordata	Ordo: Cyprinodontiformes	Family: Poeciliidae
Description	*Gambusia affinis* is small in comparison to many other freshwater fish, with females reaching a maximum length of 7 cm (2.8 in) and males a maximum length of 4 cm (1.6 in). The female can be distinguished			

	from the male by her larger size and a gravid spot at the posterior of her abdomen. The name "mosquitofish" was given because the fish eats mosquito larvae, and has been used more than any other fish for the biological control of mosquitoes. Gambusia typically eat zooplankton, beetles, mayflies, caddisflies, mites, and other invertebrates; mosquito larvae make up only a small portion of their diet.
Photograph [optimal]	
Criteria of the species in the investigated area	Provide the criteria due to Roy et al. (2015), i.e.: A. likelihood of arrival B. likelihood of establishment C. likelihood of spread post invasion ✔ D. potential impact on biodiversity ✔
Habitat	Mosquitofishare found most abundantly in shallow water protected from larger fish. They can survive relatively inhospitable environments, and are resilient to low oxygen concentrations, high salt concentrations (up to twice that of sea water), and temperatures up to 42 °C (108 °F) for short periods. Because of their notable adaptability to harsh conditions, they have been described as the most widespread freshwater fish in the world.
Is the species found in the investigated habitat?	List of habitats observed. Mark yes/no: C1 : Yes (inland surface waters) C2: Yes (surface running waters)
What is the observable level	The invasiveness level could be classified in accordance to the **R**isk **A**ssessment **P**rotocol (RAP), provided bellow.

of invasiveness?	High risk for an environment and ecology, risk of dispersal
What is the level of pressure on native species or habitats?	Mosquitofish has been harmful to indigenous aquatic life. Their introduction outside of their native range can also be harmful to local ecosystems. Mosquitofish can consume or injure other small fish or otherwise harm them through competition. The ecological impacts of mosquitofish are partly dictated by their sex ratio, which can vary dramatically across their introduced range.
Is there a management plan to combat the negative effects of the presence of the species in the investigated area?	No management plan has been set out up to now
Human usage of IAS in the region	In 2016 together with the Ministry of Environmental Protection and Agriculture and Fish Club of Georgia introduction of Mosquitofish was implemented into the ponds in the vicinity of Tbilisi in order to abolish the mosquito propagated the harmful virus. Based on the information provided by the Ministry, likewise measure had been conducted on Kolkheti lowland in destroying the mosquito Malaria.
Justification - monitoring of these indicators is needed to:	Choose the necessary: - early detection of IAS and range spread. - establishing the population dynamics; - impact assessment; - evaluating the efficiency of management measures
Investigation methods used	For implementing the permanent monitoring it should be preferable to conduct ichthyological sampling methods which enables early identification of invasion species. Because of small size of an invasion specie, small mesh size nets should be used
Period of data collection	For effective monitoring, seasonal surveys are desirable
Equipment needed for species monitoring.	For species monitoring group of experts with high quality knowledge should conduct annual observation. Specific equipment such as Scoop nets, scale, and measuring rod will be suggested

IAS scientific name	***Mnemiopsis leidyi* (**Agassiz, 1860)			
IAS name vernacular name [optimal]	Warty Comb jelly			
Taxonomy	Kingdom: Animalia	Phylum: Ctenophora	Ordo: Lobata	Family: Bolinopsidae
Description	*Mnemiopsis* has an oval-shaped and transparent lobed body, with four rows of ciliated combs that run along the body vertically and glow blue-green when disturbed. Their body comprises 97% water. They have a maximum body length of roughly 7–12 centimeters (3–5 in) and a diameter of 2.5 centimetres (1 in).It is euryoecious, tolerating a wide range of salinity (2 to 38 psu), temperature (2–32 °C or 36–90 °F), and water quality.			
Photograph [optimal]				
Criteria of the species in the investigated area	Provide the criteria due to Roy et al. (2015), i.e.: A. likelihood of arrival B. likelihood of establishment C. likelihood of spread post invasion ✔ D. potential impact on biodiversity ✔			
Habitat	***Mnemiopsisleidyi***is a pelagic marine organism that swims freely in the water column. It inhabits coastal waters as well as estuaries The native habitat of the ctenophore, Mnemiopsis, is in temperate to subtropical estuaries along the Atlantic coast of North and South America. M. leidyi is tolerant of a wide range of salinity, temperature and water quality conditions over a broad range of inshore. *Mnemiopsisleidyi* was introduced in the Black Sea in the 1980s, where only one species of comb jelly, the small sea gooseberry *Pleurobrachiapileus* occurred until then. The most likely			

	cause of its introduction is accidentally by merchant ships' ballast water. The first Black Sea record was in 1982.
Is the species found in the investigated habitat?	List of habitats observed. Mark yes/no: A7:Yes (pelagic water column)
What is the observable level of invasiveness?	The invasiveness level could be classified in accordance to the **R**isk **A**ssessment **P**rotocol (RAP), provided bellow. Risk of spread, competition with local species, high risk of ecology and environment
What is the level of pressure on native species or habitats?	In the Black Sea, *M. leidyi* eats eggs and larvae of pelagic fish. It caused a dramatic drop in fish populations, notably the commercially important anchovy *Engraulisencrasicholus* (known locally as *hamsi, hamsiya, hamsa*, etc.), by competing for the same food sources and eating the young and eggs.
Is there a management plan to combat the negative effects of the presence of the species in the investigated area?	No management plan has been set out up to now
Human usage of IAS in the region	No any fact of human usage of an invasion specie is observed
Justification - monitoring of these indicators is needed to:	Choose the necessary: - early detection of IAS and range spread. - establishing the population dynamics; - impact assessment
Investigation methods used	For sampling of*Mnemiopsisleidyi* , Zooplankton equipment - Apstein net: ⌀- 40 sm., L-100 sm., 55 µm. should be used. 3 zooplankton samples have to be taken at each station, on different depths.
Period of data collection	For effective monitoring, seasonal surveys are desirable
Equipment needed for species monitoring.	For species monitoring group of experts with high quality knowledge should conduct annual observation. Specific equipment such as Apstein net will be suggested

IAS scientific name	*Rapana venosa (Valenciennes, 1846)*			
IAS name vernacular name [optimal]	Rapa whelk			
Taxonomy	Kingdom: Animalia	Phylum: Molluska	Ordo: Arcida	Family: Arcidae
Description	The shell of Rapana venosa is rounded and heavy, possessing a very short spire, a large body whorl, a strong columella and a deep umbilicus. The aperture is large and roughly ovate. Ornamentation is present externally as axial ribs, smooth spiral ribs ending in blunt knobs at both the shoulder and body whorl, and internally as small elongated teeth disposed along the outer lip margin. The external color varies from gray to reddish-brown, with dark brown dashes on the spiral ribs. The height of the shell can reach up to 180 mm (about 7 in).			
Photograph [optimal]				
Criteria of the species in the investigated area	Provide the criteria due to Roy et al. (2015), i.e.: A. likelihood of arrival B. likelihood of establishment C. likelihood of spread post invasion ✔ D. potential impact on biodiversity ✔			
Habitat	Rapana whelks favor compact sandy bottoms, in which they can burrow almost completely. The native habitat of this species is a region of wide annual temperature ranges, comparable to other localities. Fleeing cold waters in the winter, this species may migrate to warmer, deeper waters, thereby evading cool surface waters. This fertile sea snail is extremely versatile, tolerating low salinities, water pollution and oxygen deficient waters.			
Is the species found in the investigated habitat?	List of habitats observed. Mark yes/no: A5:Yes (sublittoral sediment)			
What is the	The invasiveness level could be classified in accordance to the **R**isk			

observable level of invasiveness?	**A**ssessment **P**rotocol (RAP), provided bellow. Risk of spread, competition with local species
What is the level of pressure on native species or habitats?	Rapanavenosa in the Black Sea and the population has become very abundant and destructive to native marine life: it has been responsible for the destruction of native bivalve populations i.e. oysters, scallops, and mussels. Currently, this mussel has been widely distributed in the benthos of the Black Sea of Georgia. According to some authors, the reason of its high proliferation is connected to its massive shell and hermetic hooking, which helps the mussel to survive during oxygen deficiency in water. It was recorded for the first time in Georgia in the benthos of the Chorokhi River mouth, at depths from 5 to 20 m.
Is there a management plan to combat the negative effects of the presence of the species in the investigated area?	No management plan has been set out up to now
Human usage of IAS in the region	Rapana has been spread throughout the Black Sea since 40-ies of 20th century and dispersed among coastal countries in plentiful way. This specie has got high potential of export and demand on it has been raised gradually
Justification - monitoring of these indicators is needed to:	Choose the necessary: - early detection of IAS and range spread. - establishing the population dynamics; - evaluating the efficiency of management measures; - impact assessment
Investigation methods used	Van Veen grab with a surface of 0.135 m2, washing the samples through a 0.5 mm mesh size sieve
Period of data collection	For effective monitoring, seasonal surveys are desirable
Equipment needed for species monitoring.	For species monitoring a group of experts with high quality knowledge should conduct annual observation. Specific equipment such as Van Veen grab is an essential facility

3. IAS with High Risk of Dispersal (HRD)

The knowledge on **HRD** (**H**igh **R**isk of **D**ispersal) of the alien species is generally available from scientific reports and publications associated with a particular species introduction. This descriptor is evaluated using expert inference and used for calculation of **S**pecies-specific **B**io **P**ollution **R**isk **(SBPR)** index (Panov et al. 2009, 2010).

The species potential to spread is defined by many species traits that can be species and life stage specific. Because of the high level of complexity of these traits and uncertainty in their relative ranking, the risk of rapid species dispersal can be estimated qualitatively via such integrated descriptors as the known diversity of species-specific pathways of introduction. This knowledge is generally available from publications on invasion histories of introduced aquatic species. Records of alien species in more than 1 assessment unit (see below) can also be used as a qualitative indicator of high dispersal risk.
An expert decision regarding the existence of such a risk is formulated as **Yes / No**

3.1 - Danube Delta - Romania

IAS with **H**igh **R**isk of **D**ispersal (**HRD**) in Danube Delta – Romania (Table 6).

Table 6. Selected IAS for Danube Delta in Romania considered as HRD

No.	Latin name	Explanation	HRD
1	*Amorpha fruticosa* L.	Its use as an ornamental, means that there is a risk of further spread of *A. fruticosa* to other countries in Europe and Asia and also potentially to other continents, such as Africa and Central America. *A. fruticosa* has been intentionally introduced to countries across Europe and Asia as an ornamental species (USDA-ARS, 2018), and later for degraded land reclamation (Kozuharova et al., 2017).	yes
2	*Xanthium strumarium* L.	Invades roadsides, wasteland, disturbed land, fallow land, crops, plantations, drainage ditches, savannahs, water courses, lowlands, floodplains and sandy dry riverbeds. Rapidly forms large stands, displacing other plant species. *X. strumarium* is a major weed of row crops such as soybeans, cotton, maize and groundnuts in many parts of the world, including North America, southern Europe, the Middle East, South Africa, India and Japan. It also has a damaging impact on rice production in Southeast Asia. Cocklebur is also an alternative host for a	yes

No.	Latin name	Explanation	HRD
		number of crop pests. *X. strumarium* burrs lodge in animal hair and in sheep's wool, reducing the quality and increasing treatment costs. The plants are toxic to livestock and can lead to death if eaten.	
3	*Elodea nuttallii* (Planch.) H. St. John	Many European countries including Belgium, United Kingdom, Ireland, Norway and Poland have risk assessed this species at the national level. The European and Mediterranean Plant Protection Organization (EPPO) categorize the species as an A2 species which are determined 'as having a high potential for spread; as posing an important threat to plant health and/or the environment and biodiversity; and eventually as having other detrimental social impacts. Europe has a high density and abundance of natural freshwaters, many of which are suitable for the establishment of *Elodea nuttallii*. It can grow in lakes, reservoirs, ponds, rivers, streams, canals and ditches, but is most suited to meso- to eutrophic slow-flowing or static waters, but can even thrive in clear oligo-mesotrophic waters (Greulich and Trémolières 2005; Thiébaut et al. 1997; National Biodiversity Data Centre 2009). The practice of planting *Elodea nuttallii* in artificial watercourses or ponds, which are often proximal to these natural systems, and its use in aquaria, increases the likelihood of it transferring from this pathway to a suitable habitat either by natural spread or from the disposal of vegetative material into the wild. This pathway may also facilitate the deliberate introduction or planting of *Elodea nuttallii* into large waterbodies as an oxygenator or an ornamental plant.	yes
4	*Leptinotarsa decemlineata* Say, 1824	Because of its capacity for adaptation to different climatic conditions (Ushatinskaya and Ivanchik, 1982) and different host plants (Hsiao, 1982), *L. decemlineata* is constantly moving into fresh areas and crossing international borders. The beetle has obviously not reached the extent of its possible geographic range in the EPPO region but its spread has slowed considerably in recent years, almost entirely due to international collaborative action, for example, between France and the Channel Islands, with EPPO support	yes

No.	Latin name	Explanation	HRD
		(Portier, 1980). The British Isles, the Nordic countries, and some other European islands, maintain themselves free through the EU system of 'protected zones'. In Russia and other CIS countries, where *L. decemlineata* has spread eastwards to reach the Pacific, an attempt was made (Vlasova, 1978) to estimate the potential final distribution; it was assumed that the requirement for one full generation would be a period in summer of at least 60 days of temperature over 15°C and winter temperatures not falling below -8°C. Establishment is not likely in colder areas of the EPPO region where only one partial generation could develop. Similarly, Worner (1988) tried to predict where *L. decemlineata* could establish in New Zealand. Potential distribution has been discussed by Jolivet (1991) for Asia and by Sutherst (1991) for the world.	
5	*Perccottus glenii* Dybowski, 1877	Considering its widespread and rapid invasion in Eurasia and its potential impact on native biota it was placed on the list of the top 27 animal alien species introduced into Europe for aquaculture and related activities. This list includes species that could cause serious thread to biodiversity if they escaped to open water bodies (Savini et al., 2010).	yes

3.2 - Danube Delta - Ukraine

IAS with **H**igh **R**isk of **D**ispersal (**HRD**) in Danube Delta – Ukraine:

Macrophyts

Since the breeding parameters are not limiting for the conditions of the Danube Delta, there is the possibility of settling these species.

Due to its rampant growth, *Elodea nuttallii* (Planch.) develops rapidly into a tangled mass. It blocks out the light and alters the entire ecosystem beneath. As a result, native aquatic plants and animals are unable to survive. The plant also causes significant economic damage by choking up water channels and hydroelectric plants.

Excessive growth aquatic fern – *Azolla caroliniana* Willd. creates an anaerobic environment, which inhibits the development of other species and has a negative effect on aquatic ecosystems.

In ecological terms, *Thorea hispida* (Thore) Desvauxis a typical rheophilus, preferring fast flowing areas.

Chara rudis (A.Braun) Leonhardiis a perennial plant. It grows only in fresh oligo- and mesotrophic water bodies (lakes, ponds) with an average or high degree of mineralization and an optimal pH of 7.9-8.4, mainly in shallow water, occasionally at a depth of up to 7 m.

Desmarestia viridis is the dominant of phytocenoses of benthic vegetation along the entire coastal part to a depth of 10 m of the Danube-Dnieper inter-riverine.
At present *Halosiphon tomentosus* (Lyngbye) Jaasund fills the places in cold (up to 10°C) and deep (below 5 m) phytocoenoses dominated by Desmarestiaviridis and Ceramiumdiaphanum var. elegans. Species feature of Halosiphontomentosus, connected with dense pubescence of quite coarse tubular thalli with thin fibrils, determines the intensity of metabolic processes and enables this species to use optimally the nutrients of its new area and conditions of the winter season with low temperatures.

Terrestrial plants

Honey locust *Gleditsia triacanthos* L. (1753). Powerful tree up to 20-40 m high. In the middle of the 20th century it became widespread in the south of Ukraine in connection with the agroforestry works to combat drought and the creation of forest protection belts.The leaves contain the alkaloid triacanthin, which is toxic to humans and animals. Seedlings form impassable thickets that oppress local species. Honey plant.
Common ragweed American wormwood *Ambrosia artemisifolia* L., 1753. Ragweed belongs to the sesquiterpenoid plants, which may contain phyto-contact allergens. Ragweed pollen is notorious for causing allergic rhinoconjunctivitis ("ragweed hay fever"), allergic asthma ("ragweed asthma"), oral allergy syndrome (a. k. a. "pollen associated food allergy" or "food-allergen-syndrome"), allergic dermatitis (contact dermatitis, contact eczema). Ragweed seeds are imported or spread by contaminated bird feed, the transport of ragweed contaminated soil (also in tyre treads) and agricultural products from infested areas. Ragweed is one of the harmful plants that cause milk spoilage. When lactating animals eat a plant in the flowering phase, milk acquires a sharp unpleasant smell and taste.
Manitoba maple *Acer negundo* L., 1753. It can quickly colonize both cultivated and uncultivated areas. A protoxin present in the seeds of Acer negundohas been identified as a major risk factor fo a disease in horses, seasonal pasture myopathy. SPM is an equine neurological disease which occurs seasonally with symptoms including stiffness, difficulty walking or standing, dark urine and eventually breathing rapidly and becoming recumbent. Ingestion of sufficient quantities of box elder seeds or other parts of the plant results in breakdown of respiratory, postural, and cardiac muscles. Widespread, emerged from parks and penetrated into the aboriginal vegetation cover. Poses a serious and growing threat to biological diversity.Its ability to form multi-tiered thickets faster than other species makes it difficult for native species to regenerate. Due to its very high ecological plasticity, it is one of the most aggressive woody weeds in the forest zone of Eurasia Ash-leaved maple is winter-hardy and drought-resistant, gives a huge amount of seeds that are transported over long distances. At the same time, it tolerates air and soil pollution well, and its resettlement is very fast. The plant actively spreads, forms thickets large in area, in which there is no place for any other species.In some cases, the grass almost completely disappears.
Canadian fleabane *Erigeron canadensis* L., 1753. It causes damage to the local ecosystems and has demonstrated great potential for invasion. The investigation

found that E. canadensis can secrete allelochemicals to inhibit the growth of other nearby plants, and has a strong competitive advantage against native species. Medicinal, promotes the consolidation of sands on the newly formed coastal islands.
Hare barley *Hordeum murinum leporinum* (Link) Arcangeli 1753. Annual grass, it can be a successful invader where land has been disturbed by grazing or construction. With continued land disturbance in particular climatic conditions (wet winters and dry summers), barley grass can persist and become dominant. The grass is of high forage value early in its growing season, but the seed awn has proven harmful to stock. it was usually considered an undesirable weed until it was recognized as high quality forage early in its growing season. As the plant matures, the awns on the seed become noxious and harmful to stock, irritating their eyes and skin, and damaging the wool.
Star-cucumber *Sicyos angulatus* L. Its seed bank can last in the ground for at least three years after the destruction of the aerial part of the plant. Its infestation can be impressive, covering the pre-existing vegetation with thick and heavvy mats. It actively spreads in riverine forests along the shores of water bodies. Differs in extremely fast growth up to 3 m per week. A vicious quarantine weed. Medicinal and ornamental plant, honey plant. In new regions, the angular sitsios spreads with fruits and seeds that can be imported with seed and food material (in particular, as a trash in the composition of soybeans, sorghum, grain mixtures for pets and birds, as an ornamental plant), soil, contaminated waste, on wheels of agricultural machinery and vehicles. Naturally, the seeds of the angular sitsios are easily transferred with water currents, wind.Recently it can also be found alongside road and field edges.

Aquatic invertabrates

Craspedacusta sowerbii Lankester, 1880. The species expands continental waters of Ukraine (Protasov, Babariga, 2009, Yakovenko, Fedorenko, 2012).
Pseudodiaptomus marinus Sato, 1913. The species currently is not known in the Danube delta as well as in the North-Western part of the Black Sea in general. It was reported from the Crimean waters (Garbasey et al., 2016) and probably can invade into the Danube region.
Lethocerus patruelis (Stal, 1854). Currently is not known in the Danube delta, the range of this species in Europe is currently expanding and at present time it is known in Bulgaria (Gozeva et al., 2013), thus, can probably invade into to the Danube delta.
Streblospio gynobranchiata Rice & Levin, 1998 and *Polydora cornuta* Bosc, 1802 are widespread, actively colonize new water areas, and in favorable conditions form settlements with a very high density. Like a number of other spionids, they are considered indicators of habitats with a high level of eutrophication(Çinar et al., 2005; Radashevsky, Selifonova, 2013; Selifonova,Bartsits2018;Boltacheva, 2008). *P. cornuta* significantly influenced the bottom fauna of the northwestern shelf and, especially, the estuaries of the Black Sea region. In the interfluves, this species became a characteristic form of biocenoses *Mytilus galloprovincialis* Lamarck, 1819 and *A. succinea*; massively develops on the banks of the river Danube (Losovskaya, Zolotarev, 2003; Alexandrov, 2005; Bondarenko, 2011).

Fish

The Chinese sleeper (*Perccottus glenii*) is only HRD fish species registered in the Ukrainian Danube delta at this time. It's a competitor to aboriginal species, effects on conditions of their reproduction and nursery. In additiona, two bulhead species, *Ameiurus melas* and *A. nebulosus*, have high risk to be spread into the Danube delta. Both distributed in Romania and upstream of the Danube River, has tendency to expand its range.

Terrestrial vertebrates

Red-eared slider *Trachemys scripta* Thunberg, 1831. The rear places of registration of the species near the Danube Delta (35 km). Species registration sites are connected to the Danube Delta by water (Chronicle of nature…, 2018; our unpublished data).

Coypu *Myocastor coypus* Molina, 1782. The species is on the fauna lists of the Danube Biosphere Reserve (Chronicle of nature…, 2019). The current state of the species in the Danube Delta needs to be clarified. In EU it is registered as an alien invasives pecies (European Commission, 2017).

American mink *Neovison vison* Schreber, 1777. The speciesis on the fauna lists of the Danube Biosphere Reserve (Chronicle of nature…, 2019). The current state of the species in the Danube Delta needs to be clarified (Youngman, 1982; Cuzicetal., 2003; Marinov et al., 2012). On the territory of Ukraine it is analien invasive species (Mezhzherin, Lashkova, 2013).

3.3 - Nestos Delta - Greece

Based on information related to species traits and life history traits, we defined the **HRD**(**H**igh **R**isk of **D**ispersal) for the three species that we will be monitored through the specific BLACK SEA project.

The first studied species, *Amorpha fruticosa*, was introduced in Europe as an ornamental plant species in the early 1700s (Austin 2004), whereas moreover, it was selected and used as a honey plant (Jablonski &Koltowski 2001) or for stabilizing soil surfaces due to its extensive root system (Bowie 1982). All these usages of *Amorphafruticosa* made it one of the worst invasive alien species in Europe (DAISIE 2009). Nowadays, it is widely distributed in a large number of European countries(and over the last 20 years it was introduced in Greece as well. However, as it is a plant species preferring river banks (poplar or willow galleries, almond willow-osier scrubs),unvegetated or sparsely vegetated shores, water-fringing reed-beds, riverine and lakeshorescrubs (Anastasiu et al. 2008), its seeds can be easily transferred through water flow and germinate in areas far away from its parental plants. Thus, *A. fruticosa* is already widely distributed in several countries of Europe, and has the potential to increase its distribution range in places where it is being established through a wide range of pathways of introduction.

Contrary to *Amorpha fruticosa, Acer negundo* and *Robinia pseudoacacia*, are two tree species whose invasiveness is cannot be predicted as both species are trees and vegetation succession is a very slow process. However, on the other hand, *A. negundo* is characterized by a very large seed production and its seeds are being dispersed in large distances through the wind, although in some cases dispersal by birds and squirrels also occurs. On the other hand, vegetative reproduction is

common on damaged individuals. The fact that *A. negundo* produces a large number of wind dispersal seeds whose percentages of germination varies (germination rate under test conditions: 0-96%; Williams and Winstead, 1972; Olson and Gabriel, 1974) makes it potentially a species of high risk of dispersal.

Robinia pseudoacacia is listed among the most invasive species in Europe (Sádlo et al. 2017). Now, it is widely distributed all around Greece as it was formerly used to stabilize land masses and to prevent soil erosion. *R. pseudoacacia* is a fast growing tree which flowers for the first time at the age of three years, whereas it is able to produce a very large quantity of seeds which can be dispersed in quite large distances. Dry seeds are viable even after 10 years. Moreover, *R. pseudoacacia* can sprout from both stump and roots, especially after being cut or damaged. These characteristics make *R. pseudoacacia* a species which can easily colonize bare areas, whereas moreover, it is very difficult to remove it from areas that has already been established. Consequently, the risk of dispersal is expected to be high even in this species, although detailed data are needed to draw more detailed conclusions.

3.4 - Kızılırmak Delta - Turkey

Selected IAS in the Table were determine species by species according to their High Risk of Dispersal (HRD) (Table 7).

Table 7. Selected IAS in the Kızılırmak Deltaic area considered as HRD

Number	Latin Name	HRD
1	*Cyprinus carpio* (Linnaeus, 1758)	YES
2	*Carassius gibelio* (Bloch, 1782)	YES
3	*Gambusia holbrooki* (Girard, 1859)	YES
4	*Gambusia affinis*(S. F. Baird and Girard, 1853)	YES
5	*Lithognathus mormyrus* (Linnaeus, 1758)	YES
6	*Liza haematocheila* (Temminck and Schlegel, 1845)	NO
7	*Parablennius incognitus* (Bath, 1968)	YES
8	*Syngnathus acus* (Linnaeus, 1758)	NO
9	*Oncorhynchus mykiss* (Walbaum, 1792)	YES
10	*Gobius cruentatus* (Gmelin, 1789)	NO
11	*Callinectes sapidus* (Rathbun, 1896)	YES
12	*Pseudosolenia calcar-avis (Schultze) (Sundström,1986)*	YES
13	*Thalassiosira nordenskioeldii* (Cleve, 1873)	YES
14	*Alexandrium minutum* (Halim, 1960)	YES
15	*Oxyphysis oxytoksoides (*Kofoid 1926*)*	YES
16	*Scrippsiella trochoidea (Stein)*	YES
17	*Ulva lactuca (Linnaeus, 1753) = Ulva fasciata (*Delile,	*YES*

	1813)	
18	*Mnemiopsis leidyi* (Agassiz, 1865)	*YES*
19	*Beroe ovata (*Mayer 1912)	*YES*
20	*Acartia tonsa (Dana, 1849) (*)*	*YES*
21	*Balanus improvisus* (Darvin 1854)	YES
22	*Oithona davisae* (Ferrari and Orsi, 1984)	YES
23	*Rapana venosa* (Valenciennes, 1846)	YES
24	*Anadara kagishimensis* (Tokunaga, 1906)	YES
25	*Potamopyrgus antipodarum*(Gray, 1843)	YES
26	Astacus leptodactylus (Eschscholtz, 1823)	NO

3.5 - Chorokhi and Kolkheti - Georgia

Selected IAS in the Table were determine species by species according to their High Risk of Dispersal (HRD) (Table 9).

Table 8. Selected IAS in the Chorokhi and Kolkheti Deltaic area considered as HRD

Number	**Latin Name**	**HRD**
1	*Ambrosia artimisiifolia* (Linnaeus, 1758)	YES
2	*Robinia pseudoacacia* (Linnaeus, 1758)	YES
3	*Gambusia affinis* (Baird and Girard, 1853)	YES
4	*Mnemiopsis leidyi* (Agassiz, 1860)	YES
5	*Rapana venosa* (Valenciennes, 1846)	YES

4. IAS with High Risk for Establishment in a new environment (HRE)

The knowledge on **HRE** (**H**igh **R**isk for **E**stablishment in a new environment) of the alien species is generally available from scientific reports and publications associated with a particular species introduction. This descriptor is evaluated using expert inference and used for calculation of **S**pecies-specific **B**io **P**ollution **R**isk **(SBPR)** index (Panov et al. 2009, 2010).

The potential for establishment in a new environment is defined by biological traits of the species, such as their euryhalinity, temperature tolerance, habitat generalism (provide the IAS specificity to the habitat type) and some other traits. Generally, the risk of rapid establishment in a new environment can be attributed to a species if found at high abundances in 2 or more invaded areas (assessment units).

An expert decision regarding the existence of such a risk is formulated as **Yes / No**

4.1 - Danube Delta - Romania

IAS with **H**igh **R**isk for **E**stablishment in a new environment (**HRE**) in Danube Delta – Romania (Table 9).

Table 9. Selected IAS for Danube Delta in Romania considered as HRE

No.	Latin name	Explanation	HRE
1	*Amorpha fruticosa* L.	*A. fruticosa* grows in a wide range of habitats, including riparian and alluvial habitats, sandy banks of ravines, coastal areas, dunes and disturbed land, such as plantations, orchards, meadows and urban areas (Szigetvári, 2002; Flora of China Editorial Committee, 2010; Karmyzova, 2014).	yes
2	*Xanthium strumarium* L.	The geographic distribution of *X. strumarium* extends from latitude 53°N to 33°S (Holm et al., 1977). It is most often found in the temperate zone, but also occurs in subtropical and Mediterranean climates. Love and Dansereau (1959) identified the centre of origin of *X. strumarium* as Central or South America. The native North American Xanthium taxa originally grew along shores and rivers and the fruits were dispersed by water or occasionally by animals.	yes
3	*Elodea nuttallii* (Planch.) H. St. John	*E. nuttallii* has been found growing in	yes

No.	Latin name	Explanation	HRE
		a wide range of water bodies, in general in quiet water such as shorelines of lakes, reservoirs and ponds, along rivers and streams, and also in wetlands, canals and ditches (Hickman, 1993). In England, it has been recorded in lowland habitats only (Preston and Croft, 1997).	
4	*Leptinotarsa decemlineata* Say, 1824	-	no
5	*Perccottus glenii*Dybowski, 1877	The Amur sleeper is a limnophilic species, inhabiting freshwater canals, gravel pits, natural and fish ponds. It lives in the littoral zone of these waterbodies. It prefers rather stagnant waters with dense aquatic vegetation and muddy substrate; in rivers it avoids the main current and is common in flood plains and oxbow lakes. It tolerates low oxygenation of water, so it can be found also in drying, shallow waterbodies. It usually co-occurs with gibel carp (*Carassius gibelio*), crucian carp (*Carassius carassius*) and mud loach (*Misgurnusfossilis*).	yes

4.2 - Danube Delta - Ukraine

IAS with **H**igh **R**isk for **E**stablishment in a new environment (**HRE**) in Danube Delta – Ukraine:

Macrophyts

These species are characterized by a high growth rate, large size, the possibility of reproduction in eutrophic waters, and the creation of populations.

Egeria densa Planch. is an ecological weed that can affect agriculture by blocking irrigation canals.The plant forms thick mats that obstruct boat passage, clog water intakes and aqueducts, trap sediments, crowd out native vegetation, and impede the migration of anadromous fish.

Vallisneria spiralis L. long lived, fast growing, has high reproductive potential, reproduces asexually.

Terrestrial plants

The species with HRD, such as A. artemisifolia, A. negundo, E. canadensis, H. murinum leporinum, S. angulatus, are laso considered as HRE in the Ukrainian part of the Danube delta. In addition, the HRE list consists of two species:

False indigo-bush *Amorpha fruticosa* L., 1753. Has serious threat to the structure and biodiversity of the riparian forests. It has occupied large coastal areas, proved a high capacity spread and is adapted to occupy many types of habitats such as

various types of wetlands, river banks, forest edges, unvegetated or sparsely vegetated shores, waterfringing reedbeds, riverine and lakeshore scrubs, meadows, disturbed lands.Honey plant, poisonous, phytomeliorator, medicinal, ornamental.
Blacklocust *Robinia pseudoacacia* L., 1753. Widespread, emerged from parks and penetrated into the aboriginal vegetation cover. Spreads quickly thanks to shoots, to strengthen the soil for loose sandy, pebble and stony soil.

Aquatic invertabrates

Sinanodonta woodiana (I. Lea, 1834) quickly spreads over fresh waterbodies, forming stable populations, often dominating in abundance and biomass in benthic communities (Yanovych, Pampura, 2012).
Potamopyrgus antipodarum J. E. Gray, 1843. The New Zealand snail is characterized by a high growth rate of the population and the formation of a high density (Alonso, Castro-Diez, 2012), significantly affects the structure and function of macrozoobenthos communities.
Streblospio gynobranchiata and *Polydora cornuta* are widespread, actively colonize new water areas, and in favorable conditions form settlements with a very high density. Like a number of other spionids, they are considered indicators of habitats with a high level of eutrophication (Çinar et al., 2005; Radashevsky, Selifonova, 2013; Selifonova, Bartsits 2018; Boltacheva, 2008). *Polydora cornuta* significantly influenced the bottom fauna of the northwestern shelf and, especially, the estuaries of the Black Sea region. In the interfluves, this species became a characteristic form of biocenoses Mytilus galloprovincialis Lamarck, 1819 and A. succinea; massively develops on the banks of the river. Danube (Losovskaya, Zolotarev, 2003; Alexandrov B. 2005; Bondarenko, 2011).
Mya arenaria Linnaeus, 1758 and *Anadara kagoshimensis* (Tokunaga, 1906) widespread in the coastal and estuarine areas of the northwestern part of the Black Sea, including in the coastal areas of the river mouth. Danube. Molluscs form high-density settlements. Their introduction significantly affects the diversity of benthic fauna, leads to a serious restructuring of benthic communities and the formation of new biocenoses (Aleksandrov et al., 1998; Zaitsev et al., 2006; Vorobyeva et al., 2017).

Vertebrates

No vertebrate species with HRE observed in the Ukrainina Danube delta.

4.3 - Nestos Delta - Greece

The risk of establishment is directly related to the ecological requirements of the studied species, and specifically to its germination rate and if it is characterized as generalist or specialist. *Amorpha fruticosa* is grows in wide range of soils. These can be medium to wet, well-drained, whereas moreover, it can tolerate partially shade and occasionally flooding sites. However, it has also been observed in dry soils (Kozuharova et al. 2017). These facts clearly demonstrate that *A. fruticosa* is a highly generalist species and whose seeds can disperse in large distances and germinate under a wide range of environmental conditions. Thus, it is expected that the risk of establishment of *A. fruticosa* in new environments is especially high.

Acer negundo is another tree species that has been widely used in cities and parks all around Greece, as well as in a large number of countries. The reason that this species was selected as an ornamental is – among others – the wide range of ecological conditions that it can tolerate. Specifically, it was selected because it is resilient in conditions of increased atmospheric pollution, whereas it can also tolerate heat and water stress. Moreover, it can tolerate temporary or permanently logged areas (Howell and Benson 2000) and it is very sensitive to water stress (Ward et al. 2002). However, once it is established in an area, it is drought-tolerant (Rosario 1988). Consequently, its seeds are able to germinate in a wide range of environments and together with the rather high germination rate, it is able to spread and affect local plant communities.

The last of the three invasive species that will be studied in Nestos area, *Robiniapseudoacacia*, is well known that occurs in a wide range of environmental conditions and this is majorly the reason of its selection in several countries. It is well known that R. pseudoacaciahas become established on a wide variety of disturbed sites such as old fields or other cleared areas, and moroever it can also tolerate saline and infertile soils, and is found at altitudes up to 2500 m. The only known restriction for this species is that it cannot tolerate water-logging areas, and thus, we will not see it close to such areas (CABI database).

4.4 - Kızılırmak Delta - Turkey

Selected IAS in the Table 10 is the list of species were determine to their High Risk for Establishment in a new environment (HRE).

Table 10. Selected IAS in Kızılırmak Deltaic area considered as HRE

Number	Latin Name	HRE
1	*Cyprinus carpio* (Linnaeus, 1758)	YES
2	*Carassius gibelio* (Bloch, 1782)	YES
3	*Gambusia holbrooki* (Girard, 1859)	YES
4	*Gambusia affinis*(S. F. Baird and Girard, 1853)	YES
5	*Lithognathus mormyrus* (Linnaeus, 1758)	NO
6	*Liza haematocheila* (Temminck and Schlegel, 1845)	NO
7	*Parablennius incognitus* (Bath, 1968)	YES
8	*Syngnathus acus* (Linnaeus, 1758)	YES
9	*Oncorhynchus mykiss* (Walbaum, 1792)	YES
10	*Gobius cruentatus* (Gmelin, 1789)	YES
11	*Callinectes sapidus* (Rathbun, 1896)	YES
12	*Pseudosolenia calcar-avis (Schultze), (Sundström, 1986*	YES
13	*Thalassiosira nordenskioeldii* (Cleve, 1873)	YES
14	*Alexandrium minutum* (Halim, 1960)	YES

15	*Oxyphysis oxytoksoides (*Kofoid 1926*)*	YES
16	*Scrippsiella trochoide (Stein)*	YES
17	*Ulva lactuca (Linnaeus, 1753) = Ulva fasciata (*Delile, 1813)	*YES*
18	*Mnemiopsis leidyi* (Agassiz, 1865)	*YES*
19	*Beroe ovata (*Mayer 1912)	*YES*
20	*Acartia tonsa (Dana, 1849) (*)*	*YES*
21	*Balanus improvisus* (Darvin 1854)	YES
22	*Oithona davisae* (Ferrariand Orsi, 1984)	YES
23	*Rapana venosa* (Valenciennes, 1846)	YES
24	*Anadara kagishimensis* (Tokunaga, 1906)	YES
25	*Potamopyrgus antipodarum*(Gray, 1843)	YES
26	*Astacus leptodactylus* (Eschscholtz, 1823)	YES

4.5 - Chorokhi and Kolkheti - Georgia

Selected IAS in the Table 11 is the list of species were determine to their High Risk for Establishment in a new environment (HRE).

Table 11. Selected IAS in the Chorokhi and Kolkheti Deltaic area considered as HRE

Number	**Latin Name**	**HRE**
1	*Ambrosia artimisiifolia (Linnaeus, 1758)*	YES
2	*Robinia pseudoacacia (Linnaeus, 1758)*	YES
3	*Gambusia affinis*(Baird and Girard, 1853)	YES
4	*Mnemiopsisleidyi* (Agassiz, 1860)	YES
5	*Rapana venosa* (Valenciennes, 1846)	YES

5.IAS with High Risk to cause ecological and socio-economic Impacts (HRI)

The knowledge on **HRI** (**H**igh **R**isk to cause ecological and socio-economic **I**mpacts) of the alien species is generally available from scientific reports and publications associated with a particular species introduction. This descriptor is evaluated using expert inference and used for calculation of **S**pecies-specific **B**io **P**ollution **R**isk **(SBPR)** index (Panov et al. 2009, 2010).

The ecological impact of an invasive alien species can be defined as the quantifiable negative effect on the recipient environment, which can be measured using the existence of scientific reports and publications associated with a particular species introduction. The risks of these adverse impacts can be also estimated using the ‘‘ecosystem service approach for socioeconomic impacts.’’ A species can be considered as likely to cause adverse impacts if the answer to any of 8 following questions is ‘‘yes’’:

1. Does it cause loss of native biodiversity at species/population, community, or ecosystem level?
3. Does it cause significant changes in ecosystem functions?
4. Does it cause loss in trophic production (e.g., food, energy supply)?
5. Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?
6. Does it impact on human or domestic (cultured) animal and plant health?
7. Does it cause impacts to recreational and aesthetic activities?
7. Does it cause damage to infrastructure (including shore erosion)?
8. Does it cause economic control costs?

A general expert decision regarding the existence of such a risk is formulated as **Yes / No**

5.1 - Danube Delta - Romania

IAS with **H**igh **R**isk to cause ecological and socio-economic **I**mpacts (**HRI**) in Danube Delta – Romania (Table 12).

Table 12. Selected IAS for Danube Delta (Romania) considered as HRI

No.	Latin name	Questions	HRI
1	*Amorpha fruticosa* L.	Does it cause loss of native biodiversity at species/population, community, or ecosystem level?	yes
		Does it cause significant changes in ecosystem functions?	yes
		Does it cause loss in trophic production (e.g., food, energy supply)?	no
		Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?	yes
		Does it impact on human or domestic (cultured) animal and plant health?	yes
		Does it cause impacts to recreational and aesthetic activities?	no
		Does it cause damage to infrastructure (including shore erosion)?	no
		Does it cause economic control costs?	yes
2	*Xanthium strumarium* L.	Does it cause loss of native biodiversity at species/population, community, or ecosystem level?	yes
		Does it cause significant changes in ecosystem functions?	no
		Does it cause loss in trophic production (e.g., food, energy supply)?	no
		Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?	no
		Does it impact on human or domestic (cultured) animal and plant health?	yes
		Does it cause impacts to recreational and aesthetic activities?	yes
		Does it cause damage to infrastructure (including shore erosion)?	no
		Does it cause economic control costs?	no
3	*Elodea nuttallii* (Planch.) H. St. John	Does it cause loss of native biodiversity at species/population, community, or ecosystem level?	yes
		Does it cause significant changes in ecosystem functions?	yes
		Does it cause loss in trophic production (e.g., food, energy supply)?	yes
		Does it have an impact in terms of human access to	yes

No.	Latin name	Questions	HRI
		natural resources (e.g., biodiversity, wild fish, water supply)?	
		Does it impact on human or domestic (cultured) animal and plant health?	no
		Does it cause impacts to recreational and aesthetic activities?	yes
		Does it cause damage to infrastructure (including shore erosion)?	no
		Does it cause economic control costs?	yes
4	*Leptinotarsa decemlineata* Say, 1824	Does it cause loss of native biodiversity at species/population, community, or ecosystem level?	no
		Does it cause significant changes in ecosystem functions?	no
		Does it cause loss in trophic production (e.g., food, energy supply)?	yes
		Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?	no
		Does it impact on human or domestic (cultured) animal and plant health?	yes
		Does it cause impacts to recreational and aesthetic activities?	no
		Does it cause damage to infrastructure (including shore erosion)?	no
		Does it cause economic control costs?	yes
5	*Perccottus glenii* Dybowski, 1877	Does it cause loss of native biodiversity at species/population, community, or ecosystem level?	yes
		Does it cause significant changes in ecosystem functions?	yes
		Does it cause loss in trophic production (e.g., food, energy supply)?	yes
		Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?	yes
		Does it impact on human or domestic (cultured) animal and plant health?	yes
		Does it cause impacts to recreational and aesthetic activities?	no
		Does it cause damage to infrastructure (including shore erosion)?	no

No.	Latin name	Questions	HRI
		Does it cause economic control costs?	no

5.2 - Danube Delta - Ukraine

IAS with **H**igh **R**isk to cause ecological and socio-economic **I**mpacts (**HRI**) in Danube Delta – Ukraine:

Macrophyts

These species can create dense thickets of water surface cover, which can significantly change the structure of natural plant communities in the Danube Delta.

Pistia stratiotes L.is a vicious weed. In a short period of time, it can completely cover the surface of a small reservoir, dooming it to disappearance. The cover from the *Pistia* significantly increases the water consumption from the reservoir, since incomparably more water is consume for its transpiration than for evaporation from the open surface of the reservoir.Currently, it is very widespread in the Dnieper River basin and leads to serious disturbances in the structure of aquatic vegetation.

Elodea canadensis Michx., lead to changes in habitat conditions: they reduce the transparency of the water content, affect its temperature, oxygen and acidity. Often they displaces native species, forming single-species communities over large area.

Lemna turionifera Landolt lead to changes in habitat conditions: they reduce the transparency of the water content, affect its temperature, oxygen and acidity. Often they displaces native species, forming single-species communities over large area.

Terrestrial plants

Three species from the monitoring list are considered as HRI: *A. fruticosa , A. artemisifolia, H. murinum leporinum*. *Amorpha fruticosa* is a model species used in our monitoring. It has next characteristics of invasiveness:

- Proved invasive outside its native range
- Has a broad native range
- Abundant in its native range
- Highly adaptable to different environments
- Is a habitat generalist
- Tolerates, or benefits from, cultivation, browsing pressure, mutilation, fire etc
- Pioneering in disturbed areas
- Tolerant of shade
- Highly mobile locally
- Long lived
- Has high reproductive potential
- Has propagules that can remain viable for more than one year
- Reproduces asexually
- Has high genetic variability

Impact outcomes:

- Ecosystem change/ habitat alteration
- Increases vulnerability to invasions
- Modification of successional patterns
- Monoculture formation

- Reduced native biodiversity
- Threat to/ loss of native species

Impact mechanisms:

- Allelopathic
- Competition - shading
- Competition - smothering
- Rapid growth

Likelihood of entry/control:

- Highly likely to be transported internationally deliberately
- Difficult to identify/detect in the field
- Difficult/costly to control

Social Benefit:

Recent research has demonstrated the potential health benefits of *A. fruticosa*, particularly in treating diabetes and metabolic disease (Kozuharova et al., 2017)

Environmental Services:

A. fruticosa is a honey plant and an important food source for bees across its native and introduced range (Kozuharova et al., 2017). Its well-developed root system means that it has also been planted to stabilize soil and prevent erosion, e.g. on railway embankments (Kozuharova et al., 2017).

Aquatic invertabrates

Mnemiopsis leidyi A. Agassiz, 1865. The Black Sea pelagic ecosystem was extremely degraded from blooms of invasive ctenophore since the end of 1980s (Shiganova et al., 1998, 2000, 2004, 2019).

Beroe ovata Bruguière, 1789. It is main predator of preceding species (Shiganovaet al., 2014).

Acartia tonsa Dana, 1849, *Oithona davisae* Ferrari & Orsi, 1984. Reproduce and established self-sustaining populations in their new Black Sea environment with regular occurrence in coastal, shelf, slope and open sea, they are component of the forage zooplankton for fish (Polischuk, Nastenko, 2006, Mihneva & Stefanova, 2013).

Five species with HRE, e.g. *Streblospio gynobranchiata*, *Sinanodonta woodiana*, *Potamopyrgus antipodarum*, *Mya arenaria* and *Anadara kagoshimensis*, are also listed here.

Corbicula leana (O. F. Müller, 1774) (= *C. fluminea* misidentification). A negative consequence of the introduction can be a decrease in the indices of the abundance of plankton, the productivity of the reservoir, the transformation of the biotope, and a change in the structure and diversity of the ecosystem (Zhivoglyadova, Revkov, 2018).

Physella acuta (Draparnaud, 1805) is widespread, coexists successfully with other invasive species, and can promote the invasion of macrophytes. Species affect changes in the diversity and structure of macrozoobenthos communities (Lyashenko, A.V.et. al, 2005; Panov et. al, 2009; Son, 2007, 2009, 2010).

Pectinatella magnifcam (Leidy, 1851) can significantly influence the structure of the community, increase the transparency of water, and promote the development of

local species. Colonies can settle on fishing nets and pipes of municipal water treatment systems and clog them (Alexandrov et al., 2014).

Fish

Prussian carp (*Carassius gibelio*) and so-iuy mullet (*Planiliza haematocheila*) are numerous and is used as a fishing object. Stone moroko (*Pseudorasbora parva*), pumpkinseed (*Lepomis gibbossus*) and Chinese sleeper (*Perccottus glenii*) has a high risk of environmental and socio-economic effect (HRI). It's a competitor to aboriginal species, effects on conditions of their reproduction and nursery.

Terrestrial vertebrates

Rattus norvegicus Berkenhout, 1769. The species has created a powerful population in the Danube Delta, which is not associated with human habitation. Due to its high numbers, the species competes with aboriginal species and has a significant ecological impact on the ecosystem (Chronicle of nature…, 2018; Chronicle of nature…, 2019; our unpublished data).

Ondatra zibethicus Linnaeus, 1766. The species has created a population in the Danube Delta. The species competes with aboriginal species (including *Arvicola amphibius* Linnaeus, 1758) and has an ecological impact on the ecosystem (European Commission, 2017).

Canis aureus Linnaeus, 1758. The species appeared inUkraine recently (Volokh et al., 1998; Rozhenko, Volokh, 1999; Zagorodniuk, 2006). The species created a population in the Danube Delta (Chronicle of nature…, 2019). The species competes with aboriginal species and has an ecological impact on thee cosystem (Chronicle of nature…, 2019).

Nyctereutes procyonoides Gray, 1834. The species has created a population in the Danube Delta (Chronicle of nature…, 2019). The species competes with aboriginal species and has an ecological impact on the ecosystem (European Commission, 2017).

5.3 - Nestos Delta - Greece

The knowledge whether an alien species cause serious ecological and socio-economic impacts is of crucial importance and this is why it is characterized as invasive or not. Thus, it is expected that species which have been officially characterized as invasive have serious impacts in the ecological and economic components. Here, based on expert knowledge, we will answer the nine questions for each one of the three species separately.

Amorpha fruticosa:

1. Does it cause loss of native biodiversity at species/population, community, or ecosystem level?**YES**
3. Does it cause significant changes in ecosystem functions?**YES**
4. Does it cause loss in trophic production (e.g., food, energy supply)? **NO**
5. Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?**YES**
6. Does it impact on human or domestic (cultured) animal and plant health?**NO**

7. Does it cause impacts to recreational and aesthetic activities?**NO**
8. Does it cause damage to infrastructure (including shore erosion)?**NO**
9. Does it cause economic control costs?**POTENTIALLY YES**

Acer negundo:

1. Does it cause loss of native biodiversity at species/population, community, or ecosystem level?**YES**
3. Does it cause significant changes in ecosystem functions?**YES**
4. Does it cause loss in trophic production (e.g., food, energy supply)? **NO**
5. Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?**YES**
6. Does it impact on human or domestic (cultured) animal and plant health?**NO**
7. Does it cause impacts to recreational and aesthetic activities?**NO**
8. Does it cause damage to infrastructure (including shore erosion)?**NO**
9. Does it cause economic control costs?**POTENTIALLY YES**

Robinia pseudoacacia:

1. Does it cause loss of native biodiversity at species/population, community, or ecosystem level?**YES**
3. Does it cause significant changes in ecosystem functions?**YES**
4. Does it cause loss in trophic production (e.g., food, energy supply)? **NO**
5. Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?**YES**
6. Does it impact on human or domestic (cultured) animal and plant health?**YES**
7. Does it cause impacts to recreational and aesthetic activities?**YES**
8. Does it cause damage to infrastructure (including shore erosion)?**NO**
9. Does it cause economic control costs?**POTENTIALLY YES**

Based on the given answers, one can understand that the three studied species in Nestos area are of high risk to cause ecological and socio-economic Impacts. However, our knowledge about all these functions will be increased during the work that will be conducted in the field.

5.4 - Kızılırmak Delta - Turkey

Selected IAS in the Table 12 is the list of species were determine to their High Risk to cause ecological and social-economic impact (HRI).

Table 12. Selected IAS in Kızılırmak Deltaic area considered as HRI

No	Latin Name	Explanation	HRI
1	*Cyprinus carpio* (Linnaeus, 1758)	Does it cause loss of native biodiversity at species/population, community, or ecosystem level?	YES
		Does it cause significant changes in ecosystem functions?	YES
		Does it cause loss in trophic production (e.g., food, energy supply)?	YES
		Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?	YES
		Does it impact on human or domestic (cultured) animal and plant health?	NO
		Does it cause impacts to recreational and aesthetic activities?	NO
		Does it cause damage to infrastructure (including shore erosion)?	NO
		Does it cause economic control costs?	NO
2	*Carassius gibelio* (Bloch, 1782)	Does it cause loss of native biodiversity at species/population, community, or ecosystem level?	*YES*
		Does it cause significant changes in ecosystem functions?	*YES*
		Does it cause loss in trophic production (e.g., food, energy supply)?	*YES*
		Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?	*YES*
		Does it impact on human or domestic (cultured) animal and plant health?	*NO*
		Does it cause impacts to recreational and aesthetic activities?	*NO*
		Does it cause damage to infrastructure (including shore erosion)?	*NO*
		Does it cause economic control costs?	*YES*
3	*Gambusia holbrooki* (Girard, 1859)	Does it cause loss of native biodiversity at species/population, community, or ecosystem level?	*YES*
		Does it cause significant changes in ecosystem functions?	*NO*
		Does it cause loss in trophic production (e.g., food, energy supply)?	*NO*
		Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?	*YES*
		Does it impact on human or domestic (cultured) animal and plant health?	*NO*
		Does it cause impacts to recreational and aesthetic activities?	*NO*

		Does it cause damage to infrastructure (including shore erosion)?	*NO*
		Does it cause economic control costs?	*NO*
4	*Gambusia affinis (Baird and Girard, 1853)*	Does it cause loss of native biodiversity at species/population, community, or ecosystem level?	*YES*
		Does it cause significant changes in ecosystem functions?	*NO*
		Does it cause loss in trophic production (e.g., food, energy supply)?	*NO*
		Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?	*YES*
		Does it impact on human or domestic (cultured) animal and plant health?	*NO*
		Does it cause impacts to recreational and aesthetic activities?	*NO*
		Does it cause damage to infrastructure (including shore erosion)?	*NO*
		Does it cause economic control costs?	*NO*
5	*Lithognathus mormyrus* (Linnaeus, 1758)	Does it cause loss of native biodiversity at species/population, community, or ecosystem level?	YES
		Does it cause significant changes in ecosystem functions?	NO
		Does it cause loss in trophic production (e.g., food, energy supply)?	NO
		Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?	NO
		Does it impact on human or domestic (cultured) animal and plant health?	NO
		Does it cause impacts to recreational and aesthetic activities?	NO
		Does it cause damage to infrastructure (including shore erosion)?	NO
		Does it cause economic control costs?	NO
6	*Liza haematocheila* (Temminck and Schlegel, 1845)	Does it cause loss of native biodiversity at species/population, community, or ecosystem level?	NO
		Does it cause significant changes in ecosystem functions?	NO
		Does it cause loss in trophic production (e.g., food, energy supply)?	NO
		Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?	NO
		Does it impact on human or domestic (cultured) animal and plant health?	NO
		Does it cause impacts to recreational and aesthetic activities?	NO
		Does it cause damage to infrastructure (including shore erosion)?	NO
		Does it cause economic control costs?	NO

		Does it cause loss of native biodiversity at species/population, community, or ecosystem level?	NO
7	*Parablennius incognitus* (Bath, 1968)	Does it cause loss of native biodiversity at species/population, community, or ecosystem level?	NO
		Does it cause significant changes in ecosystem functions?	NO
		Does it cause loss in trophic production (e.g., food, energy supply)?	NO
		Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?	NO
		Does it impact on human or domestic (cultured) animal and plant health?	NO
		Does it cause impacts to recreational and aesthetic activities?	NO
		Does it cause damage to infrastructure (including shore erosion)?	NO
		Does it cause economic control costs?	NO
8	*Syngnathus acus* (Linnaeus, 1758)	Does it cause loss of native biodiversity at species/population, community, or ecosystem level?	NO
		Does it cause significant changes in ecosystem functions?	NO
		Does it cause loss in trophic production (e.g., food, energy supply)?	NO
		Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?	NO
		Does it impact on human or domestic (cultured) animal and plant health?	NO
		Does it cause impacts to recreational and aesthetic activities?	NO
		Does it cause damage to infrastructure (including shore erosion)?	NO
		Does it cause economic control costs?	NO
9	*Oncorhynchus mykiss* (Walbaum, 1792)	Does it cause loss of native biodiversity at species/population, community, or ecosystem level?	YES
		Does it cause significant changes in ecosystem functions?	NO
		Does it cause loss in trophic production (e.g., food, energy supply)?	YES
		Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?	YES
		Does it impact on human or domestic (cultured) animal and plant health?	NO
		Does it cause impacts to recreational and aesthetic activities?	YES
		Does it cause damage to infrastructure (including shore erosion)?	NO
		Does it cause economic control costs?	NO
10	*Gobius*	Does it cause loss of native biodiversity at species/population,	NO

	cruentatus (Gmelin, 1789)	community, or ecosystem level?	
		Does it cause significant changes in ecosystem functions?	NO
		Does it cause loss in trophic production (e.g., food, energy supply)?	NO
		Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?	NO
		Does it impact on human or domestic (cultured) animal and plant health?	NO
		Does it cause impacts to recreational and aesthetic activities?	NO
		Does it cause damage to infrastructure (including shore erosion)?	NO
		Does it cause economic control costs?	NO
11	*Callinectes sapidus* (Rathbun, 1896)	Does it cause loss of native biodiversity at species/population, community, or ecosystem level?	YES
		Does it cause significant changes in ecosystem functions?	NO
		Does it cause loss in trophic production (e.g., food, energy supply)?	NO
		Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?	YES
		Does it impact on human or domestic (cultured) animal and plant health?	NO
		Does it cause impacts to recreational and aesthetic activities?	NO
		Does it cause damage to infrastructure (including shore erosion)?	NO
		Does it cause economic control costs?	NO
12	*Pseudosolenia calcar-avis (Schultze), (Sundström, 1986)*	Does it cause loss of native biodiversity at species/population, community, or ecosystem level?	YES
		Does it cause significant changes in ecosystem functions?	YES
		Does it cause loss in trophic production (e.g., food, energy supply)?	YES
		Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?	NO
		Does it impact on human or domestic (cultured) animal and plant health?	NO
		Does it cause impacts to recreational and aesthetic activities?	YES
		Does it cause damage to infrastructure (including shore erosion)?	NO
		Does it cause economic control costs?	NO
13	*Thalassiosira nordenskioeldii* (Cleve, 1873)	Does it cause loss of native biodiversity at species/population, community, or ecosystem level?	YES
		Does it cause significant changes in ecosystem functions?	YES
		Does it cause loss in trophic production (e.g., food, energy	YES

		supply)?	
		Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?	YES
		Does it impact on human or domestic (cultured) animal and plant health?	YES
		Does it cause impacts to recreational and aesthetic activities?	YES
		Does it cause damage to infrastructure (including shore erosion)?	NO
		Does it cause economic control costs?	NO
14	*Alexandrium minutum* (Halim, 1960)	Does it cause loss of native biodiversity at species/population, community, or ecosystem level?	YES
		Does it cause significant changes in ecosystem functions?	YES
		Does it cause loss in trophic production (e.g., food, energy supply)?	YES
		Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?	YES
		Does it impact on human or domestic (cultured) animal and plant health?	YES
		Does it cause impacts to recreational and aesthetic activities?	YES
		Does it cause damage to infrastructure (including shore erosion)?	NO
		Does it cause economic control costs?	NO
15	*Oxyphysis oxytoksoides (*Kofoid 1926*)*	Does it cause loss of native biodiversity at species/population, community, or ecosystem level?	YES
		Does it cause significant changes in ecosystem functions?	YES
		Does it cause loss in trophic production (e.g., food, energy supply)?	YES
		Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?	NO
		Does it impact on human or domestic (cultured) animal and plant health?	NO
		Does it cause impacts to recreational and aesthetic activities?	YES
		Does it cause damage to infrastructure (including shore erosion)?	NO
		Does it cause economic control costs?	NO
16	*Scrippsiella trochoidea (Stein)*	Does it cause loss of native biodiversity at species/population, community, or ecosystem level?	YES
		Does it cause significant changes in ecosystem functions?	YES
		Does it cause loss in trophic production (e.g., food, energy supply)?	YES
		Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?	YES

		Does it impact on human or domestic (cultured) animal and plant health?	YES
		Does it cause impacts to recreational and aesthetic activities?	YES
		Does it cause damage to infrastructure (including shore erosion)?	NO
		Does it cause economic control costs?	NO
17	*Ulva lactuca (Linnaeus, 1753)=Ulva fasciata* (Delile, 1813)	Does it cause loss of native biodiversity at species/population, community, or ecosystem level?	YES
		Does it cause significant changes in ecosystem functions?	YES
		Does it cause loss in trophic production (e.g., food, energy supply)?	YES
		Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?	YES
		Does it impact on human or domestic (cultured) animal and plant health?	YES
		Does it cause impacts to recreational and aesthetic activities?	YES
		Does it cause damage to infrastructure (including shore erosion)?	NO
		Does it cause economic control costs?	YES
18	*Mnemiopsis leidyi* (Agassiz, 1865)	Does it cause loss of native biodiversity at species/population, community, or ecosystem level?	YES
		Does it cause significant changes in ecosystem functions?	YES
		Does it cause loss in trophic production (e.g., food, energy supply)?	YES
		Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?	YES
		Does it impact on human or domestic (cultured) animal and plant health?	YES
		Does it cause impacts to recreational and aesthetic activities?	YES
		Does it cause damage to infrastructure (including shore erosion)?	NO
		Does it cause economic control costs?	NO
19	*Beroe ovata* (Mayer, 1912)		
		Does it cause loss of native biodiversity at species/population, community, or ecosystem level?	YES
		Does it cause significant changes in ecosystem functions?	YES
		Does it cause loss in trophic production (e.g., food, energy supply)?	YES
		Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?	NO
		Does it impact on human or domestic (cultured) animal and plant health?	NO

		Does it cause impacts to recreational and aesthetic activities?	YES
		Does it cause damage to infrastructure (including shore erosion)?	NO
		Does it cause economic control costs?	NO
20	*Acartia tonsa (Dana, 1849)*	Does it cause loss of native biodiversity at species/population, community, or ecosystem level?	NO
		Does it cause significant changes in ecosystem functions?	NO
		Does it cause loss in trophic production (e.g., food, energy supply)?	NO
		Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?	YES
		Does it impact on human or domestic (cultured) animal and plant health?	NO
		Does it cause impacts to recreational and aesthetic activities?	NO
		Does it cause damage to infrastructure (including shore erosion)?	NO
		Does it cause economic control costs?	NO
21	*Balanus improvisus* (Darvin, 1854)	Does it cause loss of native biodiversity at species/population, community, or ecosystem level?	YES
		Does it cause significant changes in ecosystem functions?	YES
		Does it cause loss in trophic production (e.g., food, energy supply)?	YES
		Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?	YES
		Does it impact on human or domestic (cultured) animal and plant health?	YES
		Does it cause impacts to recreational and aesthetic activities?	YES
		Does it cause damage to infrastructure (including shore erosion)?	NO
		Does it cause economic control costs?	YES
22	*Oithona davisae* (Ferrariand Orsi, 1984)	Does it cause loss of native biodiversity at species/population, community, or ecosystem level?	NO
		Does it cause significant changes in ecosystem functions?	YES
		Does it cause loss in trophic production (e.g., food, energy supply)?	NO
		Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?	NO
		Does it impact on human or domestic (cultured) animal and plant health?	NO
		Does it cause impacts to recreational and aesthetic activities?	NO
		Does it cause damage to infrastructure (including shore erosion)?	NO

		Does it cause economic control costs?	NO
23	*Rapana venosa* (Valenciennes, 1846)	Does it cause loss of native biodiversity at species/population, community, or ecosystem level?	YES
		Does it cause significant changes in ecosystem functions?	YES
		Does it cause loss in trophic production (e.g., food, energy supply)?	YES
		Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?	YES
		Does it impact on human or domestic (cultured) animal and plant health?	YES
		Does it cause impacts to recreational and aesthetic activities?	NO
		Does it cause damage to infrastructure (including shore erosion)?	NO
		Does it cause economic control costs?	YES
24	*Anadara kagishimensis (Tokunaga, 1906)*	Does it cause loss of native biodiversity at species/population, community, or ecosystem level?	YES
		Does it cause significant changes in ecosystem functions?	YES
		Does it cause loss in trophic production (e.g., food, energy supply)?	YES
		Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?	YES
		Does it impact on human or domestic (cultured) animal and plant health?	NO
		Does it cause impacts to recreational and aesthetic activities?	NO
		Does it cause damage to infrastructure (including shore erosion)?	NO
		Does it cause economic control costs?	NO
25	*Potamopyrgus antipodarum (Gray, 1843)*	Does it cause loss of native biodiversity at species/population, community, or ecosystem level?	YES
		Does it cause significant changes in ecosystem functions?	YES
		Does it cause loss in trophic production (e.g., food, energy supply)?	YES
		Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?	YES
		Does it impact on human or domestic (cultured) animal and plant health?	YES
		Does it cause impacts to recreational and aesthetic activities?	NO
		Does it cause damage to infrastructure (including shore erosion)?	NO
		Does it cause economic control costs?	NO

26	*Astacus leptodactylus (Eschscholtz, 1823)*	Does it cause loss of native biodiversity at species/population, community, or ecosystem level?	YES
		Does it cause significant changes in ecosystem functions?	NO
		Does it cause loss in trophic production (e.g., food, energy supply)?	NO
		Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?	YES
		Does it impact on human or domestic (cultured) animal and plant health?	NO
		Does it cause impacts to recreational and aesthetic activities?	NO
		Does it cause damage to infrastructure (including shore erosion)?	NO
		Does it cause economic control costs?	NO

5.5 - Chorokhi and Kolkheti - Georgia

Selected IAS in the Table 13 is the list of species were determine to their High Risk to cause ecological and social-economic impact (HRI).

Table 13. Selected IAS in the Chorokhi and Kolkheti Deltaic area considered as HRI

No	Latin Name	Explanation	HRI
1	*Ambrosia artimisiifolia (Linnaeus, 1758)*	Does it cause loss of native biodiversity at species/population, community, or ecosystem level?	YES
		Does it cause significant changes in ecosystem functions?	YES
		Does it cause loss in trophic production (e.g., food, energy supply)?	NO
		Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?	NO
		Does it impact on human or domestic (cultured) animal and plant health?	YES
		Does it cause impacts to recreational and aesthetic activities?	YES
		Does it cause damage to infrastructure (including shore erosion)?	NO
		Does it cause economic control costs?	NO
2	*Robinia pseudoacacia (Linnaeus, 1758)*		
		Does it cause loss of native biodiversity at species/population, community, or ecosystem level?	YES
		Does it cause significant changes in ecosystem functions?	YES
		Does it cause loss in trophic production (e.g., food, energy supply)?	NO
		Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?	NO
		Does it impact on human or domestic (cultured) animal and	NO

		plant health?	
		Does it cause impacts to recreational and aesthetic activities?	NO
		Does it cause damage to infrastructure (including shore erosion)?	NO
		Does it cause economic control costs?	NO
3	*Gambusia affinis* (Baird and Girard, 1853)	Does it cause loss of native biodiversity at species/population, community, or ecosystem level?	YES
		Does it cause significant changes in ecosystem functions?	YES
		Does it cause loss in trophic production (e.g., food, energy supply)?	NO
		Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?	NO
		Does it impact on human or domestic (cultured) animal and plant health?	NO
		Does it cause impacts to recreational and aesthetic activities?	NO
		Does it cause damage to infrastructure (including shore erosion)?	NO
		Does it cause economic control costs?	NO
4	*Mnemiopsislei dyi* (Agassiz, 1860)	Does it cause loss of native biodiversity at species/population, community, or ecosystem level?	YES
		Does it cause significant changes in ecosystem functions?	YES
		Does it cause loss in trophic production (e.g., food, energy supply)?	YES
		Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?	NO
		Does it impact on human or domestic (cultured) animal and plant health?	NO
		Does it cause impacts to recreational and aesthetic activities?	NO
		Does it cause damage to infrastructure (including shore erosion)?	NO
		Does it cause economic control costs?	NO
5	*Rapana venosa* (Valenciennes, 1846)	Does it cause loss of native biodiversity at species/population, community, or ecosystem level?	YES
		Does it cause significant changes in ecosystem functions?	YES
		Does it cause loss in trophic production (e.g., food, energy supply)?	YES
		Does it have an impact in terms of human access to natural resources (e.g., biodiversity, wild fish, water supply)?	NO
		Does it impact on human or domestic (cultured) animal and plant health?	NO

		Does it cause impacts to recreational and aesthetic activities?	NO
		Does it cause damage to infrastructure (including shore erosion)?	NO
		Does it cause economic control costs?	NO

6. Assessment of Species-specific Bio Pollution Risk (SBPR) index

In order to classify species with respect to their potential negative impacts, a specific **SBPR**index is used.To calculate it, three intermediate descriptors: **HRD** (**H**igh **R**isk of **D**ispersal), **HRE** (**H**igh **R**isk for **E**stablishment in a new environment) and **HRI** (**H**igh **R**isk to cause ecological and negative socio-economic **I**mpacts) are evaluated as **Yes/No** (see above).
According this procedure, if information on the potential risks of rapid species dispersal, establishment, and adverse impacts is not available, alien species should be attributed to the grey list of species with ‘‘unknown risk’’ (unknown level of invasiveness, and the SBPR index remains unidentified—‘‘N/A’’ or 0).

In the cases where information is available only on the risks of rapid species dispersal (**HRD**) or establishment (**HRE**), alien species can be specified as white-list species with low biopollution risk (SBPR index = 1, low level of invasiveness).

If information is available on both the risks of rapid dispersal(**HRD**) and establishment (**HRE**), then alien species can be specified as white-list species with moderate biopollution risk (SBPR index = 2, moderate level of invasiveness).

If information is available on the risks of adverse impacts (**HRI**), regardless of the existence of information on dispersal and establishment risks, then the nonnative species can be specified as a black-list species with high risk (SBPR index = 3, high level of invasiveness).

This is shown schematically in Figure 1.

This approach to the risk-based assessment of invasiveness of the alien species, established in the aquatic ecosystem (assessment units), was further used in the formal procedure of listing of alien species into the Grey, White and Black Lists. Further, the gray list is a priority for research and clarification of the status of species, and the black list - for environmental management.

This procedure should be carried out during the monitoring process, as a result of which the current situation will be shown. After modeling the climatic niches, if the potential distribution of the species turns out to be much wider than that observed during monitoring, the reevaluation of the SBPR index based on the modeling results will show predictive indicators of risks.

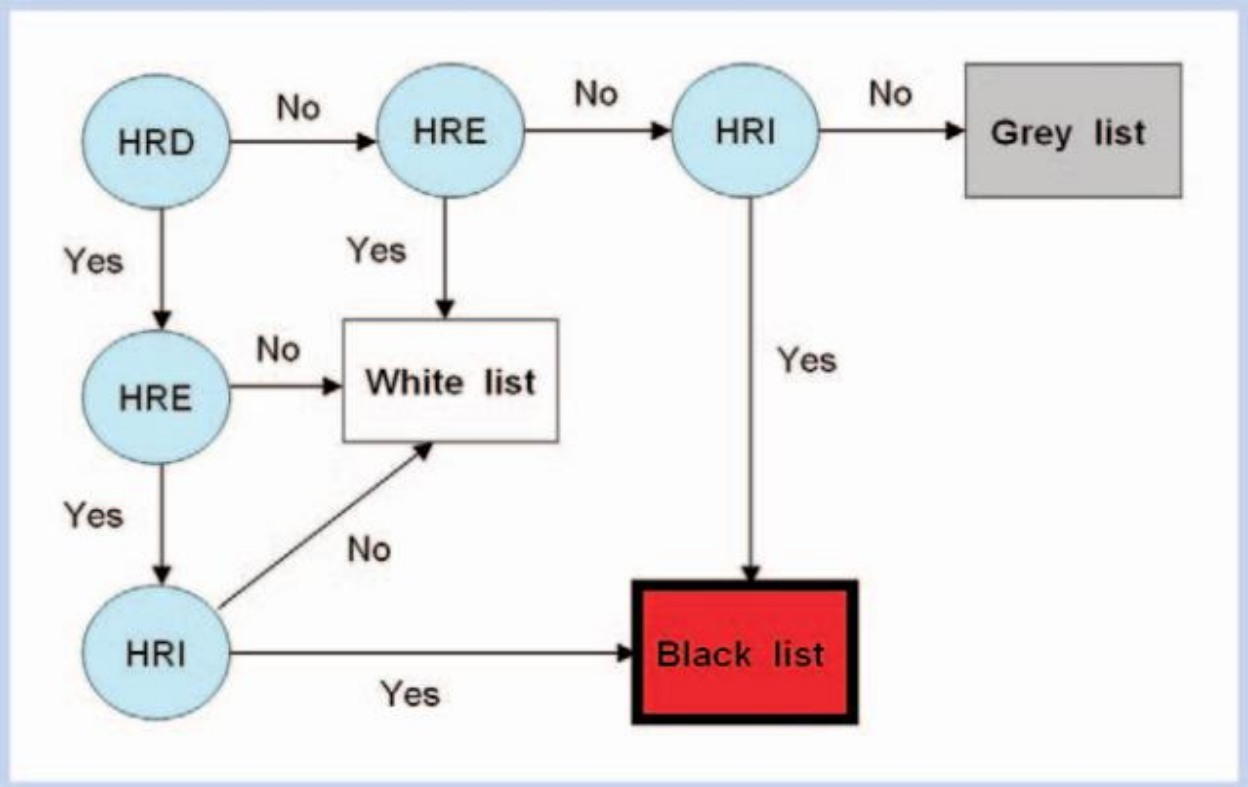


Figure 1. Assessment of SBPR index (Panov et al. 2009). "Yes" in this scheme means that information on potential invasiveness of the species is available, "No" means "Unknown", or information is not available.

The SBPR assessment table structure is developed for IAS in the Romanian part of the Danube Delta (Table 14) as well as for the Kızılırmak Delta in Turkey (Table 15).

Table 14. Selected IAS for Danube Delta (Romania) for SBPR calculation

No.	Latin Name	HRD	HRE	HRI	SBPR index	White List	Grey List	Black List
1	*Amorpha fruticosa* L.	Yes	Yes	Yes	3	-	-	X
2	*Xanthium strumarium* L.	Yes	Yes	Yes	3	-	-	X
3	*Elodea nuttallii* (Planch.) H. St. John	Yes	Yes	Yes	3	-	-	X
4	*Leptinotarsa decemlineata* Say, 1824	yes	no	yes	2	-	X	-
5	*Perccottus glenii*Dybowski, 1877	yes	yes	yes	3	-	-	X

Table 15: Selected IAS in Kızılırmak Deltaic area (Romania) for SBPR calculation

Latin Name	HRD	HRE	HRI	Grey List	White List	Black List
Cyprinus carpio (Linnaeus, 1758)	+	+	-		+	
Carassius gibelio (Bloch, 1782)	+	+	+			+
Gambusia holbrooki (Girard, 1859)	+	+	+			+
Gambusia affinis(S. F. Baird and Girard, 1853)	+	+	+			+
Lithognathus mormyrus (Linnaeus, 1758)	NA	NA	NA	+		
Mugil soiuy= Liza haematocheila (Temminck & Schlegel, 1845)	-	-	-	+		
Parablennius incognitus (Bath, 1968)	+	+	-	+		
Syngnathus acus (Linnaeus, 1758)	+	-	-		+	
Oncorhynchus mykiss (Walbaum, 1792)	+	+	-		+	
Gobius cruentatus (Gmelin, 1789)	+	-	-		+	
Callinectes sapidus (Rathbun, 1896)	+	+	-		+	
Pseudosolenia calcar-avis (Schultze) B.G.Sundström 1986	+	+	+			+
Thalassiosira nordenskioeldii (Cleve, 1873)	-	+	-		+	
Alexandrium minutum (Halim, 1960)	+	+	+			+
*Oxyphysis oxytoksoides (*Kofoid 1926*)*	+	+	+			+
Scrippsiella trochoide	+	+	+			+
*Ulva lactuca Linnaeus, 1753 = Ulva fasciata (*Delile, 1813)	+	+	+			+
Mnemiopsis leidyi (Agassiz, 1865)	+	+	+			+
*Beroe ovata (*Mayer 1912)	+	+	-		+	

Acartia tonsa (Dana, 1849) (*)	+	+	-		+	
Balanus improvisus (Darvin 1854)	+	+	+		+	
Oithona davisae (Ferrari F.D. and Orsi, 1984)	+	+	+			+
Rapana venosa (Valenciennes, 1846)	+	+	+			+
Anadara kagishimensis (Tokunaga, 1906)	+	+	+			+
Potamopyrgus antipodarum(J. E. Gray, 1843)	+	+	+			+
Astacus leptodactylus (Eschscholtz, 1823)	+	+	-		+	

7. Assessment units

The assessment units (part of aquatice cosystem, serving asassessment and management ones) are used in **HRD** (**H**igh **R**isk of **D**ispersal) and **HRE** (**H**igh **R**isk for **E**stablishmentin a new environment) evaluations (see above). In both cases, you need to understand whether the species is marked within the same region or in different regions. For this, Europe (within which this methodology is applied) is divided into assessment units.
These was codified in the Panov et al. (2009) for key invasion corridors (fresh waters), especially for Black Sea basins (within Danube and Dnieper rivers) (figure 2).
Especially were codified SC1 "Danube Delta" (Razimlagoonal complex may be included in this unit) and SC2 "Lower Danube". As in our project we are extending this methodology to terrestrial and marine ecosystems, we must expand the list of accounting units (see bellow).

For the purposes of the project, we propose to supplement this list with working codes for inland waters: NST1 (Nestos Delta), KIZ1 (Kızılırmak Delta), CHR1 (Chorokhi basin), KLK1 (inland waters within Kolkheti region).
For terrestrial ecosystems, using the same SC1, SC2, NST1, KIZ1, CHR1, KLK1is suggested.
The appropriate scale would be to select several units for the sea, for example: BS1 – Dnieper-Odessa Sea District, BS2 – Dniester Sea District, BS3 – Danube Sea District (with Razim lagoon as southern border), BS4 – Agigea-Mangalia Sea District, BS5 – maritime region adjacent to Kızılırmak Delta; BS6 – Georgian sector of the Black Sea.

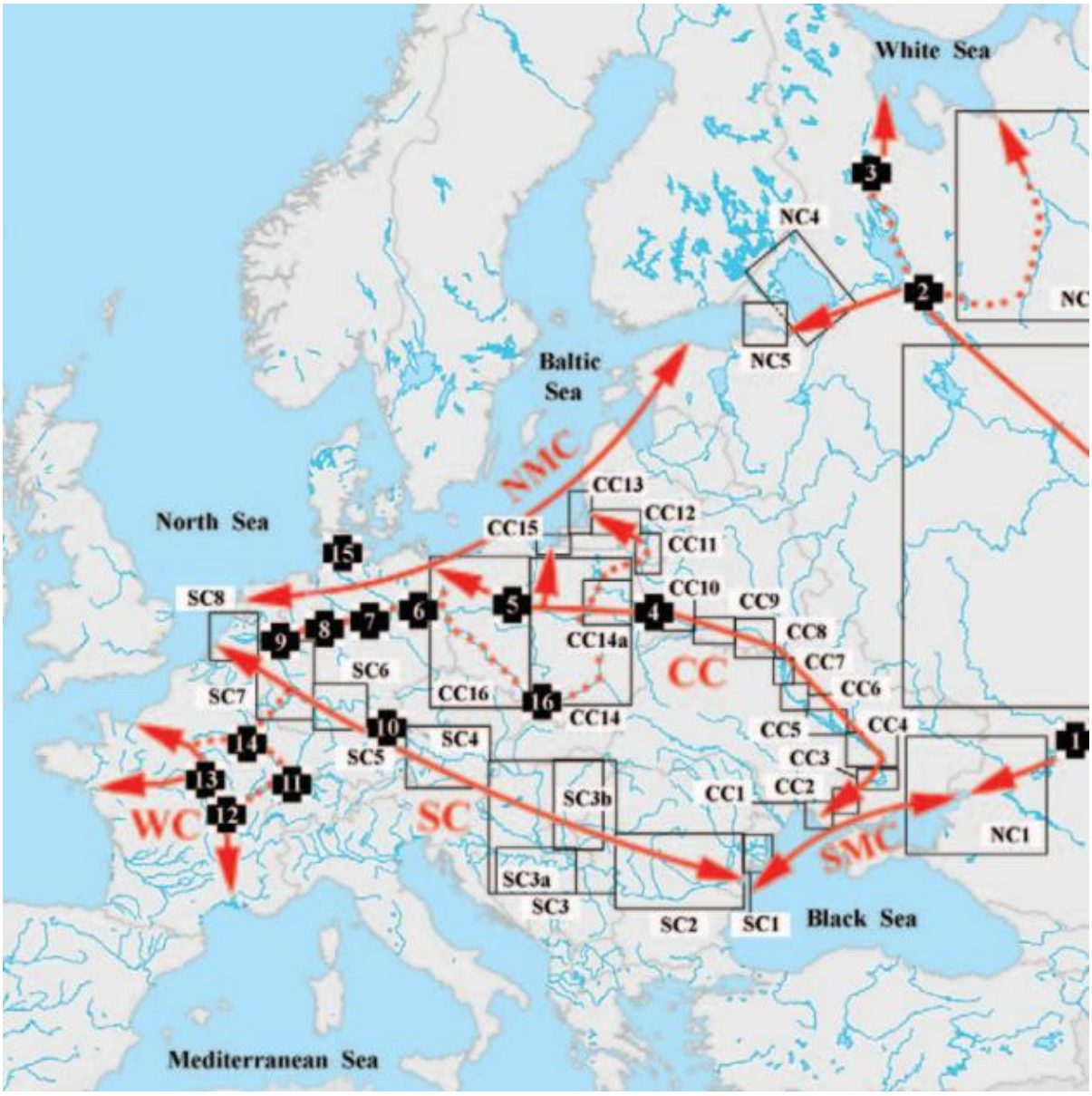


Figure 2. Examples of assessmentunits (Panov et al. 2009)

The assessment of HRD, HRE, and HRI is based both on units that are within the study region and on any units within Europe. Units away from other European regions (**HRD** and **HRE** assessment is partly based on literature data) do not need to be specially highlighted, but the project participants simply needs to understand the scale of such units, assessing the prevalence of the invasive species.

7.1. Usage of the units in practice

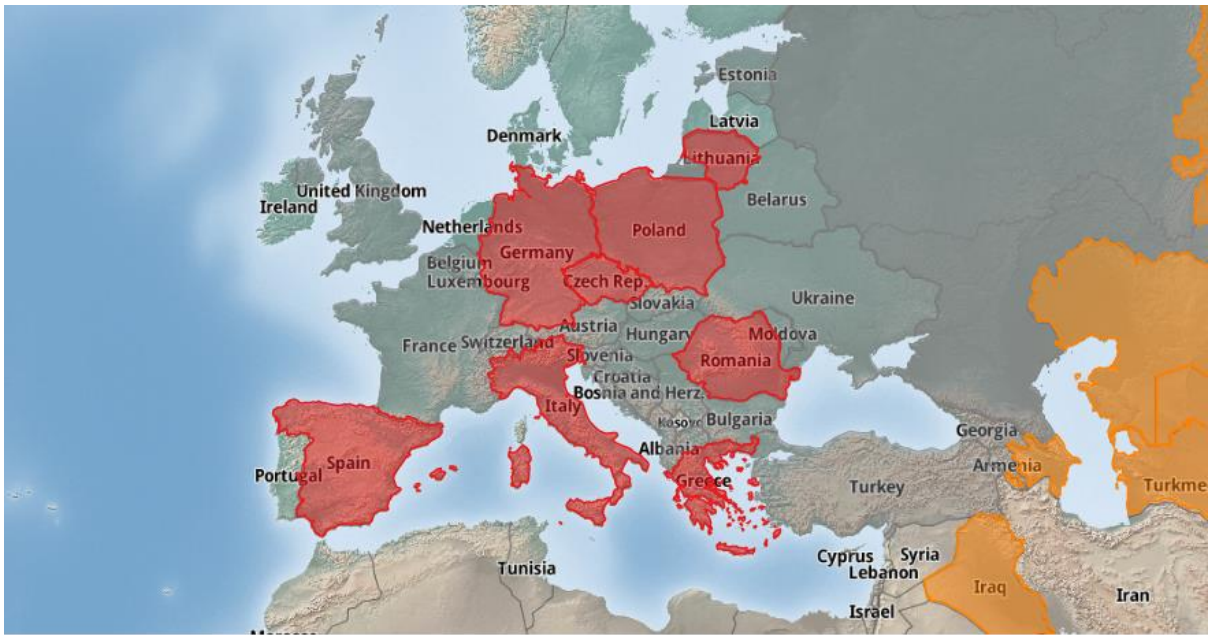
Regarding the IAS selected for the Danube Delta - Romania, a specific dispersion corridor or the prevalence of the invasive species cannot be estimated / evaluated. However, according to the officially available literature and data, their distribution

maps at European level can be highlighted, on the basis of which assessment units can be estimated and coded according to requirements.

1. *Amorpha fruticosa* L.

Continent / Country / Region	Distribution	Origin	Invasive	Reference	Notes
EUROPE					
Albania	Present	Introduced		Euro+MedPlantBase (2011)	
Austria	Present	Introduced		Euro+MedPlantBase (2011)	
Belarus	Present	Introduced		Euro+MedPlantBase (2011)	
Belgium	Present	Introduced		DAISIE (2015)	Casual
Bosnia and Herzegovina	Present	Introduced		Euro+MedPlantBase (2011)	
Bulgaria	Present	Introduced		Euro+MedPlantBase (2011)	
Croatia	Present	Introduced		Euro+MedPlantBase (2011)	
Czechia	Present	Introduced	Invasive	Euro+MedPlantBase (2011)	Naturalized
Estonia	Present	Introduced		Euro+MedPlantBase (2011)	
France	Present, Localized			EPPO (2020)	
-Corsica	Absent			EPPO (2020)	
Germany	Present	Introduced	Invasive	DAISIE (2015)	Naturalized
Greece	Present	Introduced	Invasive	DAISIE (2015)	Naturalized
Hungary	Present			EPPO (2020)	
Italy	Present	Introduced	Invasive	DAISIE (2015)	Naturalized
Lithuania	Present	Introduced	Invasive	CABI (Undated)	Original citation: Gudžinskas and Žalneravicius (2015)
Moldova	Present	Introduced		Euro+MedPlantBase (2011)	
Montenegro	Present	Introduced		Euro+MedPlantBase (2011)	
North Macedonia	Present	Introduced		Euro+MedPlantBase (2011)	
Poland	Present	Introduced	Invasive	DAISIE (2015)	Naturalized
Romania	Present	Introduced	Invasive	Dumitrascu et al. (2013)	
Russia	Present	Introduced		Euro+MedPlantBase (2011)	
-Central Russia	Present	Introduced		Euro+MedPlantBase (2011)	
-Northern Russia	Present	Introduced		Euro+MedPlantBase (2011)	
-Russian Far East	Present	Introduced	Naturalized	USDA-ARS (2018)	Naturalized
-Southern Russia	Present	Introduced		Euro+MedPlantBase (2011)	
-Western Siberia	Present	Introduced	Naturalized	USDA-ARS (2018)	Naturalized
Serbia	Present			EPPO (2020)	
Slovakia	Present	Introduced		Euro+MedPlantBase (2011)	
Slovenia	Present			EPPO (2020)	
Spain	Present	Introduced	Invasive	DAISIE (2015)	Naturalized

Continent / Country / Region	Distribution	Origin	Invasive	Reference	Notes
Switzerland	Present			EPPO (2020)	
Ukraine	Present	Introduced		Euro+MedPlantBase (2011)	
United Kingdom	Present	Introduced		Euro+MedPlantBase (2011)	



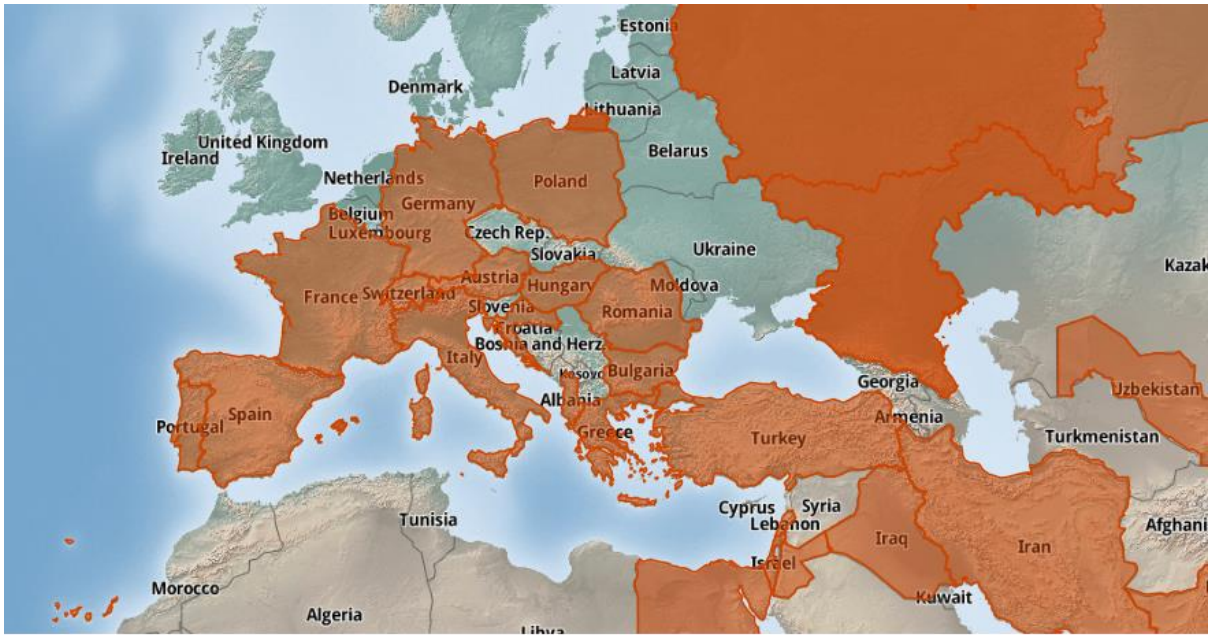
CABI, 2021. Amorpha fruticosa. In: Invasive Species Compendium. Wallingford, UK: CAB International. https://www.cabi.org/isc

- Invasive
- Naturalized
- Invasive status not recorded

2. *Xanthium strumarium* L

Continent / Country / Region	Distribution	Origin	Invasive	Reference	Notes
EUROPE					
Albania	Present			CABI (Undated)	Original citation: Love, 1976
Austria	Present			CABI (Undated)	Original citation: Love, 1976
Bulgaria	Present			CABI (Undated)	Original citation: Love, 1976
Croatia	Present			Vrandecic et al. (2007)	

Continent / Country / Region	Distribution	Origin	Invasive	Reference	Notes
Czechoslovakia	Present			CABI (Undated)	Original citation: Love, 1976
Federal Republic of Yugoslavia	Present, Widespread			Holm et al. (1991)	
France	Present			CABI (Undated)	Original citation: Love, 1976
Germany	Present			CABI (Undated)	Original citation: Love, 1976
Greece	Present			Thanassoulopoulos et al. (1981)	
Hungary	Present			Holm et al. (1991)	
Italy	Present			Sartorato et al. (1996)	
Poland	Present			Holm et al. (1991)	
Portugal	Present			CABI (Undated)	Original citation: Love, 1976
-Azores	Present			CABI (Undated)	Original citation: Love, 1976
Romania	Present			CABI (Undated)	Original citation: Love, 1976
Russia	Present			Holm et al. (1991)	
-Central Russia	Present			CABI (Undated)	Original citation: Love, 1976
-Northern Russia	Present			CABI (Undated)	Original citation: Love, 1976
-Southern Russia	Present			CABI (Undated)	Original citation: Love, 1976
Spain	Present, Widespread			Holm et al. (1991)	
-Balearic Islands	Present			CABI (Undated)	Original citation: Love, 1976
Switzerland	Present			CABI (Undated)	Original citation: Love, 1976



CABI, 2021. Xanthium strumarium. In: Invasive Species Compendium. Wallingford, UK: CAB International. https://www.cabi.org/isc

3. *Elodea nuttallii* (Planch.) H. St. John

Continent / Country / Region	Distribution	Origin	Invasive	Reference	Notes
EUROPE					
Austria	Present	Introduced		NOBANIS (2010)	
Belgium	Present	Introduced		DAISIE (2009)	
Bulgaria	Present, Localized			EPPO (2020)	
Croatia	Present, Localized			EPPO (2020)	
Czechia	Present	Introduced		DAISIE (2009)	
Denmark	Present	Introduced		DAISIE (2009)	
Finland	Present			EPPO (2020)	
France	Present	Introduced		DAISIE (2009)	
Germany	Present, Widespread	Introduced		DAISIE (2009)	
Hungary	Present	Introduced		DAISIE (2009)	
Ireland	Present	Introduced		DAISIE (2009)	
Italy	Present	Introduced		DAISIE (2009)	
Luxembourg	Present	Introduced		DAISIE (2009)	
Netherlands	Present	Introduced		DAISIE (2009)	
Norway	Present			EPPO (2020)	
Poland	Present	Introduced		NOBANIS (2010)	
Romania	Present	Introduced		Sârbu et al. (2006)	
Slovakia	Present	Introduced		Ot'ahel'ová and Valachovič	

Continent / Country / Region	Distribution	Origin	Invasive	Reference	Notes
				(2002)	
Slovenia	Present	Introduced		Grudnik et al. (2014)	
Sweden	Present	Introduced		DAISIE (2009)	
Switzerland	Present	Introduced		DAISIE (2009)	
United Kingdom	Present	Introduced		DAISIE (2009)	
-Channel Islands	Present	Introduced		DAISIE (2009)	
-Northern Ireland	Present			EPPO (2020)	

CABI, 2021. Elodea nuttallii. In: Invasive Species Compendium. Wallingford, UK: CAB International. https://www.cabi.org/isc

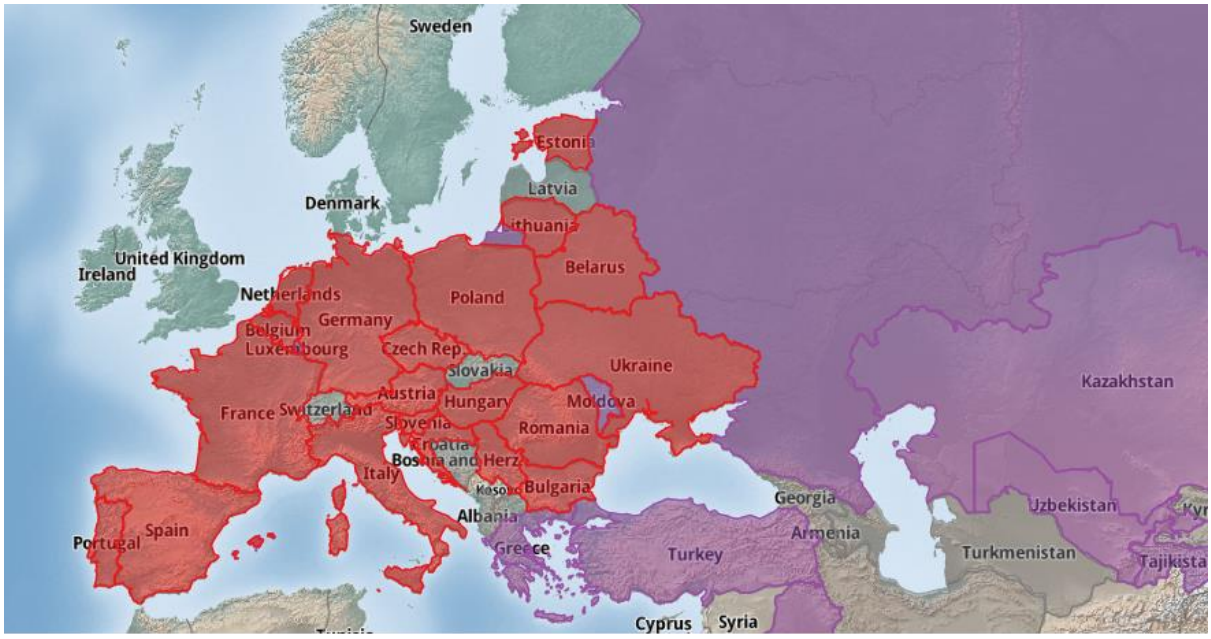
4. *Leptinotarsa decemlineata* Say, 1824

Continent / Country / Region	Distribution	Origin	Invasive	Reference	Notes
EUROPE					
Albania	Present			UK, CAB International (1962)	
Andorra	Present			UK, CAB International (1962)	
Austria	Present, Widespread			UK, CAB International (1962)	
Belarus	Present, Widespread			UK, CAB International (1962)	
Belgium	Present, Widespread			UK, CAB International (1962)	

Continent / Country / Region	Distribution	Origin	Invasive	Reference	Notes
Bosnia and Herzegovina	Present			UK, CAB International (1962)	
Bulgaria	Present, Widespread			UK, CAB International (1962)	
Croatia	Present, Widespread			UK, CAB International (1962)	
Cyprus	Absent, Confirmed absent by survey			EPPO (2020)	
Czechia	Present, Widespread			UK, CAB International (1962)	
Denmark	Absent, Eradicated			Bejer and Esbjerg (1980)	
Estonia	Present, Widespread			UK, CAB International (1962)	
Finland	Absent, Eradicated			EPPO (2020)	
France	Present, Widespread			UK, CAB International (1962)	
-Corsica	Present			EPPO (2020)	
Germany	Present, Widespread			UK, CAB International (1962)	
Greece	Present, Localized			UK, CAB International (1962)	
Guernsey	Absent, Confirmed absent by survey			EPPO (2020)	
Hungary	Present, Widespread			UK, CAB International (1962)	
Ireland	Absent, Intercepted only			EPPO (2020)	
Italy	Present, Widespread			UK, CAB International (1962)	
-Sardinia	Absent, Invalid presence record(s)			EPPO (2020)	
-Sicily	Present			EPPO (2020)	
Latvia	Present			UK, CAB International (1962)	
Lithuania	Present, Widespread			UK, CAB International (1962)	
Luxembourg	Present, Localized			UK, CAB International (1962)	
Malta	Absent			EPPO (2020)	
Moldova	Present, Localized			UK, CAB International (1962)	
Netherlands	Present,			UK, CAB International (1962)	

Continent / Country / Region	Distribution	Origin	Invasive	Reference	Notes
	Widespread				
North Macedonia	Present			UK, CAB International (1962)	
Norway	Absent, Intercepted only			EPPO (2020)	
Poland	Present, Widespread			UK, CAB International (1962)	
Portugal	Present, Widespread			UK, CAB International (1962)	
-Azores	Absent, Confirmed absent by survey			EPPO (2020)	
-Madeira	Absent, Confirmed absent by survey			EPPO (2020)	
Romania	Present, Widespread			UK, CAB International (1962)	
Russia	Present, Localized			UK, CAB International (1962)	
-Central Russia	Present			UK, CAB International (1962)	
-Eastern Siberia	Present			UK, CAB International (1962)	
-Northern Russia	Present			EPPO (2020)	
-Russian Far East	Present			UK, CAB International (1962)	
-Southern Russia	Present			UK, CAB International (1962)	
-Western Siberia	Present			UK, CAB International (1962)	
Serbia	Present, Widespread			EPPO (2020)	
Serbia and Montenegro	Present, Widespread			UK, CAB International (1962)	
Slovakia	Present			UK, CAB International (1962)	
Slovenia	Present, Widespread			UK, CAB International (1962)	
Spain	Present, Widespread			UK, CAB International (1962)	
-Balearic Islands	Present, Localized			EPPO (2020)	
Sweden	Absent, Eradicated			UK, CAB International (1962)	
Switzerland	Present			UK, CAB International (1962)	
Ukraine	Present, Widespread			UK, CAB International (1962)	

Continent / Country / Region	Distribution	Origin	Invasive	Reference	Notes
United Kingdom	Absent, Eradicated			UK, CAB International (1962)	
-Channel Islands	Absent, Eradicated			EPPO (2020)	
-England	Absent, Eradicated			EPPO (2020)	
-Northern Ireland	Absent, Intercepted only			EPPO (2020)	
-Scotland	Absent, Intercepted only			EPPO (2020)	



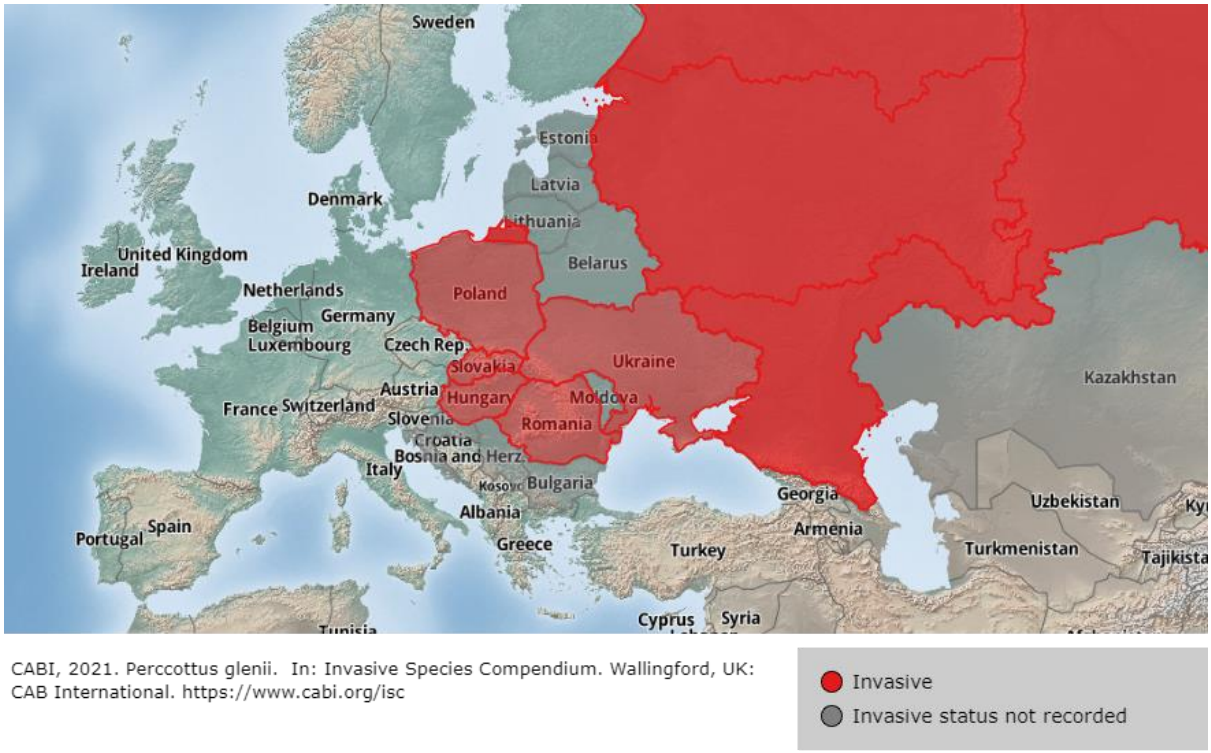
CABI, 2021. Leptinotarsa decemlineata. In: Invasive Species Compendium. Wallingford, UK: CAB International. https://www.cabi.org/isc

5. *Perccottus glenii* Dybowski, 1877

Continent / Country / Region	Distribution	Origin	Invasive	Reference	Notes
EUROPE					
Belarus	Present, Widespread	Introduced		Mastitsky et al. (2010)	
Bulgaria	Present,	Introduced		Jurajda et al. (2005)	In the Danube

Continent / Country / Region	Distribution	Origin	Invasive	Reference	Notes
	Localized				River (between the village Vrat and the town Lom: 840-744th river km)
Croatia	Present	Introduced		Caleta et al. (2010)	In the Sava River (Danube tributary) near city of SlavonskiBrot: 380th river km
Estonia	Present	Introduced		Tambets and Järvekülg (2005)	
Hungary	Present, Localized	Introduced	Invasive	Harka (1998)	In the Tisza River (Danube tributary)
Latvia	Present	Introduced		Plikss and Aleksejevs (1998)	
Lithuania	Present, Localized	Introduced		Virbickas (2000)	
Moldova	Present	Introduced		Mosu (2007)	Northern part of Moldova in the left tributaries of Prut River (Danube tributary)
Poland	Present, Localized	Introduced	Invasive	Antychowicz (1994)	
Romania	Present	Introduced	Invasive	Nalbant et al. (2004)	
Russia	Present, Widespread	Introduced	Invasive	Bogutskaya and Naseka (2002)	It has been found in 36 provinces of the Russian Federation: Arkhangelsk, Bryansk, Chelyabinsk, Irkutsk, Kaliningrad, Kaluga, Kemerovo, Kirov, Kostroma, Kurgan, Kursk, Leningrad,

Continent / Country / Region	Distribution	Origin	Invasive	Reference	Notes
					Lipetsk, Moscow, Nizhny Novgorod, Novosibirsk, Orenburg, Omsk, Penza, Pskov, Ryazan, Samara, Saratov, Smolensk, Sverdlovsk, Tambov, Tomsk, Tula, Tyumen, Tver, Ulyanovsk, Vladimir, Volgograd, Vologda, Vorenezh, Yaroslavl
-Central Russia	Present, Widespread	Introduced	Invasive	Reshetnikov (2010)	Bryansk, Kostroma, Lipetsk, Moscow, Ryazan, Smolensk, Tambov, Tver', Vladimir
-Eastern Siberia	Present	Introduced	Invasive	Reshetnikov (2010)	
-Northern Russia	Present, Localized	Introduced	Invasive	Reshetnikov (2010)	Arkhangelsk
-Russian Far East	Present	Native		Reshetnikov (2010)	
-Southern Russia	Present	Introduced	Invasive	Reshetnikov (2010)	Kursk, Orenburg, Samara, Saratov, Volgograd, Voronezh
-Western Siberia	Present	Introduced	Invasive	Reshetnikov (2010)	Chelyabinsk
Serbia	Present	Introduced		Sipos et al. (2004)	
Slovakia	Present	Introduced	Invasive	Kautman (1999)	
Ukraine	Present	Introduced	Invasive	Bogutskaya and Naseka (2002)	



CABI, 2021. Perccottus glenii. In: Invasive Species Compendium. Wallingford, UK: CAB International. https://www.cabi.org/isc

Invasive
Invasive status not recorded

7.2. Invasive Species Compendium

The ISC is an encyclopedic resource that draws together scientific information on all aspects of invasive species.
It comprises detailed datasheets that have been sourced from experts, edited by CABI's scientific staff, peer-reviewed, enhanced with data from specialist organizations, and with images and maps, and linked to a bibliographic database.
In 2001, CABI's Compendium Programme Consortia identified a need for a Compendium on Invasive Species in recognition of the threat posed by invasive species to the global economy and environment.

The data regarding the IAS distribution (selected for the Danube Delta - Romania) at continental level and the distribution maps are according to the website https://www.cabi.org/isc/(18.03.2021)

8. Conclusions

1. IAS monitoring protocols and risk assessment methodology were applied on the 5 Invasive Alien Species selected for Danube Delta – Romania: *Amorpha fruticosa* L., *Xanthium strumarium* L., *Elodea nuttallii* (Planch.) H. St. John, *Leptinotarsa decemlineata* Say, 1824, *Perccottus glenii* Dybowski, 1877;
2. Among 51 invasive or potencially invasive species, which occurred in the Danube delta, or may established in nearest time, 7 species are chosen for the standard protocol description, as most common and invasive in the monitoring area;
3. In Greece, three species are characterized by a HRD (High Risk of Dispersal), HRE (High Risk for Establishment in a new environment) and HRI (High Risk to cause ecological and negative socio-economic Impacts);
4. 26 IAS were selected from Kızılırmak Deltaic region. 10 of them are pisces, 2 of them are Diatom, 3 of them areDinophylagellate, one of tehem are Cholorophyta, 2 of them are Ctenophora, 3 of them are Arthropoda, two of them are Gastropoda, one of them is Bivalvia and two pf them are Crustaces. Each species was identified as latin name, common name, vernacular name, picture, small description about species, habitat, invasiveness, pressure on native species, etc.(detail descriptions were in the 2.4);
5. In Chorokhi Deltaic and Kolkheti Lowland we have specified 5 invasion species which are harmful for ecology, environment and socio-economy. Out of 5 invasive species, two of them are plants distributed all over the country, one fish with high risk of dispersal, one ctenophore being harmful by its predation and high speed distribution in nature and mollusk having threat to local species.
6. The Monitoring Protocol for IAS species was developed, involving descriptive elements or criteria based on scientific evaluation.
7. Species are classified from the worst invasive to the least invasive in Greece as follows: *Amorpha fruticosa, Robinia pseudoacacia* and *Acer negundo*.
8. For each of the species a Standard Sheet containing descriptive elements has been developed for the characterization of the IAS, in which components of the monitoring protocol are highlighted;
9. For each IAS were estimated High Risk of Dispersal (HRD), High Risk for Establishment in a new environment (HRE), High Risk to cause ecological and socio-economic Impacts (HRI) and calculated biopollution risk (SBPR) index.
10. Regarding the IAS selected for the Danube Delta - Romania, a specific dispersion corridor or the prevalence of the invasive species cannot be estimated / evaluated. However, according to the officially available literature and data, their distribution maps at European level can be highlighted, on the basis of which assessment units can be estimated and coded according to requirements.
11. Selected species in Georgia were categories as HRD (22 species), HRE (24 species), HRI according to their dispersal, establishment and ecological and

social-economic impacts. 13 species were found in the Black list, while 10 species were found in the White list and other 3 species were found in the Grey list.

9. Bibliography

ABBAS HK, BARRENTINE WL, 1995. Alternaria helianthi and imazaquin for control of imazaquin susceptible and resistant cocklebur (Xanthium strumarium) biotypes. Weed Science, 43(3):425-428;

ALEKSANDROV, B.G., ZAITSEV, Y.P., VOROBYOVA, L.V. 1998. Seaside ecosystem of the Ukrainian Danube Delta. Odessa: Astroprint, 332 p. [in Russian]

ALEXANDROV, B. 2005. Introduced species in the Black Sea: the role of ballast water at Odessa Port, Ukraine. NEAR Curriculum in Natural Environmental Science, Terre etEnvironnement. Vol. 50. P. 141–154.

ALONSO, A., CASTRO-DIEZ, P. 2012. The exotic aquatic mud snail *Potamopyrgus antipodarum* (Hydrobiidae, Mollusca): state of the art of a worldwide invasion. Aquatic Sciences, 74(3): 375-383

ANASTASIU PAULINA, NEGREAN G., BAŞNOU CORINA, SÂRBU C., OPREA A., 2008 – A preliminary study on the neophytes of wetlands in Romania, In: Rabitsch, W., F. ESSL ŞI F. KLINGENSTEIN (ed.): Biological Invasions – from Ecology to Conservation. NEOBIOTA 7 (2008): 180-190;

BARRAT-SEGRETAIN MH, 2001. Invasive species in the Rhône River floodplain (France): replacement of Elodea canadensis Michaux by E. nuttallii St. John in two former river channels. ArchivfürHydrobiologie, 152(2):237-251;

BARRAT-SEGRETAIN MH; ELGER A; SAGNES P; PUIJALON S, 2002. Comparative life-history traits of two invasive macrophyte species, Elodea Canadensis Michaux and Elodea nuttallii (Planchon) H. St John. Aquat. Bot, 74:299-313;

BEST EPH; WOLTMAN H; JACOBS FHH, 1996. Sediment-related growth limitation of Elodea nuttallii as indicated by a fertilization experiment. Freshwater Biology, 36(1):33-44;

BLAGOJEVIC, M., KONSTANTINOVIC, B., SAMARDŽIC, N., KURJAKOV, A., ORLOVIC, S., 2015. Seed bank of *Amorpha fruticosa* L. on some ruderal sites in Serbia. Journal of Agricultural Science and Technology B, 5(2), 122-128. http://www.davidpublisher.org/Public/uploads/Contribute/55f22f7ab3e2c.pdf

BOLTACHEVA, N.A. 2008. Finding of new alien species *Streblospio gynobranchiata* Rice et Levin, 1998 (Polychaeta: Spionidae) in the Black Sea. Marine Ecological Journal. 7(4): 12. [in Russian].

BONDARENKO, O.S. 2011. Polychaete taxocene in the seaside estuary of Danube River. Marine Ecological Journal. 2, 11–16. [in Russian].

BORISOVA, E.V., YAKUSHENKO, D.N. 2015. The first find of *Chararudis* (A. Braun) Leonh. (Charales, Charophyta) in Ukraine. Algologia, 25(4): 439-444.

BOWMER KH; JACOBS SWL; SAINTY GR, 1995. Identification, biology and management of Elodea canadensis, Hydrocharitaceae. Journal of Aquatic Plant Management, 33:13-19;

BURDA, R. 2003. Alien trees and shrubs in the Ukrainian agricultural landscape. In: Phytogeographical problems of synanthropic plants, Eds. A. Zając, M. Zając, B. Zamanek. Cracow: In-t botany Jagiellonian un-t, pp. 11–16.

BURDA, R.I. 2018. Alien Plant Species in the agricultural habitats of Ukraine: diversity and risk assessment. Ekológia, 37(1): 24–31.

BURDA, R.I., PASHKEVICH, N.A., BOIKO, G.V., FITSAILO, T.V. 2015. Alien species of the protected flora of Forest Steppe of Ukraine. Kyiv: Naukova Dumka.

BOZIC D., SARIC-KRSMANOVIC M., PAVLOVIC D. & VRBNICANIN S. 2013 - Effect of nicosulfuron on plant traits of Xanthium strumarium. Journal of Plant Diseases and Protection, 120 (5/6), 233–237, 2013, ISSN 1861-3829.

CHRONICLE of nature of the Danube Biosphere Reserve. 2018. Volume 38, Vilkove, 231 p. (manuscript) [in Ukrainian]

CHRONICLE of nature of the Danube Biosphere Reserve. 2019. Volume 39, Vilkove, 224 p. (manuscript) [in Ukrainian]

CIUVAT, A.L., VASILE, D., DINU, C., APOSTOL, E., APOSTOL, B., PETRITAN, A.M. 2016. Posibilitati de valorificare a speciei invazive *Amorpha fruticosa* L. in Romania. Revista de Silvicultura si Cinegetica, 21(39): 96-99.

CSISZÁR, Á. 2009. Allelopathic effects of invasive woody plant species in Hungary. Acta Silvatica & Lignaria Hungarica, 5, 9-17.

CUZIC, M., MARINOV, M., CUZIC, V. 2003. American mink (*Mustela vison*) – a new mammal species of the DDBR territory. Analele Stiintifice INCDDD, 9: 52 – 54.

ÇINAR, M.E., ERGEN, Z., DAGLI, E., PETERSEN, M.E. 2005. Alien species of spionid polychaetes *(Streblospio gynobranchiata* and *Polydora cornuta)* in Izmir Bay, eastern Mediterranean. Journal of the Marine Biological Association of the United Kingdom, 85(4): 821-827.

COOK CDK; URMI-KÖNIG K, 1985. A revision of the genus Elodea (Hydrocharitaceae). Aquatic Botany, 21(2):111-156

DENDÈNE MA; ROLLAND T; TRÉMOLIÈRES M; CARBIENER R, 1993. Effect of ammonium ions on the net photosynthesis of three species of Elodea. Aquatic Botany, 46(3-4):301-315.

DEREVIANKO, V.M., LEVON, F.M. 2007. *Gledichia* in the South of Ukraine. NNTs IAE, Kyiv, 148 p.

DOGADINA, T.V., GROMAKOVA, A.B., GORBULIN, O.S. 2009. A new find of a representative of *Rhodophyta* from the r. Seversky Donets (Ukraine). Algologia, 19(3): 313-317.

DOROFTEI M., 2009(a) - Chorology of Amorpha fruticosa in Danube Delta, Romanian Journal of Plant Biology, Romanian Academy, Bucureşti.

DUBYNA, D.V., SHELYAH-SOSONKO, YU.R., ZHMUD, O.I., ZHMUD, M.YE., DVORETSKYI, T.V., DZYUBA, T.P., TYMOSHENKO, P.A. 2003. Danube Biosphere Reserve. Plant world, Kiev: Phytosotsiocenter, 448 pp.

ELANIDZE, R. 1983. Ichthyofauna of the rivers and lakes of Georgia. Tbilisi, Georgia: Metsniereba;

EREMENKO, T.I. 1980. Methods of studying marine phytobenthos. In: Guide to methods of biological analysis of bottom sediments. Hydrometizdat, Leningrad, P. 166-176.

European Commission. 2017. List of Invasive Alien Species of Union concern. Luxembourg: Publications Office of the European Union, 36 pp. https://ec.europa.eu/environment/nature/pdf/IAS_brochure_species.pdf

GAGIC, R., MIHAJLOVIC, R., GLAVENDEKIC, M. 2008. *Acanthoscelides pallidipennis* (Coleoptera: Bruchidae), a spermatophagous insect of indigo bush (*Amorpha fruticosa* L.) and its natural enemies in Serbia. Acta Herbologica, 17(2): 195-201.

GARBASEY, O.A., POPOVA, E.V., GUBANOVA, A.D., ALTUKHOV, D.A. (2016) First record of the occurrence of *Pseudodiaptomus marinus* (Copepoda: Calanoida: Pseudodiaptomidae) in the Black Sea (Sevastopol Bay). Mar. Biol. J., 1(4): 78-80.

Gleditsia prickly // Medicinal plants: Encyclopedic reference book / Ed.: A. M. Grodzinsky. - Kiev: Publishing House "Ukrainian Encyclopedia", Ukrainian production and commercial center "Olimp", 1992. - P. 111.

GREULICH, S. AND TRÉMOLIÈRES, M., 2006 - Present distribution of the genus Elodea in the Alsatian Upper Rhine floodplain (France) with a special focus on the expansion of Elodea nuttallii St. John during recent decades. Hydrobiologia 570:249-255;

GROZEVA, S., KUZNETSOVA, V.G., SIMOV, N., LANGOUROV, M., DALAKCHIEVA, S. 2013. Sex chromosome pre-reduction in male meiosis of *Lethocerus patruelis* (Stål, 1854) (Heteroptera, Belostomatidae) with some notes on the distribution of the species. In: Popov, A., Grozeva, S., Simov, N., Tasheva, E. (Eds.) Advances in Hemipterology. ZooKeys, 319: 119–135.

Flora of China Editorial Committee, 2010. Flora of China. St. Louis, Missouri and Cambridge, Massachusetts, USA: Missouri Botanical Garden Press and Harvard University Herbaria.http://www.efloras.org/flora_page.aspx?flora_id=2;

HICKMAN JC, 1993. The Jepson manual. Higher plants of California. The Jepson manual. Higher plants of California. University of California Press. http://ucjeps.berkeley.edu/interchange/I_treat_indexes.html;

HOLM LG, PLUCKNETT DL, PANCHO JV, HERBERGER JP, 1977. The World's Worst Weeds. Distribution and Biology. Honolulu, Hawaii, USA: University Press of Hawaii;

HUXLEY A., 1992 - The New RHS Dictionary of Gardening., MacMillan Press ISBN 0-333-47494-5;

IKUSIMA I, 1984. Aquatic macrophytes. In: Lake Biwa [ed. by Hiroe, S.]. Dordrecht: Dr. Junk Publishers, 303-311;

JHALA, Y.V.; MOEHLMAN, P.D. 2004. 6.2 Golden Jackal. In Sillero-Zubiri, Claudio; Hoffmann, Michael; Macdonald, David Whyte (eds.). Canids: Foxes, Wolves, Jackals, and Dogs: Status Survey and Conservation Action Plan. IUCN-The World Conservation Union. pp. 156–161.

JOLIVET, P., 1991 - Le doryphore menace l'Asie Leptinotarsa decemlineata. L'Entomologiste 47, 29-48;

JONES JI; EATON JW; HARDWICK K, 1993. Physiological plasticity in Elodea nuttallii (Planch.) St. John. Journal of Aquatic Plant Management, 31:88-94;

JULIEN MH, BROADBENT JE, MATTHEWS NC, 1979. Effects of Puccinia xanthii on Xanthium strumarium (Compositp). Entomophaga, 24(1):29-34;

KALUGINA-GUTNIK, A.A. 1969. Research of bottom vegetation with the use of light diving equipment. In: Marine underwater research. Science, Moscow, pp.14-18.

KARMYZOVA, L. 2014. Ecological study of invasive *Amorpha fruticosa* L. at research biological stations within Steppe zone, Ukraine. Journal of V.N. Karazin Kharkiv National University. Series: biology, 20(1100): 300-304.

KAUL V, 1965. Physiological-ecology of Xanthium strumarium L. II. Physiology of seeds in relation to its distribution. Journal of Indian Botanical Society, 44:365-380;

KAUL V, 1971. Physiological-ecology of Xanthium strumarium L. IV. Effect of climatic factors on growth and distribution. New Phytologist, 70:799-812;

KISS J.B., 1997 - Carteadeltei. EdituraFundaţia AVES, 221 p.+ 12 anexe.;

KISS J.B., REKASI J., STERBETZ I., 1976 - Date privindhrana de iarnă a fazanului (Phasianuscolchicus L.) înpădureaLetea. Silviculturaşiexploatareapădurilor. Bucureşti.;

KISS J.B., REKASI J., STERBETZ I., 1985 - Date noiprivindhranafazanului (Phasianuscolchicus L.) în Delta Dunării. Studiişicomunicări de ecologie, Bucureşti;

KIKODZE D; MEMIADZE N; KHARAZISHVILI D; MANVELIDZE Z; MUELLER H. 2010. The alien flora of Georgia. Second Edition;

KOMAKHIDZE A; MAZMANIDI N. 1998. ,,Black Sea Biological Diversity. Georgia". Black Sea Environmental Series Vol: 8 United Nations Publications. New York;

KONISHCHUK, V.V., KHODYN, O.B., SOLOMAKHA, I.V., KOVAL, S.I., MELNYK, N.M. 2019. Ecological impact of phytoinvasions in Ukraine. Proceed. III INt. Conf. "Smart Bio", Kaunas, Lithuania.journal, 69(1), 54-68 (in Ukrainian).

KOTTELAT, M., FREYHOF, J. 2007. Handbook of European freshwater fishes. Publications Kottelat, Cornol and Freyhof, Berlin, 646 pp.

KOZUHAROVA, E., MATKOWSKI, A., WOZACUTENIAK, D., SIMEONOVA, R., NAYCHOV, Z., MALAINER, C., MOCAN, A., NABAVI, S.M., ATANASOV, A.G. 2017. *Amorpha fruticosa* - a noxious invasive alien plant in Europe or a medicinal plant against metabolic disease?. Frontiers in Pharmacology, 8(June), 333. doi: 10.3389/fphar.2017.00333

LYASHENKO, A.V., SINITSINA, O.O., VOLOSHKEVICH, YE.V. 2005. Bottom Invertebrates as Alien Newcomers in Water Bodies of the Lower Reaches of the Danube. Hydrobiological Journal, 41(6): 56-65.

LOSOVSKA G.V., ZOLOTAREV V.N. 2003. Polychaete worm *Polydora limicola* in benthic communities of the Black Sea. Biologiya morya, 29: 281–283. [in Russian]

LOVE D & DANSERAU P, 1959. Biosystematic studies on Xan-thium: taxonomic appraisal and ecological traits. Can J Bot37, 173-209;

MARINOV, M., KISS, J., TOMAN, A., POLEDNIK, L., ALEXE, V., DOROFTEI, M., DOROȘENCU, A., KRANZ, A. (2012) Monitoring of European Mink (*Mustela lutreola*) In The Danube Delta Biosphere Reserve-Romania, 2003-2011. Current Status and setting of goals for the European Mink conservation. Scientific Annals of the Danube Delta Institute, 18, 69-74. https://www.alkawildlife.eu/media/emink-delta.pdf

MAZURENKO, M. AND A. KHOKHRYAKOV. 1972. Relative analysis of adventive naturalized plants of Colchis flora. Bulletin MOIP, Biology dept;

MEZHZHERIN, S.V., LASHKOVA, O.I. 2013. Mammals of Ukraine (Reference book). Naukova dumka, Kyiv, 356 p. [in Ukrainian]

MIHNEVA, V., STEFANOVA, K. 2013. The non-native copepod *Oithona davisae* (Ferrari F.D. and Orsi, 1984) in the Western Black Sea: seasonal and annual abundance variability. BioInvasions Records, 2: 119–124.

MINICHEVA, G.G. 1989. Indicators of the surface of algae in the structural and functional assessment of phytobenthos: Abstract. dis. . Cand. biol. Science, Sevastopol, 19 p.

MINICHEVA, G.G. 2015a. New Invader in the Black Sea: Kelp *Chorda tomentosa* Lyngb. International Journal on Algae. 17(3): 219-224

MINICHEVA, G. 2015b. Finding of alien brown macroalgae Chorda tomentosaLyngb. in the Ukrainian Black Sea coast. J. Black Sea / Mediterranean Environment. 21(2): 227-231.

MINICHEVA, G.G., EREMENKO, T.I. 1993. Algological findings in the northwestern part of the Black Sea. Algology, 3(4): 83-87.

Missouri Botanical Garden, 2009. Tropicos database. St Louis, USA: Missouri Botanical Garden. http://www.tropicos.org;

MOSKALENKO, G.P., YUDIN, B.I. 1999. Atlas of seeds and fruits of weeds found in regulated goods and materials. Moscow, Partnership of scientific publications KMK, 264 p

National Biodiversity Data Centre (2009). Species profile for Elodea nuttallii, Nuttall's Waterweed, Tímuiscechaol. Available online: http://species.biodiversityireland.ie/profile.php?taxonId=41365 [Accessed 17/01/2014];

NEWMAN JR, 2009. Information sheet 25: Elodea nuttallii, Nuttall's Pondweed. Information sheet 25: Elodea nuttallii, Nuttall's Pondweed. Centre for Ecology and Hydrology;

OZIMEK T; DONK EVAN; GULATI RD, 1993. Growth and nutrient uptake by two species of Elodea in experimental conditions and their role in nutrient accumulation in a macrophytedominated lake. Hydrobiologia, 251:13-18;

PALDAT, 2000. PalDat - a palynological database. https://www.paldat.org/

PANOV V.E., ALEXANDROV B., ARBACIAUSKAS K., BINIMELIS R., COPP G. H., GRABOWSKI M., LUCY F., LEUVEN R. S.E.W., NEHRING S., PAUNOVIC M., SEMENCHENKO V., SON M.O. 2009. Assessing the risks of aquatic species invasions via European inland waterways: from concepts to environmental indicators. Integrated Environmental Assessment and Management, 5(1): 110-126.

PANOV V.E., ALEXANDROV B., ARBACIAUSKAS K., BINIMELIS R., COPP G.H., GRABOWSKI M., LUCY F., LEUVEN R.S.E.W., NEHRING S., PAUNOVIĆ M., SEMENCHENKO V., SON M.O. 2010. Risk assessment of aquatic invasive species introductions via European inland waterways. Settele J. et al. (Eds), Atlas of Biodiversity Risk. Pensoft, Sofia, pp 140-143.

PASHKEVYCH, N., LYSOHOR, L, GUBAR, L. 2018. Alien species plant of information system of Ukraine (Asteraceae, Poaceae, Brassicaceae). Joint

ESENINIAS and DIDIAS Scientific Conference and 8th ESENIAS Workshop on Management and sharing of IAS data to support knowledge based decision making at regional level. Bucharest, pp. 97.

PASHKEVYCH, N., LYSOHOR, L, GUBAR, L., et al. 2018. Analysis of the floristic list of information system of alien plant species in Ukraine. In: XII International Conference on Synanthropization of Flora and Vegetation. Uzhhorod, p. 53.

PETROV, K.M. 1962. New methods of accounting for stocks of underwater vegetation. In: Proceedings of the All-Union. meeting. workers in the algae industry, Vol. 1. Arkhangelsk, P. 59-61.

POLISCHUK, L.N., NASTENKO, E.V. 2006. Meso- and macrozooplankton. In: Zaitsev YP, Aleksandrov BG, Minicheva GG (eds) North-western part of the Black sea: biology and ecology. Naukova Dumka, Kiev, 229 (in Russian)

PRESTON CD; CROFT JM, 1997. Aquatic plants in Britain and Ireland. Aquatic plants in Britain and Ireland., 365 pp;

PROKOPUK, M.S. 2018. Invasions of macrophytes in the Middle Dnipro Region. Dissertation for the candidate of biological sciences degree in speciality 03.00.16 – «Ecology». SI “Institute for volutionary ecology NAS Ukraine”, State Ecological Academy of Postgruate Education and Management, Kyiv.

PROTASOV, A.A., BABARIGA, S.P. 2009. On the distribution of *Craspedacusta sowerbii* (Cnidaria, Limnomedusa) in Ukraine. Vestnik Zoologii, 6: 543–545. [in Russian]

PROTOPOPOVA, V.V. 1973. Alien plants of Forest Steppe and Steppe of Ukraine (Ed. M.I. Kotov). Kyiv: Naukova Dumka.

PROTOPOPOVA, V.V. 1991. Synanthropic flora of Ukraine and trends of its development. Kyiv: Naukova Dumka.

PROTOPOPOVA, V.V., MOSYAKIN, S.L., SHEVERA, M.V. 2002. Phytoinvasions in Ukraine as a threat to biodiversity: current state and tasks for the future. Kyiv.

PROTOPOPOVA, V.V., MOSYAKIN, S.L., SHEVERA, M.V. 2002. Plant Invasions in Ukraine as a Threat to Biodiversity: The Present Situation and Tasks for the Future. M.G. Kholodny Institute of Botany, NAS of Ukraine, Kyiv, 1–32. [In Ukrainian]

PROTOPOPOVA, V.V., MOSYAKIN, S.L., SHEVERA, M.V. 2003. Influence of non-aboriginal plant species on the biota of Ukraine. In: Dudkin O. (Ed.). Assessment and directions of reduction of threats to biodiversity. Kyiv. Khimdgest.

PROTOPOPOVA, V.V., SHEVERA, M.V., MOSYAKIN, S.L. 2003. Impact of alien plant species on the phytobiota of Ukraine. In: Dudkin O. V. (Ed).

Assessment and Mitigation of Threats to Biodiversity. Khimdzhest, Kyiv, 129–155, 358, 364–374. [In Ukrainian]

PROTOPOPOVA, V.V., SHEVERA, M.V., MOSYAKIN, S.L. 2006. Deliberate and unintentional introduction of invasive weeds: a case study of the alien flora of Ukraine. Euphytica, 148(1/2), 17-33.

PROTOPOPOVA, V.V., SHEVERA, M.V., MOSYAKIN, S.L., SOLOMAKHA, V.A., SOLOMAKHA, T.D., VASYLYEVA, T.V., PETRYK, S.P. 2009. Invaziyni vydy u flori Pivnichnoho Prychornomor'ya. Phytosociocentre, Kyiv, 56 pp. [in Ukrainian]

RADASHEVSKY, V.I., SELIFONOVA, ZH.P. 2013. Records of *Polydora cornuta* and *Streblospio gynobranchiata* (Annelida, Spionidae) from the Black Sea. Medit. Mar. Sci., 14/2: 261-269.

RESHETNIKOV, A.N. & SCHLIEWEN, U.K., 2013 - First record of the invasive alien fish rotan *Perccottus glenii* Dybowski, 1877 (Odontobutidae) in the Upper Danube drainage (Bavaria, Germany). J. Appl. Ichthyol. 29: 1367-1369;

Robinia pseudoacacia // Medicinal plants: Encyclopedic reference book / Executive editor A. M. Grodzinsky. - Kiev: Publishing House "Ukrainian Encyclopedia", Ukrainian production and commercial center "Olimp", 1992. - P. 111.

ROZHENKO, N.V., VOLOKH, A.M. 1999. The common jackal (*Canis aureus* L., 1758) is a new species of mammals in Dniester delta. Biodiversity Conservation of the Dniester River Basin. Proceedings of the International Conference. Chisinau, October 7-9. Chisinau: BIOTICA Ecological Society, 196-198. [in Russian] https://www.eco-tiras.org/books/Dniester-99.pdf

SAVINI D, OCCHIPINTI-AMBROGI A, MARCHINI A, TRICARICO E, GHERARDI F, OLENIN S, GOLLASCH S, 2010. The top 27 animal alien species introduced into Europe for aquaculture and related activities. Journal of Applied Ichthyology [Alien species in aquaculture and fisheries. Proceedings of a conference Managing Alien Species for Sustainable Development of Aquaculture and Fisheries (MALIAF), University of Florence, Italy, 5-7 November 2008.], 26(s2):1-7. http://www.blackwell-synergy.com/loi/jai

SELIFONOVA, ZH.P., BARTSITS, L.M. 2018. First occurrence of the invasive alien species *Streblospio gynobranchiata* (Rice & Levin, 1998) and *Polydora cornuta* Bosc, 1802 (Polychaeta: Spionidae) on the coast of Abkhazia (Sukhum Bay, Black Sea). Ecologica Montenegrina 18: 129-132.

SHIGANOVA, T.A. 1998. Invasion of the Black Sea by the ctenophore *Mnemiopsis leidyi* and recent changes in pelagic community structure. Fish Oceanogr., 7: 305−310.

SHIGANOVA, T. A. BULGAKOVA, Y.V. 2000. Effect of gelatinous plankton on the Black and Azov Sea fish and their foodresources. ICES J. mar. Sci, 57, 641–648.

SHIGANOVA, T.A., BULGAKOVA, Y.V., SOROKIN, P.YU., LUKASHEV, YU.F. 2000. Investigations of new settler *Beroe ovata* in the Black Sea. Biol. Bull., 2, 247–255.

SHIGANOVA, T.A., DUMONT, H.J.D, MIKAELYAN, A.S, GLAZOV, D.M, BULGAKOVA, Y.V., MUSAEVA, E.I., SOROKIN, P.Y., PAUTOVA, L.A., MIRZOYAN, Z.A., STUDENIKINA, E.I. 2004. Interaction between the Invading Ctenophores *Mnemiopsis leidyi* (A. Agassiz) and *Beroe ovata* sensu Mayer 1912, and their Influence on the Pelagic Ecosystem of the Northeastern Black Sea. Eds. Dumont H, Shiganova TA, Niermann U. The Ctenophore Mnemiopsis leidyi in the Black, Caspian and Mediterranean Seas and other aquatic invasions. NATO ASI Series, 2. Environment. Kluwer Acad. Pub., pp. 33-70.

SHIGANOVA, TA, LEGENDRE, L, KAZMIN, AS, NIVAL, P. 2014. Interactions between invasive ctenophores in the Black Sea: assessment of control mechanisms based on long-term observations. Mar. Ecol. Prog. Ser., 507: 111-123.

SHIGANOVA, T.A., MIKAELYAN, A.S., MONCHEVA, S., STEFANOVA, K., CHASOVNIKOV, V.K., MOSHAROV, S.A., MOSHAROVA, I.N., SLABAKOVA, N., MAVRODIEVA, R., STEFANOVA, E., ZASKO, D.N., DZHUROVA, B. 2019. Effect of invasive ctenophores *Mnemiopsis leidyi* and Beroe ovata on low trophic webs of the Black Sea ecosystem. Marine Pollution Bulletin, 141: 434-447.

SIMPSON DA, 1990. Displacement of Elodea canadensis Michx by Elodea nuttallii (Planch.) H. St John in the British Isles. Watsonia, 18(2):173-177;

SLODOWICZ D, DESCOMBES P, KIKODZE D, BROENNIMANN O, MÜLLER-SCHÄRER H. 2018. Areas of high conservation value at risk by plant invaders in Georgia under climate change. Ecol Evol. 2018;

SOLOMAKHAM, V.A., KOSTYLIOVM, O.V., SHELIAG-SOSONKOM, YU.R. 1992. Synanthropic vegetation of Ukraine. Naukova Dumka, Kyiv.

SON, M. 2007 Invasive mollusks (Mollusca, Bivalvia, Gastropoda) in the Danube Delta. Vestnik Zoologii, 41(3): 213-218.

SON, M.O. 2009. Mollusks-invaders in the Ukraine territory: the sources and directions of invasion. Russian Journal of Biological Invasions, 37–48. [In Russian]

SON, M.O. 2010. Alien mollusks within the territory of Ukraine: Sources and directions of invasions, 37–44.

ST JOHN H, 1965. Monograph of the genus Elodea. Part 4: The species of the eastern and central North America. Rhodora, 67:1-35.

STOLLER EW, WAX LM, 1974. Dormancy changes and the fate of some annual weed seeds in the soil. Weed Science, 22(2):151-155;

SZIGETVÁRI, C. 2002. Initial steps in the regeneration of a floodplain meadow after a decade of dominance of an invasive transformer shrub, *Amorpha fruticosa* L. Tiscia, 33: 67-77.

ŞOFLETEA N., CURTU L., 2001 – Dendrologie vol. II – Corologia, ecologiaşiînsuşirilebiologice ale speciilor, EdituraPentruViaţă, Braşov, ISBN 973-99874-6-8, 300 p.;

SUTHERST, R.W., - 1991 - Pest risk analysis and the greenhouse effect. Review of Agricultural Entomology 79;

THALMANN D. J. K., KIKODZE D., KHUTSISHVILI M., KHARAZISHVILI D., GUISAN A., BROENNIMANN O., AND MÜLLERSCHÄRER H. (2014) Areas of high conservation value in Georgia: present and future threats by invasive alien plants. Biol. Invasions;

THIÉBAUT G; MULLER S, 1999. A macrophyte communities sequence as an indicator of eutrophication and acidification levels in weakly mineralisedstreams in north-eastern France. Hydrobiologia [Man and river systems. The functioning of river systems at the basin scale.], 410:17-24;

THIEBAUT G; ROLLAND T; ROBACH F; TREMOLIERES M; MULLER S, 1997. Some consequences of the introduction of two macrophyte species, Elodea canadensis Michaux and Elodea nuttallii St. John, in continental aquatic ecosystems: example of the Alsace plain and the northern Vosges (North-East France). Bulletin Français de la Pêche et de la Pisciculture, No. 344/345:441-452;

THIÉBAUT, G., 2005 - Does competition for phosphate supply explain the invasion pattern of Elodea species? Water Research 39:3385-3993;

USHATINSKAYA, R.S.; IVANCHIK, E.P., 1982 - Reversibility of ecologo-physiological adaptations in the Colorado beetle (Leptinotarsa decemlineata)]. ZoologicheskiiZhurnal 61, 358-363.

VADACHKORIA P; TREGUBOV A; MAKHARADZE G; MIKASHAVIDZE E; VARSHANIDZE M 2020. Distribution and Quantitative Characteristics of Four Invasive Alien Species of the Black Sea Coast of Georgia"Acta Zool. Bulg. 72 (4); *ESENIAS and DIAS Scientific Reports 4, http://www.acta-zoologica-bulgarica.eu/00SIO_1_08*

VARSHANIDZE M. GUCHMANIDZE A. 2004. Ecological role of benthic and pelagic invaders in benthic ecosystem, their biology and history of invasion.

International Workshop On Black Sea Benthos, 18–23 April 2004, Turkish marine research foundation. Istanbul-Turkey;

VENCILL WK, BANKS PA, 1994. Effects of tillage systems and weed management on weed populations in grain sorghum (Sorghum bicolor). Weed Science, 42(4):541-547;

VINOGRADOVA, Y.K. 2006. Formation of the secondary range and variability of invasive populations of ash-leaved maple (*Acer negundo* L.). Bull. Ch. bot. Garden, 190: 25–47.

VLASOVA, V.A., 1978 - Forecasting the area of distribution of the Colorado beetle in the Asiatic territory of the USSR. ZashchitaRastenii No. 6, pp. 44-45;

VOLOKH, A.M., ROZHENKO, N.V., LOBKOV, V.F. 1998. First record of the common jackal (*Canis aureus* L.) in the southwest of Ukraine. Nauchnyie Trudy Zool. Muz. of Odessa State University, 5: 187–188. [in Russian]

VOROBYOVA, L.V., KULAKOVA, I.I., SINEGUB, I.A., et al. 2017. Odessa region of the Black Sea: hydrobiology of pelagic and benthic areas. Odessa: Astroprint, 324 p. [in Russian].

WORNER SP, 1988. Ecoclimatic assessment of potential establishment of exotic pests. Journal of Economic Entomology, 81(4):973-983;

WEAVER SE, LECHOWICZ MJ, 1983. The biology of Canadian weeds. 56. Xanthium strumarium L. Canadian Journal of Plant Science, 63(1):211-225

YAKOVENKO, V.O., FEDONENKO, O.V. 2012. Invasion of jellyfish *Craspedacusta sowerbii* Lankester, 1880 in the Zaporozskoe reservoir. Problems of ecology end nature conservation of technogenic region, 1(12), 195-200 (in Russian).

YANOVYCH, L.M., PAMPURA, M.M. 2012. New find of *Sinanodonta woodiana* (Bivalvia, Unionidae) in the pool of Danube of Ukraine. Sci. Bull. Uzhgorod Univ. (Ser. Biol.), Vol. 32.

YOUNGMAN, P. 1982. Distribution and Systematics of the European Mink *Mustela lutreola* Linnaeus 1761. Acta Zoologica Fennica. 166. 1- 48.

ZAGORODNIUK, I. 2006. Adventive mammal fauna of Ukraine and a significance of invasions in historical changes of fauna and communities. Fauna in anthropogenic environments. Proceedings of Theriological School, 8: 18-47. [in Ukrainian] http://terioshkola.org.ua/library/pts8-synantr/pts8-13zag-(advent-mam).pdf

ZAITSEV, Y.P., ALEKSANDROV, B.G., MINICHEVA, G.G. 2006. North-Western part of the Black Sea: biology and ecology. Naukova Dumka, Kyiv, 701 pp. [in Russian]

ZAVIALOVA, L.V. 2016. About modern approaches to the investigation of plant invasions in protected areas of Ukraine. Dynamics of biological and

landscape diversity of Protected Areas. Ruta Publ., Kamianets-Podilskyi, 46–49. (In Ukrainian)]

ZAVIALOVA, L.V. 2017. The most harmful invasive plant species for native phytodiversity of protected areas of Ukraine. Scientific Herald of Chernivtsi University. Biology (Biological Systems), 9(1): 88–107. (In Ukrainian)]

ZHIVOGLYADOVA, L.A., REVKOV, N.K. 2018. Invasion of the Bivalve *Corbicula fluminea* (O. F. Müller, 1774) (Bivalvia: Cyrenidae) into the lower Don basin. Aquatic Bioresources & Environment, 1(1): 44–50.