IMPRECO

Common strategies and best practices to IMprove the transnational PRotection of ECOsystem integrity and services

Deliverable T1.2.1

Joint Monitoring Protocol for species, habitats, ES function and ESS

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Project acronym:	IMPRECO
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Project Number:	450

Partners responsible:	LP - Municipality of Staranzano, PP2 - Veneto Agricoltura – Veneto Region's Agency for the Innovation in the Primary Sector, PP3 - University of Salento – Department of Biological and Environmental Science and Technologies (DiSTeBA)
Editors:	Matteo De Luca, Jacopo Richard, Gabriele Marini, Maurizio Pinna

Table 1: Project Partners and contributors

Partner	Partner name	Abbreviation	Country	Contributors
LP	Municipality of Staranzano	Staranzano	ITALY	Matteo De Luca, Francesca Visintin, Massimiliano Pinat
PP2	Veneto Agricoltura – Veneto Region's Agency for the innovation in the primary sector	VA	ITALY	Jacopo Richard, Federico Vianello
PP3	University of Salento – Department of Biological and Environmental Science and Technologies (DiSTeBA)	UniSalento - DiSTeBA	ITALY	Maurizio Pinna, Gabriele Marini, Francesca Giannotta, Valeria Specchia
PP4	DOPPS-BirdLife Slovenia	DOPPS	SLOVENIA	Bojana Lipej, Borut Mozetic, Nataša Šalaja, Bia Rakar, Urša Koce
PP5	Public Institution for the Management of Protected Areas in the County of Split and Dalmatia "Sea and Karst"	PI Sea and Karst	CROATIA	Ante Žuljević, Jelena Kurtovic
PP6	Albanian Development Fund	ADF	ALBANIA	Mirlinda Spahaj, Stela Kruja, Abdulla Diku, Greta Gjoncaj
PP7	Region of Crete	CRETE	GREECE	Anna Kagiampaki, Eleni Hatziyanni

Pelecanus crispus **- First observation for the Isonzo Rivermouth Nature Reserve, target species for Shkodra Lake**

***Pinna nobilis* - First observation for the Aquatina di Frigole. Target species for Isonzo Rivermouth Nature Reserve and Aquatina di Frigole**

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Overview

The significance of the monitoring aimed at evaluating suitable quality indicators of the environment in which we live is universally recognized. To date, the use of bioindicators is widely applied in different fields of environmental assessments. For the purposes of this project, it seemed appropriate to identify a set of target species/habitats through a common approach, able to express the quality level of the ecosystems present in the PA and the related ecosystem services offered.
In order to assess the ES quality level a Joint Monitoring Protocol for species, habitats, ES functions and ESS has been developed. A common methodological approach has been used to find out some target species, habitats or biocenosis representative of each PA. The Biodiversity Monitoring Protocol developed in the AdriaWet2000 pj has been capitalized to take advantage of the previous CBC experience.
The protocol defines some common criteria for choosing species (Fig.1); those criteria have to be adopted by each PP to find a list of target species/habitats or bioceonsis linked with the project objective and useful as indicators of ES and ESS quality. Starting from the **Inventory and mapping of species, habitats, ecosystems, ecosystem services** (Deliverable T1.1.1) each partner define some target following the common criteria. All the data are collected in an excel file (Annex I).

Those common criteria **to find** target species are the following:

- Conservation value (column C, D, E) - Species or habitats included in European directives, International red lists, national, regional;
- Other choise criteria (column F) - Species or habitats useful to reapply the aims of the project;
- Presence of direct or indirect pressures (column G, H);
- Linkage with project actions and objectives(column I, J, K, L);

	Common criteria for choosing species or habitats									
	Conservation			*Other criteria*	*Pressures*		*Connection with project actions*			
Specie / Habitat/ from baseline db	Annex Habitat/ Birds directive	Red List Iucn	Red List Nationale/Regional	Ex. Importance for the site, easiness to monitoring for citizens....	Direct	Indirect	Ecosystem relationship	Benefit from Pilot Action	Indicator as Es quality	Indicator as ESS quality
					direct pressures on habitat or sp	*indirect pressures on habitat or sp*	*Linkage with ecosystem (following the classification adopted in*	*Benefit for habitat or sp. from Pilot Actions*	*1 to 5 (1 low - 5 high)*	*1 to 5 (1 low - 5 high)*
11.33 - Mediterraneo-Pontic Cymodocea and Zostera beds	I hd			General conservation status of the habitat	anchorage and damage from propellers of recreational boating		marine	manintenance of a good contervation status	5	4
Pinna nobilis	IV hd			General conservation status of the species	anchorage of recreational boating, unauthorized collection		marine	increas of the population	4	2

Figure 1: Example of common criteria used for choosing 11.33 Habitat and *Pinna nobilis* species.

In the same way, a **Common approach** has been used to define the way **to monitoring** species, habitats or biocenosis (Fig. 2). Starting from some status indicators, representing the situation and the conservation status of chosen species or habitats before the project actions, two different kinds of monitoring activities are planned.

1 - A standard monitoring protocol on target species or habitats will be carry out by technicians or professionals, following international or national recognized methodologies. For each species or habitat the procedure, sampling effort and techniques, descriptors and indicators are reported.

2 – A simplified monitoring protocol on some of the target species or habitat will be separately developed as deliverable (T1.2.2). This Monitoring protocol will be based on species presence/absence criteria and supplied to volunteers for their involvement in data collection and, in a more wide view, in conservation topics. The simplified monitoring protocols could also allow to obtain some particular informations on the selected species (i.e.: presence of juveniles and egg-laying areas in reptiles). In every case the data provided from volunteers have to be correct and useful.

In the following figure the common approach to monitoring is highlighted.

	Status and monitoring			
	Status indicators		***Monitoring methods***	
Specie / Habitat/ from baseline db	Number/Hectares ante Pilot	Conservation Status ante Pilot	Standard metodologyfor professional (sheet2)	Semplified monitoring protocol for citizens (Sheet 3)
	Status Indicators (ex surface,	*Conservation status indicators (ex*	*Official standrad monitoring methodology (see Sheet2)*	*Semplified monitoring methodology to*
11.33 - Mediterraneo-Pontic Cymodocea and Zostera beds	667 ha	good	Fotointerpretation and vegetetional releves (Ispra 2016)	Yes Sheet 3
Pinna nobilis	distribution on 4 of 1km x 1 km mesh of etrs grid	medium	Line transect (Ispra 2016)	Yes Sheet 3

Figure 2: Common approach for monitoring target species and habitats.

Monitoring results post pilot and post project are then expected (column Q, R; Fig. 3).

	Post Project results	
	Expected results	
Specie / Habitat/ from baseline db	Number/Hectares post Pilot	Conservation Status post Pilot
11.33 - Mediterraneo-Pontic Cymodocea and Zostera beds	667 ha	good
Pinna nobilis	distribution on 5 of 1km x 1 km mesh of etrs grid	good

Figure 3: Expected results.

Finally a common approach to collect data resulting from the join monitoring protocol has been adopted by using a geodatabase .This geodatabase derives from that realized within the project AdriaWet 2000 and is structured as follows:

point	transect	species/habitat	number	indicator	presence	year	month	day	grid ETRS	coord E	coord N	zone	observer	reliability	notes	sensitive data	data inserted by	date of entry
code of point or n.d	*code of transect or n.d*	*name of the species/habitat*		*ex: individuals, males, eggs etc. for species ; hectares for habitats*	*presence/absence when numbers are not available*				*1km*1km grid Etrs Laea*			*Zone ofo protected area or n.d*		*Quality of data (high, medium, low)*		*sensitive data yes/no*		
FI_avi_ge_1		Actitis hypoleucos	1	individuals	true	2017	1	5	E4593N2523			B1	Silvano Candotto	high		false	Irene Ceschia	23/02/2017

Target Species, habitats and biocenosis

With the Join Protocol described in the previous section, the PPs have chosen 54 different target habitats, biocenosis or species, because of a local contextualization, belonging at different taxonomic groups (as shown in table 1 and figure 4).

Table 1: Habitats, biocenosis and species chosen by the PPs.

Target		
Group	*Number*	*%*
Habitats	5	9,3
Biocenosis	1	1,9
Plants	7	13,0
Invertebrates	8	14,8
Fishes	3	5,6
Amphibians	5	9,3
Reptiles	4	7,4
Birds	19	35,2
Mammals	2	3,7

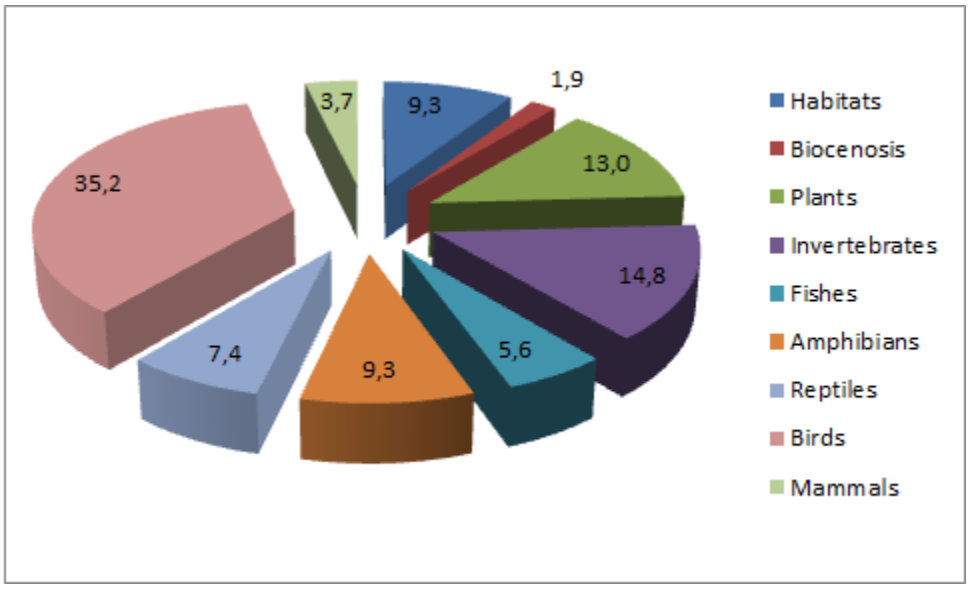


Figure 4: Partitioning of different Habitas, biocenosis and species (percentage) chosen by the PPs.

The tables 2 to 10 show the different habitats, biocenosis, plant or animal target species.

Table 2: Habitats chosen by the PPs

11.33 - Mediterraneo-Pontic Cymodocea and Zostera beds - 1110 Sandbanks which are slightly covered by sea water all the time
9370 - Palm groves of Phoenix*
1170, Reefs
**1120, Posidonia beds (Posidonion oceanicae)*
2130 - Fixed coastal dunes with herbaceous vegetation (grey dunes)*

All the chosen habitats are related to marine or coastal ecosystems

Table 3: biocenosis chosen by the PPs.

Benthic macroinvertebrate biocenosis

The idea of using biocenosis as an indicator at the experiment level will be put into practice by the PP3.

Table 4: plant species chosen by the PPs.

Centaurea aegialophila Wagenitz, 1974
Anacamptis piramidalis (Linnaeus) Richard, 1817
Campanula pelviformis Lamarck, 1785
Trapa natans Linnaeus, 1753
Nuphar lutea Smith, 1809
Nymphaea alba Linnaeus, 1753
Nymphoides peltata (S.G. Gmelin) Kuntze, 1891

The identified plant species are essentially linked to terrestrial or freshwater ecosystems.

Table 5: Invertebrate species chosen by the PPs.

Callinectes sapidus Rathbun, 1896
Ophidiaster ophidianus (Lamarck, 1816)
Centrostephanus longispinus (Philippi, 1845)
Luria lurida (Linnaeus, 1758)
Charonia tritonis (Linnaeus, 1758)
Pinna nobilis Linnaeus, 1758
Vertigo angustior Jeffreys, 1830
Tyria jacobaea (Linnaeus, 1758)

As far as invertebrates are concerned, most of the species chosen are typical of marine ecosystems; *Pinna nobilis* has been chosen by 3 different PAs.

Table 6: Fish species chosen by the PPs.

Aphanius fasciatus Valenciennes, 1821
Hippocampus guttulatus (=*Hippocampus ramulosus*) Cuvier, 1829
Acipenser sturio Linnaeus, 1758

Among the fish were chosen marine or eurialines species.

Table 7: Amphibian species chosen by the PPs.

Pelophylax cretensis Beerli, Hotz, Tunner, Heppich and Uzzell, 1994
Lissotriton vulgaris Linnaeus, 1758
Hyla arborea (Linnaeus, 1758)
Pelobates fuscus (Laurenti, 1768)
Pelophylax shqipericus (Hotz, Uzzell, Günther, Tunner & Heppich, 1987)

Five species of amphibians were chosen by two PAs.

Table 8: Reptile species chosen by the PPs.

Caretta caretta (Linnaeus, 1758)
Emys orbicularis (Linnaeus, 1758)
Podarcis siculus Rafinesque, 1810
Testudo hermanni Gmelin, 1789

Among the reptiles there are purely marine species, species related to fresh or transitional waters, and species related to coastal dune systems.

Table 9: Bird species chosen by the PPs.

Larus melanocephalus Temminck, 1820
Sterna sandvicensis Latham, 1787
Phalaocrocorax aristotelis desmarestii (Payraudeau, 1826)
Pluvialis squatarola (Linnaeus, 1758)
Numenius arquata (Linnaeus, 1758)
Calidris alpina (Linnaeus, 1758)
Gavia arctica (Linnaeus, 1758)
Gavia stellata (Pontoppidan, 1763)
Anthus campestris (Linnaeus, 1758)
Falco eleonorae Gene, 1839
Sylvia ruppeli Temminck, 1823
Sterna hirundo Linnaeus, 1758
Ixobrychus minutus Linnaeus, 1766
Rallus aquaticus Linnaeus, 1758
Himantopus himantopus (Linnaeus, 1758)
Aix galericulata (Linnaeus, 1758)
Pelecanus crispus Bruch, 1832
Marmaronetta angustirostris (Ménétriés, 1832)
Charadrius alexandrinus Linnaeus, 1758

The group of birds is the one with most of the identified terget species; most of them are related to aquatic environments, mainly marine.

Table 10: mammal species chosen by the PPs.

Meles meles (Linnaeus, 1758)
Lutra lutra (Linnaeus, 1758)

Only two target species were chosen among mammals.

Monitoring protocols

The monitoring activities relating to each project area are shown below. Starting from the scientifically recognized monitoring standards, field activities were planned by the PAs in relation to local needs and project objectives.

Isonzo Rivermouth Nature Reserve (LP)

The selected target habitat and species and the related monitoring methods for Isonzo Rivermouth Nature Reserve are listed in table 11.

Table 11: Habitats, species and related monitoring methods chosen by LP.

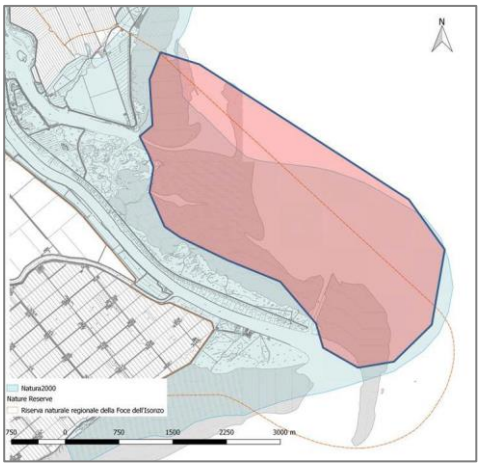
Habitat/species	Monitoring methods
11.33 –Mediterraneo-Pontic Cymodocea and Zostera beds	Fotointerpretation and vegetational releves
Pinna nobilis	Line transect
Larus melanocephalus	Point or line transect
Phalaocrocorax aristotelis desmarestii	Point or line transect
Sterna sandvicensis	Point or line transect
Pluvialis squatarola	Roost count
Numenius arquata	Roost count
Calidris alpina	Roost count
Gavia arctica	Point or line transect
Gavia stellata	Point or line transect
Aphanius fasciatus	Line transect netting

The monitoring protocols that will be used in Isonzo Rivermouth RN are the subsequent:

11.33 – Mediterraneo – Pontic Cymodocea and Zostera beds (included in 1110 Sandbanks which are slightly covered by sea water all the time Natura 2000 Habitat)

The monitoring activities will be conducted in the marine area on the East side of the protected area in the period between May and July. The mapping of the coverage will be done by fotointerpretation of images taken with Drone and then by control vegetetional releves in the field (two field activities).

Monitoring Area



Expected Result: Updated Digital Map.

Pinna nobilis

Monitoring will be carried out through visual census in apnea in three sites Within the sites chosen for monitoring, 3 transects (5 stations) of 100 m each will be performed. to determine the density of the individuals and to monitor the individual vitality and size according to the protocol proposed by García-March and Vicente (2006). In situ, for all recorded animals, the unburied length (UL), maximum width (W) and minimum width (w) will be measured with a measuring-tape and gape orientation (Or) will be measured by a compass (Figure 5). Besides, Ht can be estimated by applying specific mathematical models (Garcia-March and Vicente 2006).The montoring activites will be conducted in the protected area in the period between May and July.

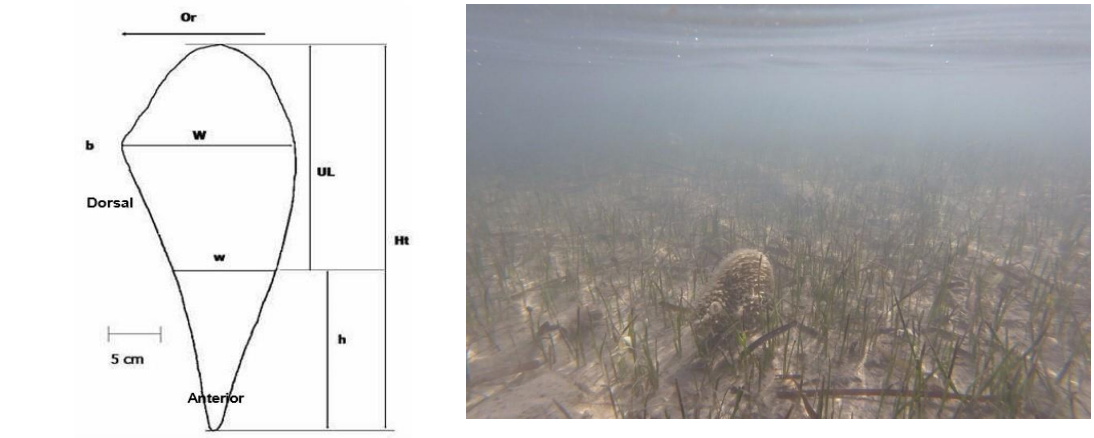
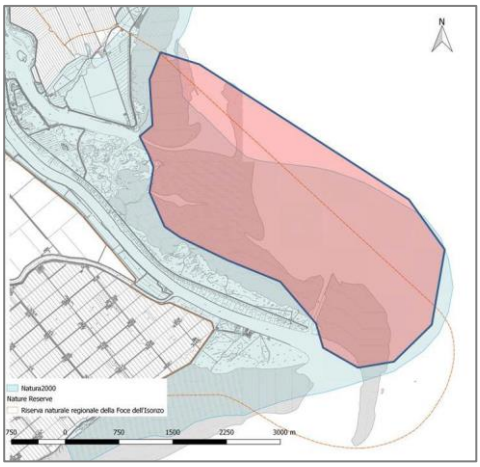


Figure 5 – No destructive biometries on *Pinna nobilis*

Monitoring Area

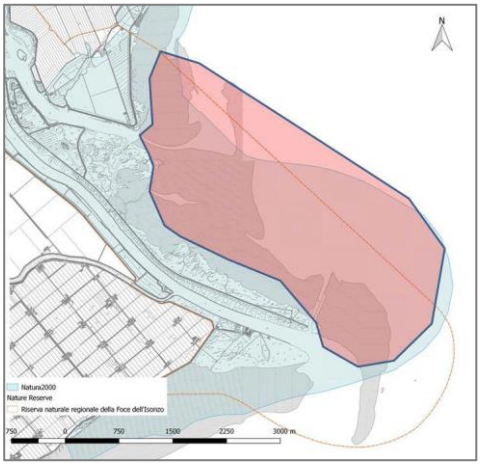


Expected Result: Distribution map and Density data.

Larus melanocephalus, Sterna sandvicensis, Phalacrocorax aristotelis desmarestii, Gavia arctica Gavia stellata

The monitoring activities for the census of those birds will be conducted in the marine area on the East side of the protected area. Line transect with the boat (following Bibby et al., 2000) will be conducted every month throughout all the year. Numbers of individuals of each species will be counted and georeferenced.

Monitoring Area

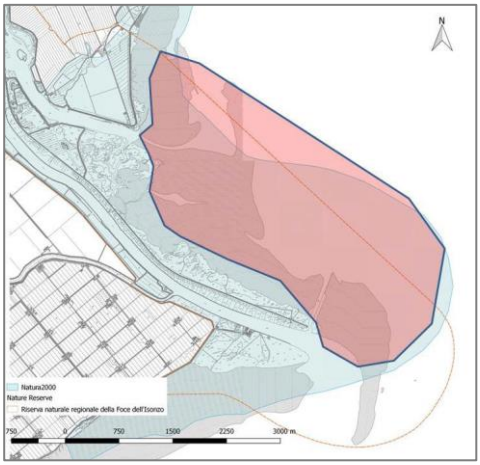


Expected Result: Distribution map and Density data.

Pluvialis squatarola, Numenius arquata, Calidris alpina

The monitoring activities for the census of those birds will be conducted in the marine area on the East side of the protected area. Roost counts during high tide (following Bibby et al., 2000) will be conducted every month throughout all the year. Numbers of individuals of each species will be counted and georeferenced.

Monitoring Area

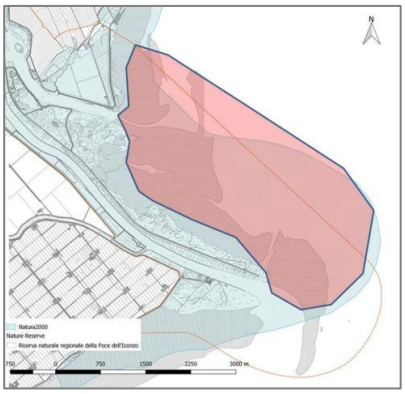


Expected Result: Distribution map and Density data.

Aphanius fasciatus

The monitoring activities for the census of this fish will be conducted in the marine area on the East side of the protected area. A 12 m seine with 2mm mesh will be used for monitoring the presence of the species in 5 different sampling sites. The monitoring activities will be conducted in the period between May and September. Numbers of individuals will be counted and georeferenced.

Monitoring Area



Expected Result: Distribution map and Density data.

Bosco Nordio Nature Reserve (PP2)

The selected target habitat and species and the related monitoring methods for Bosco Nordio are listed in table 12.

Table 12: Habitats, species and related monitoring methods chosen by PP2

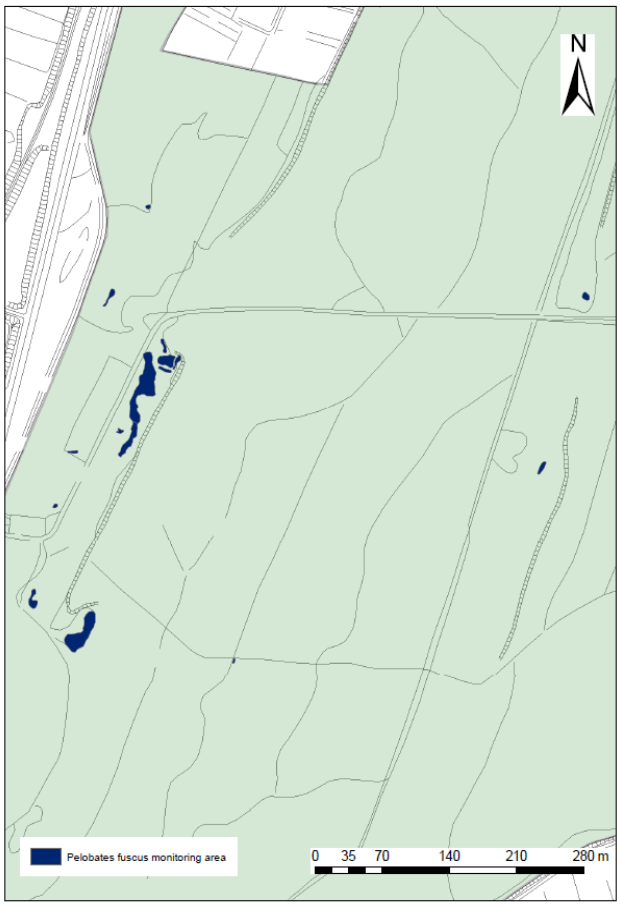
Habitat/Species	Monitoring methods
2130* - Fixed coastal dunes with herbaceous vegetation (grey dunes)	Fotointerpretation and vegetational releves (Angelini, Casella, Grignetti, Genovesi, 2016)
Pelobates fuscus	Vocalizations hearing and eggs masses searching (Angelini, Casella, Grignetti, Genovesi, 2016)
Testudo hermanni	Active searching on standard polygon areas (Angelini, Casella, Grignetti, Genovesi, 2016)
Meles meles	Camera trapping (Rovero & Zimmermann, 2016)

The monitoring protocols that will be used in Bosco Nordio are the subsequent:

Pelobates fuscus

The method consists in the detection of calling males in all the ponds of the Reserve, using a hydrophone, during the night. 3 repetitions per year will be done, on a weekly basis. Listening must last 5 minutes, in several points of the pond, located about 10-20 meters from each other. will be considered the minimum number of males certainly recognizable individually in every pond.

Monitoring area

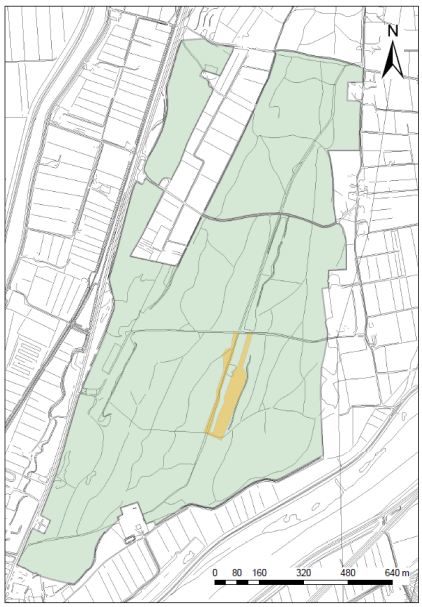


Expected Result: Distribution map and Density data.

Testudo hermanni

The method involves the active search (visual census) of the species in a sample area, which will be explored along a transept, exploring the surrounding space for a width of 3-5 meters. The census will be repeated four times each year, in April and May. The animals contacted will be measured by dividing them into three dimensional classes (newborns (<5 cm), young (5-12 cm) and adults (> 12 cm)), determining sex when possible, and marked them according to modality of STUBB et al. (1984), or dectecting the marking of the individuals previously marked.

Monitoring Area

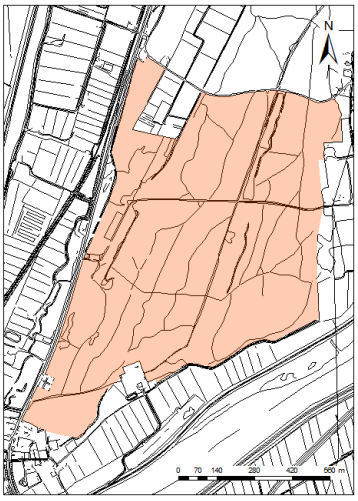


Expected Result: Distribution map and Density data.

Meles meles

The method involves the use of infrared camera traps that will be positioned at constant distances within a grid of quadrants. The camera traps will be checked every two or three weeks, replacing SD cards and batteries.

Monitoring Area



Expected Result: presence/absence in different quadrant, activity patterns and the minimum number of individuals present.

Aquatina di Frigole (PP3)

The selected target species and the related monitoring methods for Aquatina di Frigole are listed in table 13.

Table 133: Species, biocenosis and related monitoring methods chosen by PP3

Pinna nobilis	Line transect (Ispra 2016) and Biometry (Marrocco et al., 2018)
Benthic macroinvertebrate biocenosis	Box-corer
Callinectes sapidus	Traps/Nets

The monitoring protocols that will be used in Aquatina di Frigole are subsequently reported:

Pinna nobilis

Pinna nobilis (Linnaeus, 1758), the largest and endemic bivalve of the Mediterranean sea, has been listed as an endangered species as a result of collection by divers and incidental killing by trawling and anchoring (Basso et al., 2015). Consequently this fan mussel is nowadays under protection, according to the Habitats Directive (European Council Directive 92/43/EEC). Monitoring will be carried out through visual census in apnea in three sites Within the sites chosen for monitoring, 3 transects (5 stations) of 100 m each will be performed. to determine the density of the individuals and to monitor the individual vitality and size according to the protocol proposed by García-March and Vicente (2006). In situ, for all recorded animals, the unburied length (UL), maximum width (W) and minimum width (w) will be measured with a measuring-tape and gape orientation (Or) will be measured by a compass (Figure 6). Besides, Ht can be estimated by applying specific mathematical models (Garcia-March and Vicente 2006).The montoring activites will be conducted in the protected area in the period between May and July.

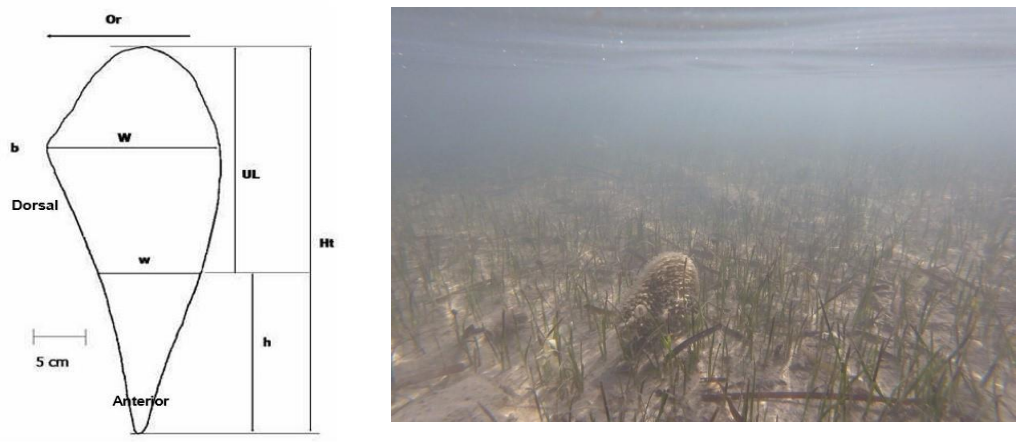


Figure 6 – No destructive biometries on *Pinna nobilis*

Monitoring Area:

At least 3 transects. All the suitable environments for *P. nobilis* will be investigated.

Expected Result: Distribution map, Density data, Population size structure and population dynamics.

References

- Basso L., Vazquez-Luis M., Garcia-March J.R., Deudero S., Alvarez E., Vicente N., Duarte C.M., Hendriks E. (2015). The pen shell, *Pinna nobilis*: a review of population status and recommended research priorities in the Mediterranean Sea. *Advances in Marine Biology*, 71: 109-160.
- García-March J.R., Vicente N. (2006). Protocol to study and monitor *Pinna nobilis* populations within marine protected areas. MedPAN-Interreg IIIC-project. *Malta Environment and Planning Authority* (MEPA), 78 pp.
- Marrocco V., Sicuro A., Zangaro F., Pinna M., 2018. First record of the protected species *Pinna nobilis* (Linnaeus, 1758) in the Aquatina Lagoon (NATURA 2000 site IT9150003, South-East Italian coastline). *Nature Conservation*, 28: 51-59.

Benthic macroinvertebrate biocenosis

Benthic macroinvertebrates are small organisms visible to the naked eye, with linear dimension more than one millimeter living in sediments or at the water-sediment interface. Benthic macroinvertebrates are considered suitable bioindicators (Rosenberg and Resh, 1993), responding to environmental or anthropogenic pressures by changing in abundance, taxonomic richness and composition, biomass, body-size and biological traits (Pinna et al., 2013). Therefore the assessment of the macroinvertebrate asseblages (biocenosis) allows to give an evaluation of the ecological quality of the water bodies. For these reasons, ecological indicators based on macroinvertebrates, such as AMBI, M-AMBI, BENTIX, BITS, BO2A, STAR-ICMI, are largely used in biomonitoring plans of aquatic ecosystems (Borja et al., 2000; Muxika et al., 2007) in accordance to the Water Framework Directive (WFD 2000/60 EC).
Monitoring will be carried out in six sampling sites with a box-corer (0.03 m^2) and sieved through a 1.0 mm mesh size sieve (®Retsch GmbH, Germany, 40 cm Ø; DIN ISO 3310/1) to remove the fine sediment and mud. Sampling will be performed to determine the species diversity, richness and ecological indicators. The montoring activites will be conducted in the protected area in the period between May and July. Macroinvertebrates will be identified to species level using published taxonomic keys to determine the species diversity, richness and density. The length of each specimen will be measured under a stereomicroscope (Leica MZ 12.5) using an image analysis system (Leica QWin). The dry specimens in a stove at 60 °C for 72 h, will be weighed using a microbalance (Sartorius MC21S) and combusted in a muffle furnace for 6 h at 500 °C (Pinna and Basset, 2004; Sangiorgio et al., 2004; Vignes et al., 2012). The ash content will be estimated and the individual biomass recorded as ash free dry weight (AFDW). The ecological indicators AMBI, M- AMBI and BITS will be measured and compared between sites. The innovative DNA-barcode methods will be also used for biodiversity investigations.

Monitoring Area:

Six sampling sites within the protected area

Expected Result: Macroinvertebrate composition, richness and ecological indicators.

References

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- Muxika, I., Borja, A., Bald, J., 2007. Using historical data, expert judgment and multi- variate analysis in assessing reference conditions and benthic ecological status, ac- cording to the European Water Framework Directive. *Mar. Pollut. Bull*. 55, 16–29. Pinna, M., Marini, G., Rosati, I., Neto, J.M., Patrício, J., Marques, J.C., Basset, A., 2013. The usefulness of large body-size macroinvertebrates in the rapid ecological assess- ment of Mediterranean lagoons. *Ecol. Indic*. 29, 48–61.
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Callinectes sapidus

The blue crab, originating from western Atlantic, has extended its distribution in much Mediterranean including most European coastal waters; transport in ballast water is considered the most probable vector (Nehring, 2011). In the Mediterranean, Callinectes sapidus was first recorded in the Northern Adriatic Sea (Giordani Soika, 1951); to date, it results almost ubiquitous (Galil, 2011) and is considered an IAS (Streftaris and Zenetos, 2006). The tolerance to extreme variations in water conditions (the species is euryhaline and eurythermal, inhabiting estuaries and lagoons from Argentina to Nova Scotia: McMillen-Jackson and Bert, 2004), high fecundity (females produce 2 to 8 million eggs per spawn: Jivoff et al., 2007), large body size (individuals may attain a maximum carapace width of 225 mm and a wet weight of 550 g: Millikin and Williams, 1984) coupled with aggressive behaviour (Reichmuth et al., 2011), are considered key ecological and biological determinants of its invasion success (Nehring, 2011).Monitoring will be carried out in six sampling sites in two periods between May and July in the protected area. Traps (60 x 60 x 60) and nets sampling will be performed to

determine the species diversity, richness and sex ratio. Biometric measurement will be measured on each specimen as (CL, Carapace length, is the distance between the center of the anterior interorbitalmargin and the center of the posterior margin; CW, Carapace width, is the widest point behind theposterior anterolateral spine; WT, Body weight)

Monitoring Area:

Six sampling sites within the protected area

Expected Result: Macroinvertebrate composition and richness.

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Skocianski Zatok Nature Reserve (PP4)

The selected target species and the related monitoring methods for Skocianski Zatok Nature Reserve are listed in table14.

Table 14: Species and related monitoring methods chosen by PP4.

Species	Monitoring methods
Vertigo angustior	Active searching on standard polygon areas and on suitable habitats
Sterna hirundo	Special nest monitoring, regular weekly bird monitoring, cartographic inventory of nesting birds
Emys orbicularis	Active searching on standard polygon areas
Lissotriton vulgaris	Active searching on standard polygon areas
Tyria jacobaea	Active searching of host plant, larvae and imago on standard polygon areas and transect monitoring
Ixobrychus minutus	Acoustic monitoring, regular weekly bird monitoring, cartographic inventory of nesting birds
Rallus aquaticus	Acoustic monitoring, regular weekly bird monitoring, cartographic inventory of nesting birds
Himantopus himantopus	Special nest monitoring, regular weekly bird monitoring, cartographic inventory of nesting birds
Podarcis siculus	Active searching on standard polygon areas
Hyla arborea	Active searching on standard polygon areas

The monitoring protocols that will be used in Škocjanski zatok Nature Reserve are the subsequent.

Vertigo angustior

The monitoring activities for the census of this invertebrate will be conducted in the freshwater part of the nature reserve - the freshwater marsh in Bertoška bonifika. Once per month, in May and June, active searching on standard polygon areas and on suitable CORINE (macro)habitats (following Slapnik, 2009) will be conducted with help of external expert(s) (following Slapnik, 2009, Oekland, 1929). The searching consist of sampling separation of snails from the litter and soil picked in randomly selected areas limited by squares 20 x 20 or 25 x 25 cm. Sampling surface: 1-4 m^2. Sifting the soil (sieve with 4 mm opening size). Numbers of live and death (snail houses) snails will be counted and georeferenced.

Monitoring area

Expected Result: Distribution map and Density data.

Sterna hirundo, Himantopus himantopus

The monitoring activities for the census of those two migratory birds will be conducted from April till August in the whole Nature Reserve area (freshwater part and coastal/brachis lagoon) during regular weekly bird monitoring and limited to the area of the coastal/brachis lagoon for cartographic inventory of nesting birds and special nest/chicks monitoring. From April till June 4 cartographic inventories of nesting birds will be conduced (1 in April, 2 in May and 1 in June) in the coastal lagoon/brachis part of the Nature Reserve and 4-5 special nest monitoring with canoe from May till the end of July: in May and June the nests will be counted and georeferenced, in June and July the chicks will be counted, georeferenced and ringed with uniquely coded color ring in combination with uniquely coded metal ring (following Mozetič, B. & Denac, K., 2012).

Monitoring area for regular weekly bird monitoring

Expected Result: Distribution map and Density data.

Monitoring area for *Sterna hirundo* (cartographic inventory of nesting birds and special monitoring of nests, chicks ringing)

Expected Result: Distribution map and Density data.

Monitoring area for *Himantopus himantopus* (cartographic inventory of nesting birds and special monitoring of nests, chicks ringing):

Expected Result: Distribution map and Density data.

Ixobrychus minutes, Rallus aquaticus

The monitoring activities for the census of those two bird species will be conducted from April (*Rallus aquaticus*) and from May (*Ixobrychus minutus*) till September in the whole Nature Reserve area (freshwater part and borders of coastal/brachis lagoon) during regular weekly bird monitoring and limited to the freshwater areas (Bertoški bonifika, Jezerce "the little lake", Ara, reed bed triangle) for cartographic inventory of nesting birds and acoustic monitoring. From April till June 4 cartographic inventories of nesting birds will be conduced (1 in April, 2 in May and 1 in June for *Rallus aquaticus* and 1 in May and 2 in June for *Ixobrychus minutus*) in the freshwater areas of the Nature Reserve and 1 acoustic monitoring per month from April (May for *Ixobrychus minutus*) till July (following Mozetič, B. & Denac, K., 2012).

Monitoring area for regular weekly bird monitoring

Expected Result: Distribution map and Density data.

Monitoring area with playback points for acoustic monitoring of *Ixobrychus minutus* and *Rallus aquaticus*:

Expected Result: Distribution map and Density data.

Emys orbicularis

The monitoring activities for the census of this reptile specie will be conducted from March till September (once per month) in some selected polygons of the freshwater area of the Nature Reserve. Active visual search methodology (Blomberg and Shine, 2006) and the method of capture/catch live individuals with pots (traps) will be used. On captured/caught individuals morphometric characteristics will be measured, their age will be defined and they will be marked. Numbers of individuals will be counted and georeferenced (following Torkar,G. & Ferjan, K., 2013). Random observations data will be collected.

Monitoring area

Expected Result: Distribution map and Density data.

Hyla arborea, Lissotriton vulgaris

The monitoring activities for the census of this two amphibian species will be conducted once per month from March till September on selected polygons of the freshwater areas/sites of the Nature Reserve. The method involves the active search (visual census) of the species in a sample area. Numbers of individuals will be counted and georeferenced (following Paul Veenvliet & Jana Kus Veenvliet, 2014). Random observations data for both species will be collected.
At least one acoustic monitoring for *Hyla arborea* will be conduced. To receive information about breeding success and quality of aquatic habitat for successful reproduction of *Lissotriton vulgaris* the method of dip netting for newt larvae will be done at least once. The larvae will be caught, counted and georeferenced.

Monitoring area

Expected Result: Distribution map and Density data.

Podarcis siculus

The monitoring activities for the census of this reptile will be conducted from April till September (once or twice per month) on the visitor trail. The method involves the active search (visual census) of

the species in a sample area – the visitor trail. Numbers of individuals will be counted and georeferenced (following Paul Veenvliet & Jana Kus Veenvliet, 2014).

Monitoring area

Expected Result: Distribution map and Density data.

Tyria jacobaea

The monitoring activities for the census of this invertebrate specie will be conducted from May till August/September, twice per month with transect monitoring (following Verovnik 2007) on 5-7 transects. In the freshwater area (Bertoška bonifika) and on embankments an inventory of host plant - Ragwort *Senecio jacobaea* will be conducted/done in July during flowering. Later on the larvae/caterpillars will be monitored on the plants, at least once per month in July and August. Numbers of individuals (larvae and adult moths) will be counted and georeferenced.

Transect monitoring – 7 transects

Expected Result: Distribution map and Density data.

Monitoring area for *Tyria jacobaea* (larvae/caterpillars) and hostplant *Senecio jacobaea*

Expected Result: Hostplant distribution map and Density data.

Pakleni otoci Islands (PP5)

In the area of Pakleni Islands, monitoring will be conducted on two habitat shown in Table 15.

Table 14 Habitats and related monitoring methods chosen by PP5.

Habitat/species	Monitoring methods
Posidonia beds	measurement of density and percentage cover on 50 long transect by scuba divers. Nr. and location of area which will be covered with this monitoring still has to be determinated.
Reefs	mapping of predominant community and indicator species in upper infralittoral from the rubber boat. All coastlines will be covered.

The monitoring protocols that will be used in Pakleni Islands are the subsequent.

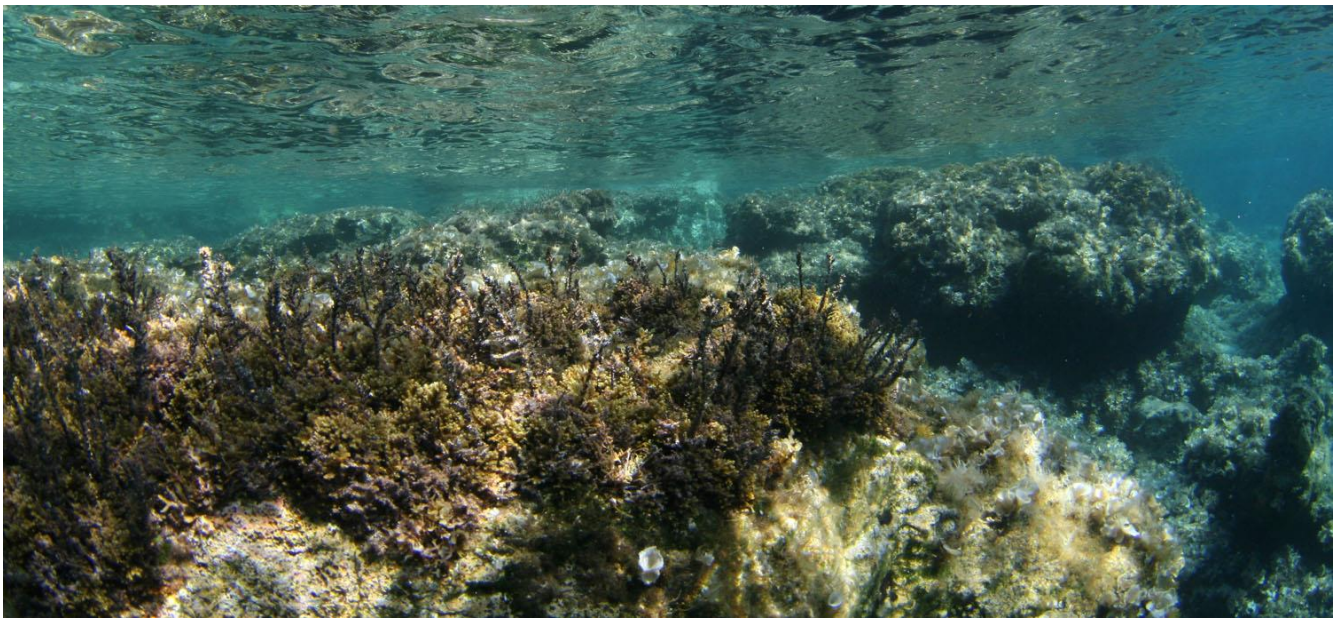
Posidonia habitat

Monitoring is based on measurement of shoot density and percentage cover (LIT) by scuba divers. Nr. of area where monitoring will be make has still to be determinate. Monitoring will be done on 15 m depth along 50 m transect. Density and LIT is measured on 3 sub-location: 0 m, 25 m and 50 m point on the transect. Density is measured by counting the number of leaf shoots on the 40 cm x 40 cm area on 6 quadrats. The coverage is the surface of seabed, expressed as a percentage, covered with live plants of *Posidonia oceanica* compared to that non-covered and consisting of sand, rock or dead matter. Percentage cover will be assessed using the Line Intercept Transect (LIT) technique. The LIT is a centimetre-marked line laid on the bottom along which the occurrence of live *Posidonia oceanica* and the nature of the substrate (sand, rock, dead matter) are recorded. Four LITs at each of the three sub-locations, 10 m length and randomly positioned, has to be obtained. For each LIT, the intercept to the nearest centimeter corresponding to the point where the key attributes changed under the line and which has to be be recorded. This protocol is reduced POMI method (Romero et al, 2007) which is adopted for the monitoring for the MSFD in Croatia (»Narodne novine«, NN 153/2014, (2892)).

Posidonia oceanica meadow in Pakleni Islands is extensively developed around the islands.

Reef habitat

Survey consists in a mapping of the entire coastline using small boat which has to be driven as close as possible to the shoreline. It is base on CARLIT methodology (Ballesteros et al 2007) which is in use for the WFD monitoring in Croatia (»Narodne novine«, NN 153/2014, (2892)). Littoral and upper-sublittoral communities (or combination of communities) are identified visually and directly annotated in printed maps. Estimation has to be made on 50 m long shoreline transects which is made of hard substrate. Mapping has to be done in spring. Information obtained from the field mapping has to be transcribed into a geo-referenced database (made by Institute of Oceanograpy and Fisheries in Split). Such as zero state will be use for further monitoring of upper lithoral communities.



Upper-sublittoral communities on rocky bottom (part of the Reef habitat) in Pakleni Islands inhabitated with different species of *Cystoseira* brown algae.

Shkodra Lake (PP6)

The selected target species for Shkodra Lake are listed in Table 16.

Table 16: Species and related monitoring methods chosen by PP6.

Species	Monitoring methods
Trapa natans, L.	Common Standards Monitoring Guidance for Vascular Plant Species (2004)
Nymphaea alba L.	Common Standards Monitoring Guidance for Vascular Plant Species (2004)
Lutra lutra, L.	Joshi, AS, Tumsare, VM, Nagar, AK, Mishra, AK and Pariwakam, MP (2016). Photographic Records of Eurasian Otter Lutra lutra from the Central Indian Landscape. IUCN Otter Spec. Group Bull. 33 (1): 73 - 78

Pelecanus crispus, B.	Status report on Dalmatian pelican (Pelecanus crispus). Project LIFE EuroSap. LIFE14 /PRE/UK/002
Phalacrocorax pygmeus, P.	Monitoring of the breeding colony (M. Marinov).

The monitoring protocols that will be used in Škocjanski zatok Nature Reserve are the subsequent.

***Trapa natans*- Population trends**

The ways for monitoring **the *Trapa natans:*** The habitat is best to visit in late May to mid September, when regeneration and associated vegetation can be assessed. There are several methods:

i) Identification of species from the Regional Agency of Protected Areas (staff), fisherman, students of the University, fisherman, volunteers, community representative and Shkodra Lake Rangers;

ii) Number of populations in site. Some habitat areas can be assessed visually; others will require point sampling using a grapnel. Evidencing by fisherman, volunteers, hunters and local RAPA staff providing pictures, GPS coordinates/locations etc.

iii) Comparison with previous data can be provided by Shkodra university students, RAPA project running in Shkodra Lake area, local SCOs, RAPA staff and rangers;

iv) Visual assessment - Plants of differing sizes present or >50 % plants producing flowers or fruits can be monitored by fisherman, students of Shkodra University, fisherman, volunteers, CSOs and Shkodra lake Rangers;

v) This specie produces barbed nuts (Swearingen et al., 2002) that pose a significant hazard to swimmers, boaters, and fishermen (Kaufman and Kaufman, 2007) and these nuts can be collected along lake shores by volunteers involved with the hand removal.

Indirect attributes - Method of assessment:

i) Visual assessment or use of secchi disk;

ii) Mapping (area of Lake Margin)

iii) Assessment of relative height of other species within vegetation sample.

Nymphaea alba

Direct attributes: It is best to visit in late May to mid September, when regeneration and associated vegetation can be assessed. There are several methods:

- **i)** Identification of species from the Regional Agency of Protected Areas (staff), fisherman, students of the University, fisherman, volunteers, community representative and Shkodra Lake Rangers;
- **ii)** Number of populations in site**.** Some habitat areas can be assessed visually; others will require point sampling using a grapnel. Evidencing by fisherman, volunteers, and hunters and local RAPA staff providing pictures, GPS coordinates/locations etc.;
- **iii)** Comparison with previous data can be provided by Shkodra university students, RAPA project running in Shkodra Lake area, local SCOs, RAPA staff and rangers;
- **iv)** Visual assessment - Plants of differing sizes present or >50 % plants producing flowers or fruits can be monitored by fisherman, students of Shkodra University, fisherman, volunteers, CSOs and Shkodra lake Rangers;

Indirect attributes - Method of assessment:

- **i)** Visual assessment or use of secchi disk;
- **ii)** Mapping (area of lake margin);
- **iii)** Assessment of relative height of other species within vegetation sample.

Lutra lutra

Three ways will be followed for monitoring protocol;

- **i)** The method will be based on camera-trapping used by Regional Agency of Protected Areas (RAPA) in Shkodra region. The cameras will be installed in suitable places; sandy banks along the Shkodra Lake and Buna streams/rivers and in slopes near deep pools in flowing streams were selected for placing the camera traps. The camera traps will stay for 25-30 days for logistical reasons; minimizing the effort of camera removal. GPS locations of the traps and sightings will be plotted on a map.
- **ii)** Evidencing the otter footprints along rivers/streams by fisherman, volunteers, and hunters and other local RAPA staff.
- **iii)** Visual identification by fisherman, volunteers, and hunters and other local RAPA staff providing pictures, GPS coordinates/locations etc.

Pelecanus crispus

Dalmatian pelican located in Shkodra Lake will be monitored at different times of the year:
Monitoring of wintering individuals–will be carried out in the second half of January each year as part of the International Winter Awakening Census (IWC). Based on this methodology requires the count of each individual present in the area of Shkodra Lake. This process will be coordinated with similar process to be done at the national level and in cooperation with the Ornithological Association of

Albania (AOS), bird watching organizations, individuals/volunteers, the Albanian Association of Water Resources Protection (APAWA) and the Regional Protected Areas Administration - Shkodra (RAPA). The first census was performed in 1992 and is repeated almost every year.

i) *Monitoring of nesting pairs*–will be carried out in April in the form of control over the entire water surface of Lake Shkodra (Albanian part), and it will be carried in cooperation with local RAPA staff and other organizations there. The process will be coordinated with AOS (Albanian ornithological society).

ii) *General Census of theDalmatian Pelican* - consists of counting each individual present in the Lake Shkodra area during May. It will be carried in cooperation with local RAPA staff and other organizations there).

Phalacrocorax pygmeus

i) *Monitoring of wintering individuals*–will be carried out in the second half of January. The methodology consists in count of each individual present in the area of Lake Skadar. That will be coordinated with local organizations and RAPA.

ii) *Monitoring of nesting pairs* - will carried during June, in the form of control over the entire water surface of Lake Shkodra (the Albanian part). As such process it will be carried in cooperation with local RAPA staff and other organizations there. The process will be coordinated with AOS (Albanian ornithological society).

North East of Crete (PP7)

In the Northeastern Part of Crete monitoring will be conducted on one habitat, three plant species, one amphibian, one reptile and three bird species. The selected habitat and target species for Northeastern Part of Crete are listed in Table 17.

Table 17: Species and related monitoring methods chosen by PP7.

Habitat / Species	**Monitoring methods**
9370* - Palm groves of *Phoenix*	1. Definition of transects - walking routes along the forest. 2. Visual inspections. 3. Record of qualitative parameters of the understorey
Centaurea aegialophila	1. Detection in possible habitats along the coasts and location of populations (presence / absence). 2. Estimation of the populations' size. 3. Record of possible threats and disturbances. 4. Use of a scale of species' abundance.
Anacamptis pyramidalis	1. Detection in possible habitats and location of populations (presence / absence). 2. Estimation of the populations' size. 3. Record of possible threats and disturbances. 4. Use of a scale of species' abundance.
Campanula pelviformis	1. Detection in possible habitats and location of populations (presence / absence). 2. Estimation of the populations' size. 3. Record of possible threats and disturbances. 4. Use of a scale of species' abundance.
Pelophylax cretensis	
Caretta caretta	

Anthus campestris	
Falco eleonorae	
Sylvia rueppelli	

Habitat type 9370* Palm groves of *Phoenix*

This priority habitat of the Habitats Directive 92/43/EEC is well represented in the Vai location, which constitutes the largest and the richest native palm forest of Europe. This unique *Phoenix theophrasti* forest ecosystem extends in a valley about 750 meters long and 100 – 250 wide. It reaches the coast, covering an area of 120 acres. Chaste trees (*Vitex agnus-castus*), lentiscs *(Pistacia lentiscus),* kermes oaks *(Quercus coccifera),* oleanders *(Nerium oleander*) and other plant species occur in the forest too.

The red palm weevil (*Rhynchophorus ferrugineus),* which was recorded in Crete for the first time in 2005, constitutes a major hazard for the palm forest. The red palm weevil destroys the ornamental palm of the Canary islands *(Phoenix canariensis)* and the date palm (*P. dactylifera),* which is also planted in Crete as ornamental. Another hazard is the possible hybridization between the palm tree of Theophrastus and the other two above-mentioned palm tree species.

The Vai palm forest has been characterized as "landscape of exceptional natural beauty" and as "scenic forest" by the national legislation, that is why the Directorate of Forest Management of the Decentralized Administration of Crete is responsible for its protection, conservation and management

The monitoring method includes the following steps:

1. Definition of transects - walking routes along the forest.

2. Visual inspection for presence / absence of *Rhynchophorus ferrugineus* and of affected *Phoenix* individuals.

3. Record of qualitative parameters concerning the understorey, namely identification of main species, density, and presence of alien species.

It would also be possible to cooperate with the Directorate of Forest Management of the Decentralized Administration of Crete for additional monitoring methods, where appropriate, e.g. comparison of past and present sattelite images, monitoring of the underground water available, and other measurable parameters.

Monitoring area: Palm forest

Plant species

The pilot area, likely most of the other NATURA 2000 sites of Crete, is not currently under any Management Body. That means, practically, that no annual or regular species monitoring is organized and, apart from the Standard Data Forms and scientific literature, there are no data series about plant

species' occurrence and populations' distributions. Therefore the first monitoring step for plant species will be the detection in possible habitats for presence / absence.

Centaurea aegialophila

This Compositae plant species ia a low, almost stemless perennial, with purple solitary or clustered flower-heads. Its flowering period is relatively long, from March to August, and its habitat is the sandy coasts. The monitoring method includes:

1. Detection in possible habitats along the coasts of the pilot area and location of populations by recording the presence or absence of the species.

2. Estimation of the populations' size either through:

a. Transects approach.

b. Plotless sampling.

c. Density, i.e. counting the number of individuals of the species.

The method to be applied will be decided on site, considering whether the species is widely distributed or forming restricted dense populations.

3. Record of possible threats and disturbances, such as use of the coasts, erosion etc.

4. Use of a scale of species' abundance within the plant community in the habitat.

Anacamptis pyramidalis

This pyramidal orchid is a rather slender short to medium tuberous perennial. Its flowering period may extend from February to May, but most usually from March to April. Its habitats are sparse woodland, phrygana, fallow land and olive groves expanding from the sea level to 800 m or even higher altitudes (up to 1,200 m).

The monitoring method includes:

1. Detection in possible habitats of the pilot area and location of populations by recording the presence or absence of the species.

2. Estimation of the populations' size either through:

a. Transects approach.

b. Plotless sampling.

c. Density, i.e. counting the number of individuals of the species.

The method to be applied will be decided on site, considering whether the species is widely distributed or forming restricted dense populations.

3. Record of possible threats and disturbances, such as field cultivation, grazing etc.

4. Use of a scale of species' abundance within the plant community in the habitat.

Campanula pelviformis

This biennial Campanulaceae species is a Cretan endemic. Its flowers are lilac-blue in colour, 3cm across, widely bell-shaped, with broad reflexed lobes. The leaves are grey-hispid, ovate, serrate and form a basal rosette. The main stem is erect, 20-30cm tall, usually with a few shorter, decumbent leaves at the base. The flowering period extends from April to June. Its habitats are calcareous rocks, rubble, woodland, street banks, in 0-950 m altitude.

The monitoring method includes:

1. Detection in possible habitats of the pilot area and location of populations by recording the presence or absence of the species.

2. Estimation of the populations' size either through:

a. Transects approach.

b. Plotless sampling.

c. Density, i.e. counting the number of individuals of the species.

The method to be applied will be decided on site, considering whether the species is widely distributed or forming restricted dense populations.

3. Record of possible threats and disturbances, such as flower cutting, grazing etc.

4. Use of a scale of species' abundance within the plant community in the habitat.

Animal species

Pelophylax cretensis

A Ranidae family medium-sized frog, not bigger than 8.5 cm in total, endemic to Crete. There is a wide colour variation within the species' individuals. This "shy" frog is active during daytime, sitting in the sunlight and diving back in the water as soon as it feels being in danger. It mates during spring and the female individuals lay their eggs in the water, in several clusters of hundreds of eggs each. It occurs in swamps, lakes, ponds and stagnant water.

The monitoring method includes:

1. Detection in possible habitats, i.e. small ponds, streams and stagnant water, and location of populations.

2. Monitoring and estimation of polulation size before and after reproduction period.

3. Report of each population status and of the habitats' status. This information is valuable for an estimation of the populations' dynamics in the years to come and of possible dangers and disturbances which affect the species.

4. Suggestion of protection measures, especially for the habitats in danger.

Caretta caretta

The loggerhead sea turtle (*Caretta caretta*) is an oceanic globally distributed turtle. It is a marine reptile of the family Cheloniidae. The average individual measures around 90 cm long, when fully grown, although larger specimens of up to 280 cm have been recorded. It lives about 100 years and its adult phase begins after the second decade of its life. The skin colour ranges from yellow to brown, and the shell is typically reddish brown. No external differences in sex are observed until the turtle reaches the adult life phase, the most obvious difference being that adult males have thicker tails and shorter plastrons than female ones.

Caretta caretta lays its eggs from May to October, when the hatched individuals make their way towards the sea. Every 2-3 years each loggerhead sea turtle will return to its selected sandy coast to lay its eggs about 60cm deeply into the sand, twice or three times during the nesting period. Every nest hosts up to 120 eggs and the incubation lasts about 55 days. The sex of the hatched individuals is determined by the nest's temperature, that is why the natural quality of the sand is important for the populations and their distribution not to be affected.

The monitoring method includes:

1. Detection in possible habitats, along sandy coasts of the pilot area, and location of nests during nesting period, from May to October.

2. Monitoring and estimation of the number of hatchlings. "Archelon" is a non-governmental organization for the protection of *Caretta caretta* (www.archelon.gr). Since 1983 they have implemented monitoring, protection and management measures and public awareness in the major loggerhead nesting areas of Zakynthos, the Peloponnese and Crete, along coasts other than our pilot area. The Region of Crete has already developed some cooperation actions with "Archelon", so their contribution may be asked for the implementation of the monitoring protocol in our pilot area.

3. Report of each population status and of the habitats' status.

4. Suggestion of protection measures.

Anthus campestris

Anthus campestris (tawny pipit) is a medium-large insectivorous passerine bird, which breeds in an extensive part of temperate Europe and Asia, and northwest Africa. It is a migrant moving in winter to tropical Africa and the Indian Subcontinent. It is 16 cm long with wing-span 25–28 cm, mainly sandy brown above and pale below, which makes it undistinguished when on the ground. Its flight is strong and direct, and it calls giving a characteristic "schip". Its breeding habitat is dry open land, including semi-deserts. It is also found from sand dunes, sandy heaths, dry grassland and clear-felled areas to artificial habitats such as gravel pits, steppe. It favours areas with dwarf shrubs and low-growing trees for songposts (Bird Life International, 2018). The breeding season is from mid-April to mid-August; although it is later in northern Europe, beginning in mid-June in Sweden and earlier in North Africa. The nest is set on the ground, with 4-6 eggs being laid.

The monitoring method includes:

1. Monitoring of territories which include suitable species' habitats along the pilot area: areas covered by open scrub, phryganic vegetation, grasslands and sand dunes.
2. Mapping of recorded individuals / populations according to habitat type, habitat characteristics and habitat use.
3. Recording behavior and action in the mainland part of the pilot area during migration period (migration notes).

Falco eleonorae

The Eleonora's Falcon is a dark-coloured, average-sized migratory falcon, which spends the winter in East Africa, especially in Madagascar. It appears in the Mediterranean area in April, and Greece is considered the most significant country for the conservation and survival of the species, since during the breeding season, it is known that Greece hosts more than 85% of the global population (Dimalexis et al., 2007). One third of these individuals breed on the islets of Crete (BirdLife International, 1999). The adult birds occur in two colour phases: a dark one, almost black, and a light phase, with the body in light, chestnut brown colour, with elongated streaks. The latter colour phase is more common. However, in open fields, even the light-coloured phase birds appear to be very dark, almost black. It is gregarious, living in colonies, and some people might confuse it with the *Falco peregrinus*, which is, however, more strongly-built and possesses a shorter tail. Its breeding season begins much later (in July), compared to other migratory birds (Hellenic Ornithological Society, 2003).

The Eleonora's falcon hunts at large distances from the nest, in an area which possibly exceeds 1,000 km^2, due to the low food availability in the nesting areas, and only few of the birds return to the colony at night. Thus, considering that islands where the reproductive colonies are located are not able to provide enough food for all individuals, Eleonora's falcons may be spotted during the reproductive season on the mainland Greece as well, even in high mountains far from the coasts (Hellenic Ornithological Society, 2003). Until the end of July, when the egg-laying has been completed, the diet of the species consists mainly of large insects, such as butterflies, flying ants, dragonflies, cicadas and

beetles, that it catches in the air with its talons, above the islands or the sea. Until October, it feeds exclusively on migratory birds. After the breeding period, i.e. between the end of October and the beginning of November, it flies to East Africa, especially to Madagascar for the winter time, returning to a diet based on insects (Hellenic Ornithological Society, 2003).

The monitoring method includes:

1. Monitoring in the mainland part of the pilot area during daytime.
2. Recording the number of individuals using special habitats, such as small natural wetlands and artificial watering pools.
3. Recording behavior and action in the mainland part of the pilot area during migration period (migration notes).

Sylvia rueppelli

Rueppell's Warbler (*Sylvia rueppelli*) is a small insectivorous passerine bird, not bigger than 14 cm in length, which breeds in Greece and Turkey. It is migratory, spending the winter in north-east Africa. The adults have a plain grey back and paler grey underparts. The male has a black head and, usually, a black throat, separated by a white malar streak, which looks like a ”moustache”. Female individuals have a pale throat, and their head is grey rather than black. Their back is grey has a brownish tinge. Its habitats are the sparse dry maquis vegetation type, with *Pistacia lentiscus, Ceratonia siliqua* and *Calicotome villosa* and the maquis formed by small wild-olive trees (*Olea oleaster*).

The monitoring method includes:

1. Detection in possible habitats along the mainland part of the pilot area.
2. Mapping of recorded individuals / populations according to habitat type, habitat characteristics and habitat use.
3. Recording behavior and action in the mainland part of the pilot area during migration period (migration notes).

Monitoring of Ecosystems and Ecosystem services.

The indicator species / habitats were chosen according to a previously described common approach in which they were also useful for assessing the integrity and therefore the quality of an ecosystem. As for the quality of an ecosystem, we consider the so called *Ecosystem functionality*, defined as the capacity or the potential to deliver ecosystem services. To each target species / habitat has been assigned (on expert based opinion) a value, from 1 to 5, to indicate the reliability of the indicator to define the degree of integrity and therefore functionality of the ecosystem in which it lives (Cfr. T 1.2.1 excel

sheet). In this way, therefore, the ecosystem monitoring protocol is implemented through the status indicators of species and target habitats.

Group	Specie / Habitat/ from baseline db	Pilot Area	Annex Habitat/ Birds directive	Red List Iucn	Red List Nationale/Regional	Indicator as Es quality
						1 to 5 (1 low - 5 high)
H	*11.33 - Mediterraneo-Pontic Cymodocea and Zostera beds - 1110 Sandbanks which are slightly covered by sea water all the time*	RN Isonzo Rivermouth	I hd			5
I	*Pinna nobilis*	RN Isonzo Rivermouth	IV hd			4
B	*Larus melanocephalus*	RN Isonzo Rivermouth	I BD	LC	LC	3
B	*Sterna sandvicensis*	RN Isonzo Rivermouth	I BD	LC	VU	3

Figure 7: Extract of T 1.2.1; in the last column the reliability values of the indicator are expressed to evaluate the quality of the reference ecosystem

For example, monitoring of sea grass habitats (11.33 Mediterraneo-Pontic Cymodocea and Zostera beds – 1110 Sandbanks wich are slightly covered by sea water all the time) makes it possible to define the quality of the marine ecosystem as well represented in the RNFI (660 hectares out of about 1000).

The next step will be to identify for each PA the ecosystem services related to the chosen ecosystems. This result will be achieved through a parallel path, through the realization of the *Deliverable T1.1.1 - Inventory and mapping of species, habitats, ecosystems, ecosystem services* (which connected the PA's ecosystems with the related ecosystem services), *Deliverable T2.1.1 - Sensitive maps* (which highlight drivers of change from SoES to ES and benefits from the ES to the SoES and rank the most sensitive ES and ESS in terms of pressures and resilience) and the decision taken by the JTF about the ESS to be targeted by the Pilot Action and the related management measures. On the targeted ecosystem services, monitoring will be initiated through specific qualitative indicators (capacity indicators, flow indicators, benefit indicators) that are not included within the scope of the present deliverable. However, they are monitored indirectly because they are consequent to the functionality of the ecosystems that generate them and therefore monitoring the quality of the ecosystems through the indicator system described above obtains a first picture of the availability and quality of ecosystem services generated.

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Annex I

	Standard metodology for professional	***Methods***	***Source***
Group	*Specie/Habitat*	methodology	Source
H	11.33 - Mediterraneo-Pontic Cymodocea and Zostera beds	Fotointerpretation and vegetetional releves	Angelini P., Casella L., Grignetti A., Genovesi P., (ed.) 2016. Manuali per il monitoraggio di specie ed habitat d'interesse comunitario (Direttiva 92/43/CEE) in Italia: habitat. Ispra, Serie Manuali e linee guida, 142/2016
I	*Pinna nobilis*	Line transect	Angelini P., Casella L., Grignetti A., Genovesi P., (ed.) 2016. Manuali per il monitoraggio di specie ed habitat d'interesse comunitario (Direttiva 92/43/CEE) in Italia: specie animali. Ispra, Serie Manuali e linee guida, 141/2016
B	*Larus melanocephalus*	Point or line transect	Bibby C.J., Burges N. D., Hill D. A. & Mustoe S., 2000 – Bird Census Techniques. 2nd Edition. Academic Press, London, UK.
B	*Phalaocrocorax aristotelis desmarestii*	Point or line transect	Bibby C.J., Burges N. D., Hill D. A. & Mustoe S., 2000 – Bird Census Techniques. 2nd Edition. Academic Press, London, UK.
B	*Sterna sandvicensis*	Point or line transect	Bibby C.J., Burges N. D., Hill D. A. & Mustoe S., 2000 – Bird Census Techniques. 2nd Edition. Academic Press, London, UK.
B	*Pluvialis squatarola*	Roost count	Bibby C.J., Burges N. D., Hill D. A. & Mustoe S., 2000 – Bird Census Techniques. 2nd Edition. Academic Press, London, UK.
B	*Numenius arquata*	Roost count	Bibby C.J., Burges N. D., Hill D. A. & Mustoe S., 2000 – Bird Census Techniques. 2nd Edition. Academic Press, London, UK.
B	*Calidris alpina*	Roost count	Bibby C.J., Burges N. D., Hill D. A. & Mustoe S., 2000 – Bird Census Techniques. 2nd Edition. Academic Press, London, UK.
B	*Gavia arctica*	Point or line transect	Bibby C.J., Burges N. D., Hill D. A. & Mustoe S., 2000 – Bird Census Techniques. 2nd Edition. Academic Press, London, UK.
B	*Gavia stellata*	Point or line transect	Bibby C.J., Burges N. D., Hill D. A. & Mustoe S., 2000 – Bird Census Techniques. 2nd Edition. Academic Press, London, UK.
F	*Aphanius fasciatus*	Line transect netting	Angelini P., Casella L., Grignetti A., Genovesi P., (ed.) 2016. Manuali per il monitoraggio di specie ed habitat d'interesse comunitario (Direttiva 92/43/CEE) in Italia: specie animali. Ispra, Serie Manuali e linee guida, 141/2016
H	2130* - Fixed coastal dunes with herbaceous vegetation (grey dunes)	Fotointerpretation and vegetational releves	Angelini P., Casella L., Grignetti A., Genovesi P., (ed.) 2016. Manuali per il monitoraggio di specie ed habitat d'interesse comunitario (Direttiva 92/43/CEE) in Italia: habitat. Ispra, Serie Manuali e linee guida, 142/2016
A	*Pelobates fuscus*	Vocalizations hearing and eggs masses searching	Angelini P., Casella L., Grignetti A., Genovesi P., (ed.) 2016. Manuali per il monitoraggio di specie ed habitat d'interesse comunitario (Direttiva 92/43/CEE) in Italia: specie animali. Ispra, Serie Manuali e linee guida, 141/2016
R	*Testudo hermanni*	Active searching on standard polygon areas	Angelini P., Casella L., Grignetti A., Genovesi P., (ed.) 2016. Manuali per il monitoraggio di specie ed habitat d'interesse comunitario (Direttiva 92/43/CEE) in Italia: specie animali. Ispra, Serie Manuali e linee guida, 141/2016
M	*Meles meles*	Camera trapping	Rovero F., Zimmermann F., (ed.) 2016. Camera trapping for wildlife research. Pelagic Publishing Ltd., 320 pp.
I	*Vertigo angustior*	Active searching on standard polygon areas and on suitable CORIN (macro)habitats?	Slapnik R. (2009): Vzpostavitev monitoringa izbranih ciljnih vrst mehkužcev. (Zaključno poročilo). Naročnik: Ministrstvo za okolje, prostor in energijo RS, Ljubljana. Znanstvenoraziskovalni center Slovenske akademije znanosti in umetnosti, Ljubljana. 71 str. (str20/71)
B	*Sterna hirundo*	Special nest monitoring	TEDENSKI POPISI, POSEBNI POPISI, GNEZDITEV - Mozetič, B., Denac, K., 2012: Protokol spremljanja stanja na območju Naravnega rezervata Škocjanski zatok
R	*Emys orbicularis*	Active searching on standard polygon areas	Torkar,G., Ferjan, K. (2018): Močvirska sklednica (Emys orbicularis (Linnaeus, 1758)) v Krajinskem parku Sečoveljske soline, rezultati raziskave
A	*Lissotriton vulgaris meridionalis*	Active searching on standard polygon areas	Paul Veenvliet, Jana Kus Veenvliet (2014): ADRIAWET 2000: Monitoring dvoživk in plazilcev v Naravnem rezervatu Škocjanski zatok (NRŠZ) – končno poročilo
I	*Tyria jacobaea*	Active searching of host plant, larvae and imago on standard polygon areas and transect monitoring	Verovnik, R. (2007): Navodila za popisovalce. BMS (Butterfly Monitoring Slovenia) Slovenija. DPOMS, Ljubljana.
B	*Ixobrychus minutus*	Acoustic monitoring	Mozetič, B., Denac, K., 2012: Protokol spremljanja stanja na območju naravnega rezervata Škocjanski zatok
B	*Rallus aquaticus*	Acoustic monitoring	Mozetič, B., Denac, K., 2012: Protokol spremljanja stanja na območju naravnega rezervata Škocjanski zatok
B	*Himantopus himantopus*	Special nest monitoring	TEDENSKI POPISI, POSEBNI POPISI, GNEZDITEV - Mozetič, B., Denac, K., 2012: Protokol spremljanja stanja na območju Naravnega rezervata Škocjanski zatok
R	*Podarcis siculus*	Active searching on standard polygon areas	Paul Veenvliet, Jana Kus Veenvliet (2014): ADRIAWET 2000: Monitoring dvoživk in plazilcev v Naravnem rezervatu Škocjanski zatok (NRŠZ) – končno poročilo
A	*Hyla arborea*	Active searching on standard polygon areas	Paul Veenvliet, Jana Kus Veenvliet (2014): ADRIAWET 2000: Monitoring dvoživk in plazilcev v Naravnem rezervatu Škocjanski zatok (NRŠZ) – končno poročilo + (to be discussed?) Angelini P., Casella L., Grignetti A., Genovesi P., (ed.) 2016. Manuali per il monitoraggio di specie ed habitat d'interesse comunitario (Direttiva 92/43/CEE) in Italia: specie animali. Ispra, Serie Manuali e linee guida, 141/2016
H	*1120, Posidonia beds (Posidonion oceanicae)	Modified POMI methods - measurment of density and coverage.	Sustav praćenja i promatranja za stalnu procjenu stanja Jadranskog mora, »Narodne novine«, NN 153/2014, (2892); Romero, J., Martinez-Crego, B., Alcoverro, T. and Perez, M. (2007) A multivariate index based on the seagrassPosidonia oceanica (POMI) to assess ecological status of coastal waters under the Water Framework Directive (WFD), Marine Pollution Bulletin, 55, 196-204. doi.10.1016/j.marpolbul.2006.08.032;
H	1170, Reefs	CARLIT - cartography of upperlittoral communnity	Sustav praćenja i promatranja za stalnu procjenu stanja Jadranskog mora, »Narodne novine«, NN 153/2014, (2892); Ballesteros E., Torras X., Pinedo S., Garcı´a M., Mangialajo L., Torres de M. (2007) A new methodology based on littoral community cartography for the implementation of the European Water Framework Directive. Marine Pollution Bulletin, 55, 172–180.
I	*Pinna nobilis*	Line transect (Ispra 2016) and Biometry (Marrocco et al., 2018)	1. Angelini P., Casella L., Grignetti A., Genovesi P., (ed.) 2016. Manuali per il monitoraggio di specie ed habitat d'interesse comunitario (Direttiva 92/43/CEE) in Italia: specie animali. Ispra, Serie Manuali e linee guida, 141/2016; 2. Marrocco V., Sicuro A., Zangaro F., Pinna M., 2018. First
	Benthic macroinvertebrate biocenosis	Box-corer	Pinna M., Marini G., Rosati I., Neto J.M., Patrício J., Marques J.C., Basset A., 2013. The usefulness of large body-size macroinvertebrates in the rapid ecological assessment of Mediterranean lagoons. Ecological Indicators, 29: 48-61.
I	*Callinectes sapidus*	Traps/Nets	Sturdivant, S.K., Clark, K.L., 2011. An evaluation of the effects of blue crab (Callinectes sapidus) behavior on the efficacy of crab pots as a tool for estimating population abundance. Fishery Bulletin 109, 48e55.
H	9370* - Palm groves of *Phoenix*		1) Dimopoulos et al. (2005), Habitat and plant species monitoring guide (in Greek). 2) Dimopoulos et al. (2012). Identification and Interpretation of forest habitats in Greede (in Greek). 3) Kent & Coker (2001). Vegetation description and analysis. A practical approach.
P	*Centaurea aegialophila*		1) Dimopoulos et al. (2005), Habitat and plant species monitoring guide (in Greek). 2) Kent & Coker (2001). Vegetation description and analysis. A practical approach.
P	*Anacamptis pyramidalis*		1) Dimopoulos et al. (2005), Habitat and plant species monitoring guide (in Greek). 2) Kent & Coker (2001). Vegetation description and analysis. A practical approach.
P	*Campanula pelviformis*		1) Dimopoulos et al. (2005), Habitat and plant species monitoring guide (in Greek). 2) Kent & Coker (2001). Vegetation description and analysis. A practical approach.
A	*Pelophylax cretensis*		
R	*Caretta caretta*		Natural History Museum of Crete, "Archelon" non-governmental organization

Standard metodology for professional	***Methods***	***Source***
Specie/Habitat	methodology	Source
Nuphar lutea (L.) SM.	In-Place Research, Monitoring.Photo Interpretation and vegetation affiliation. GPS / location. hand pulling rosettes (floating portion) after the seeds have formed but before they are ripe (early August).	NAPA: Biodiversity Monitoring Program 2018; Common Standards Monitoring Guidance for Vascular Plant Species (2004)
Nymphaea alba L.	In-Place Research, Monitoring. Photo Interpretation and vegetation affiliation. GPS / location. hand pulling rosettes (floating portion) after the seeds have formed but before they are ripe (early August).	Common Standards Monitoring Guidance for Vascular Plant Species (2004)
Nymphoides peltata (S.G.Gmel.) Kuntze	In-Place Research, Monitoring. Photo Interpretation and vegetation affiliation. GPS / location. hand pulling rosettes (floating portion) after the seeds have formed but before they are ripe (early August).	Common Standards Monitoring Guidance for Vascular Plant Species (2004)
Acipenser sturio Linnaeus, 1758	Naked DNA in water tells if fish have arrived	Williot P., Rouault T., Pelard M., Mercier D. and Jacobs L. 2009. Artificial reproduction of captive endangered European Atlantic sturgeon, Acipenser sturio. Endangered Species Research 6: 251-257.
Aix galericulata (Linnaeus, 1758)	Observation, camera trapping and eggs searching	Dhimiter Dhora. Liqeni i Shkodres 2016; BirdLife International. 2016. *Aix galericulata* . The IUCN Red List of Threatened Species 2016: e.T22680107A92843837.
Pelecanus crispus (Dalmatian Pelican)	Monitoring the number of species and bredding colony | Observation, camera trapping and eggs searching	Lamani, F. (1989) Données sur la distribution et la zoogéographie des Pelecaniformes et des Ciconiiformes en Albanie. Biologia Gallo-Hellenica 13: 111–118.; ACTION PLAN FOR THE DALMATIAN PELICAN (Pelecanus crispus) IN EUROPE.
Marmaronetta angustirostris (Ménétriés, 1832)	Observation, camera trapping and eggs searching	BirdLife International 2016. Species Action Plan for the Marbled Teal /Marmaronetta angustirostris / in the European Union; Marmaronetta angustirostris (amended version of 2016 assessment). The IUCN Red List of Threatened Species 2017: e.T22680339A110054350
Charadrius alexandrinus Linnaeus, 1758	Active observation on polygon areas	Schmitz, M., Sudfeldt, C., Deutsch, A. & Legge, H. 2001. Population status of the Kentish Plover *Charadrius alexandrinus* in Eastern Romania. Wader Study Group Bull. 95:51-54.
Pelophylax shqiperica | (Albanian Water Frog)	Active searching on standard polygon areas	Thomas Uzzell, Jelka Crnobrnja Isailovic. 2009. Pelophylax shqipericus. Hotz, H., Uzzell, T., Günther, R., Tunner, H.G. and Heppich, S. 1987. Rana shqiperica, a new European water frog species from the Adriatic Balkans (Amphibia, Salientia, Ranidae). Notulae Naturae: 1-3;
Lutra lutra (Linnaeus, 1758)	Camera trapping for wildlife research; Identification and location of collected data. GPS /Camera trapping	Jdeidi, T., Masseti, M., Nader, I., de Smet, K., & Cuzin, F. 2010. Lutra lutra. Joshi, AS, Tumsare, VM, Nagar, AK, Mishra, AK and Pariwakam, MP (2016). Photographic Records of Eurasian Otter Lutra lutra from the Central Indian Landscape. IUCN Otter Spec. Group Bull. 33 (1): 73 - 78