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Educational training program for monitoring marine habitat type 1120 Posidonia meadows (*Posidonion oceanicae*)

Dubrovnik, June 2024.

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Project title: Awareness raising, training, and scientific research activities on species and Habitat of Community interest

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Contents

1. INTRODUCTION

The island of Lokrum is protected as a special reserve of forest vegetation by the Nature Protection Act (NN 80/2013, 15/2018, 14/2019, 127/19). The island, including the surrounding marine area, extends approximately 150 meters from the coast. It is a part of the Natura 2000 network (HR4000017 Lokrum) with eight target habitat types based on Regulation of the Ecological Network and the Competences of Public Institutions for Management of Ecological Network Areas (NN 80/19).

One of the target marine habitat types is a priority habitat 1120* *Posidonia oceanica* meadows. The seagrass *Posidonia oceanica* is protected endemic Mediterranean species that is widespread throughout the Adriatic, from the south where it forms big meadows, to the west coast of Istria where smaller, individual meadows are found in generally worse state (Berković et al., 2018). The meadows of *P. oceanica* are very complex and well-structured ecosystems known for their great biodiversity and primary production, which are extremely important for the health of Mediterranean coasts (Vasarri et al.). Monitoring of *P. oceanica* meadows throughout the years is essential for determining their state and following long-term trends.

Since 2011, Sunce has been conducting monitoring according to the protocol for monitoring of *P. oceanica* meadows, established as part of the MedPAN South project by Sunce and WWF Adria (Guala et al., 2012a; 2012b), and based on the Monitoring protocol for *Posidonia oceanica* beds (Guala et al., 2014). Sunce has been carrying out monitoring of Posidonia meadows since 2011 in some national parks and nature parks and within parts of the ecological network. Such systemic application of developed methodology allows long-term monitoring of changes in the condition of meadows, based on which the needs for active protection, adapted to local conditions, can be identified (Berković et al., 2023).

Since its foundation in 1998. Sunce has been emphasizing the importance of environmental and nature protection education and the principles of sustainable development, through various educational programs. Encouraging changes in behaviour and proactive actions of individuals is thus a fundamental component of all educational activities that Sunce carries out. So far, Sunce has created and conducted more than 660 educational sessions for children and adults, with over 14,000 participants. Sunce has been organizing workshops and lectures for many years in cooperation with local associations and organizations on the topic of preserving and monitoring of *P. oceanica* meadows.

The educational training program for marine habitat type monitoring of 1120 Posidonia meadows (Posidonion oceanicae) is intended for the local population and divers from the city of Dubrovnik area, to strengthen their understanding of the importance of marine NATURA 2000 habitat types and familiarize them with the methodology of used monitoring, with an emphasis on identified threats and pressures.

As a part of the project HABI – Awareness raising, training, and scientific research activities on species and Habitat of Community interest (Interreg Italy - Croatia), PI Reserve Lokrum in cooperation with Sunce is planning the development and implementation of an educational training program intended for divers and the wider public to promote better monitoring practices and strengthen the skills needed to carry out monitoring activities in the future. As a part of the educational training program, the suggested protocol for Posidonia monitoring on the island of Lokrum will be presented, which will allow the participants to acquire knowledge specific to this area that they will be able to apply in the future (Photo 1).

Photo 1 The island of Lokrum (Archive: Sunce)

2. TRAINING PROGRAM

*Educational training program for monitoring marine habitat type1120 Posidonia meadows (*Posidonion oceanicae*)* is designed for local divers, the wider public, and the representatives of project partners. This program aims to involve them in future monitoring activities.

The training program will be implemented in July, with a total duration of 7 hours. It includes both theoretical and practical parts. The theoretical part can accommodate up to 30 participants, while the practical (in-situ) part is limited to 5 participants, depending on their interest, readiness, and diving qualifications.

The theoretical part of the program is intended for local divers and wider public interested in marine conservation, with a focus on *Posidonia* meadows. The practical part will be held after the theoretical part and will involve diving activities using autonomous diving equipment (SCUBA). The exact dive location will be determined based on the distribution data of *P. oceanica* meadows available from Public institution Reserve Lokrum. Divers who are active around Dubrovnik and its vicinity, and who have completed the theoretical part of the program, are eligible to participate in the practical sessions.

Additionally, to participate in the practical part, divers must provide proof of their highest diving certification (minimum qualification for diving up to 40 meters). All participants will be required to sign a declaration of responsibility and assumption of risk.

3. NECESSARY MATERIALS

The theoretical part of the *Educational training program for monitoring marine habitat type1120 Posidonia meadows (*Posidonion oceanicae*)* will be held on the premises of the PI Reserve Lokrum, while the practical part will take place in the marine area of Lokrum island. The specific diving location will be determined in consultation with the PI Reserve Lokrum.

Each diver participating in the program is required to bring their own personal diving equipment, as outlined in Chapter 2: Training Program. Sunce will provide the materials necessary for monitoring of *Posidonia* meadows, including monitoring equipment and a manual for inventorying and assessing the habitat (Photo 2).

Photo 2 Necessary materials (Archive: Sunce)

4. EDUCATIONAL TRAINING PROGRAM PLAN

*Educational training program for monitoring marine habitat type1120 Posidonia meadows (*Posidonion oceanicae*)* will take place in the order stated in this document. It consists of the theoretical part with PowerPoint presentation and a practical part (in-situ education) which is optional and will depend on the number of interested participants and weather conditions.

Theoretical part

Target group: divers around Dubrovnik, the wider public, the local population, and representatives of project partners.
Event place: premises of the Public Institution Reserve Lokrum.
Program duration: 3h 30 mins (total duration includes two breaks of 15 mins).
Necessary materials: laptop, projector, presentation in digital form (PowerPoint).
Program leader: Sunce employee.
Educational training program plan:

#	**Educational training program for monitoring of marine habitat type 1120 *Posidonia* meadows (Posidonion oceanicae)**	**Hours**
1.	*Introductory lecture*	0:45
2.	*P. oceanica – significance and pressures*	0:45
	Break	0:30
3.	*Habitat mapping and monitoring the state*	0:45
4.	*Methodology of monitoring the state of meadows*	0:45

1. Introductory lecture
Goal: getting familiar with agenda, educational training program plan and Sunce experience up to the present day. By examining Sunce's extensive experience in nature protection, participants will gain insight into the organization's expertise and competence in implementing such programs.
Results After the „Introductory lecture" the participants will be able to: • define the purpose and importance of this educational program, • understand the educational program plan,

• gain insight into Sunce's fields of work and protected areas in the Republic of Croatia in which Sunce is conducting monitoring of the habitat type 1120 *Posidonia oceanica* beds (Posidonion oceanicae)
Content: Familiarizing with the educational training program – *introducing participants to the educational training program plan.* Familiarizing with Sunce – *introducing participants to Sunce field of work and with projects that Sunce has conducted over the years, both locally and at the European level, with a focus on activities related to monitoring. This also includes an overview of ongoing projects at Sunce, particularly those involving divers and volunteers.*

2. *P. oceanica* – significance and pressures
Goal: Familiarizing the participants with *P. oceanica* as a key species of the habitat type 1120 *Posidonia oceanica* beds (Posidonion oceanicae). Participants will learn about the ecosystem services provided by *P. oceanica* as well as the pressures that endanger its survival, the importance of its protection, and therefore the purpose of this educational training program.
Results: After "*P. oceanica* – significance and pressures", the participants will be able to: • identify the species *P. oceanica*, • list which ecosystem services it offers, • list other species that depend on its survival, • recognize potential pressures on this habitat and species, • list the methods of protecting the *P. oceanica* meadows.
Content: *P. oceanica – familiarizing with the biology of the species as well as with other species that depend on its survival. Familiarizing with the ecosystem services it provides.* Pressures and threats – overview of *human activities that endanger its survival and the reasons for the degradation and disappearance of meadows in certain areas.* Methods of protection – *learning about methods of protection that are used in Croatia and the world.* Video recording – *watching a video created within the SASPAS project and the Posidonia keeper campaign.*

3. Habitat mapping and condition monitoring
Goal: To familiarize participants with the distribution areas of *P. oceanica* meadow habitats in the Adriatic Sea and with the methods used when creating cartographic displays to get insight into the size of the area covered by the meadows, and techniques for collecting information about their coverage, density, and state of the meadows over the years.
Results: After „Habitat mapping and condition monitoring “, the participants will be able to: • list the methods of mapping habitats, • use the National map of marine habitats, • list methods of carrying out monitoring of *P. oceanica* meadows, • explain the reasons for conducting this type of research.
Content: Habitat mapping – *introducing participants with the importance of creating cartographic displays and their role in the management of protected areas.* Monitoring of *P. oceanica* meadows – getting familiar with *the reasons for conducting monitoring of meadows according to professional standards.* Continuous monitoring – *familiarizing participants with the areas where monitoring is conducted, and the results obtained so far.*

4. Methodology of monitoring the state of meadows
Goal: To familiarize participants with the protocol for monitoring the state of the seagrass meadows, aiming to provide theoretical knowledge about the methodology implemented in the field.
Results: After „Methodology of monitoring the state of meadows “, the participants will be able to: • present the theoretical part of implementing the monitoring of *P. oceanica*, • use suggested protocol for monitoring of *Posidonia* meadow on the island of Lokrum, • recognize the methods of monitoring pressures on the habitat and species.

Content: Methodology of monitoring the state of *Posidonia* meadows – *theoretical display of methods for conducting monitoring of P. oceanica meadows.* Protocol – *familiarizing participants with the protocol that is suggested for monitoring of Posidonia meadows on Lokrum island.* Video recording – *Watching a video about monitoring as an introduction to the practical part.*

Practical part

Target group: divers active around Dubrovnik and its surroundings who fulfil the conditions listed in the Chapter 2 *Training program.*
Event place: micro-location on Lokrum island defined in cooperation with PI Reserve Lokrum.
Program duration: 3 hours.
Necessary materials: personal diving equipment, equipment for monitoring of *Posidonia* meadows, which includes a square for measuring the meadow's density (40x40), a construction meter (minimum length 10 m), data recording plates, a habitat inventory manual, documents necessary for participation listed in Chapter 2: *Training program*.
Program leader: Sunce employee.

5. Practical part
Goal: To conduct monitoring of the meadows at the micro-location, applying the knowledge gained through the theoretical part.
Results: After the practical part, the participants will be able to: • actively take part in conducting monitoring of *Posidonia* meadows, • learn the methodology of monitoring in-situ.

Content:
Going to the field –*participants follow the experts to the location from which they will begin the dive.*
Briefing – i*ntroduction to the tools and plan for conducting the practical part of the educational program.*
Diving – d*iving to the predetermined location to carry out monitoring under expert supervision.*
Debriefing – *evaluation of all phases of the conducted field part of the education program through group discussion.*
Data entry – *familiarizing with the data entry in tables which are used during data processing with expert supervision.*

5. PROGRAM EVALUATION

Evaluation of the *Educational training program for monitoring marine habitat type 1120 Posidonia meadows (*Posidonion oceanicae*)* will be conducted using a pre-prepared evaluation sheet. The results of this evaluation will be used to improve the future organization and implementation of educational programs by Sunce and Public Institution Reserve Lokrum.

6. CONCLUSION

*Educational training program for monitoring of marine habitat type 1120 Posidonia meadows (*Posidonion oceanicae*)* will enable local divers (as well as the wider public, and representatives of project partners) to gain knowledge and skills which they can use in future research activities in the area of Lokrum Reserve.

Beyond educating divers on the methods of monitoring *P. oceanica* meadow, the impact of this program has broader impacts. It will raise awareness among the wider public about *P. oceanica*, the ecosystem services it provides, and the human activities that negatively affect it.

This program serves to educate non-professional researchers and falls within the category of citizen science educational programs. By definition, citizen science includes the participation of the general public or non-professional researchers in research, data collection, and classification, thereby enhancing the capacities of both the scientific and expert communities.

7. LITERATURE

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Educational training program for monitoring *Zerynthia cassandra* and *Euplagia quadripunctaria*

Conversano, March 2024.

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Italy – Croatia

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Project title: Awareness raising, training, and scientific research activities on species and Habitat of Community interest

Project ID and acronym: ITHR0400170 - HABI

Authors: Mr. Enrico Altini – Association Polyxena

Ms. Daniela Clemente – Association Polyxena

1. INTRODUCTION

The study was carried out to verify the presence/absence of two species of Lepidoptera: the butterfly *Zerynthia cassandra* and the moth *Euplagia quadripunctaria*. The species of butterfly is mentioned in Annex IV of the Habitats Directive 92/43 EEC, instead the moth species is mentioned in Annex II of the same Directive (species of community interest whose conservation requires the designation of special conservation areas). Both species are not threatened but the low spread capacity makes their populations vulnerable to fragmentation, and therefore require rigorous protection, as provided for in the Community annexes. This study can be useful to gain informations on the populations of these two insects and deemed particularly useful for planning the conservation of the species and providing useful guidelines for the management of their habitats. The study was carried out in the spring of 2024 for what concern *Z. cassandra*, and in the summer of the same year for what concern *E. quadripunctaria*.

2. TRAINING PROGRAM

The Educational training program for monitoring Zerynthia cassandra and Euplagia quadripunctaria will take place in Castiglione location, Conversano. The training program activity will take place in April 2024, while the training activity with the project partners will take place in June 2024.

For the activity in April 2024, school classes (of all levels) will be involved in these participatory scientific monitoring activities, so this study can be assume a form of a citizen science research. The studies and the citizen science activities will be conducted through the scientific investigation methodologies of "transects" (Pollard & Yates 1993) and "light trap". In a period of important environmental changes, such as the climatic on, in which more and more young are involved and sensible in these issues, citizen science help them to obtain a conscious and collective participation in environmental management.

During the butterfly monitoring phase, public participation will be used public in the research actions. The training course will make it possible to experiment with a teaching mode highly innovative that provides for social participation in the processes of shared knowledge, integrating scientific expertise, interests, experiences and different points of view. Through field trips, the educational journey will be articulated by delving into topics related to biology, ecology and ethology of Lepidoptera Ropalocerae. A practical training course, with strongly applied connotations, which aims to provide an introductory view to the study of Butterflies. The basics will be provided on the identification of the main species, presented useful tools to assess and monitor the health status of the environment through the use of Butterflies as bio-indicators.

Polyxena Association will provide the materials necessary for monitoring Zerynthia cassandra and Euplagia quadripunctaria, including monitoring equipment.

3. EDUCATIONAL TRAINING PROGRAM PLAN

Educational training program for monitoring Zerynthia cassandra and Euplagia quadripunctaria.I will take place in the order stated in this document.

09:30 – 10:00	**WELCOME NOTE AND BRIEF INTRODUCTION OF THE EVENT** Visitors will be welcomed by guides from the Polyxena Association, which is monitoring Zerynthia cassandra and Euplagia quadripunctaria. Immediately afterwards visitors will move to one of the monitoring transects.
10:00 – 11:30	**CITIZEN SCIENCE SESSION 1** At the monitoring site, at the "Castiglione" location, the citizen science session will start. The trail is about one kilometer long and is accessible to all. Participants will be equipped with the tools for capturing and recognizing lepidopterans. They will also be able to admire one of the most picturesque stretches of the Apulian countryside.
11:30 – 13:00	**CITIZEN SCIENCE SESSION 2** At the monitoring site, at the "Castiglione" location, the second session citizen science activity will start. The trail is about one kilometer long and is accessible to all. Participants will be equipped with the tools for capturing and recognizing lepidopterans. They will also be able to admire one of the most picturesque stretches of the Apulian countryside.

Objectives:

- To increase basic scientific literacy through activities hands-on, and individual citizens' sense of belonging to the territory;
- making the territory known and reconstructing its history, to appreciate the evolution and the connection that man has had with it and to outline a new model of future eco-sustainable development;
- the activation of socially inclusive and gender equal.

Zerynthia cassandra (Zerinzia)

Population size estimate. Through the data obtained from the semi-quantitative transects we will obtain a flight curve that allows us to know the phenology and relative abundance of the population, furthermore will need to be compared between areas and over the years.

Estimation of habitat quality for the species. The main parameters are represented by density of plants of the Aristolochia genus and the degree of shading; also the intensity of grazing and mowing must be moderate (Vovlas et al., 2014). The evaluation of these parameters will have to be extended to the chosen surface and repeated over the years. 5x5 squares whose center point comes are useful georeferenced; 5 squares per hectare of extension may be sufficient.

Field actions. Frequency and period. Sampling must be carried out in the months of emergence of the adult, at least weekly. The larvae should instead be looked for starting from the end of flight period. They are active throughout the day in good weather conditions.

Estimated working days per year. To achieve effective monitoring, a population would go sampled for the entire eligible period, for a total of approximately 8 days of work. Minimum number of people to employ. Number of monitoring to be carried out over the six years pursuant to art. 17 of the Habitats Directive. Monitoring must be repeated 1st and 2nd year + 5th and 6th year (the first year is used to obtain preliminary information, for where if the population is already known, the number of years can be reduced from 4 to 3; in case it was possible only carry out two years of monitoring, it is recommended to schedule them one after the other).

Critical issues and impacts. The main threat factors are represented by abandonment and destruction of rural areas, with the consequent degradation of meadows and clearings and the extension of forests with closure of clearings. This determines, in fact, the disappearance of the host plants and the possible extinction of local populations.

Euplagia quadripunctaria (Falena dell'edera)

Monitoring techniques. The monitoring protocol involves the use of light traps, standard methodology used for nocturnal moths which allows sampling a large number of specimens with very little effort (Holloway et al., 2001; Trizzino et al., 2013). For this species however, the method is perhaps not so efficient and its attractive capacity will have to be estimated from time to time.

Population size estimate. The proposed method does not allow obtaining an exact estimate of the abundance of a population, but can be used to measure the change in its

population values over time. However, a rough estimate can be obtained by calculating the average of the values obtained for each sampling session.

Estimation of habitat quality for the species. The most important parameter for estimating quality of the habitat of E. quadripunctaria is the absence of phenomena that could produce excessive degradation of the same.

Field actions. Frequency and period. Sampling must be carried out in the summer months, from June to September, at least weekly.

Estimated working days per year. Each population should be sampled for the entire eligible period, however a total of approximately 10 days of work. Number of monitoring to be carried out over the six years pursuant to art. 17 of the Habitats Directive. A single one is enough monitoring over six years.

Critical issues and impacts. Although at a European level the species presents critical issues from one point of view conservationist, in Italy E. quadripunctaria is quite common and none of the known populations appear run the risk of becoming extinct in the immediate future.

4. PROGRAM EVALUATION

Evaluation of the *Educational training program for monitoring Zerynthia cassandra and Euplagia quadripunctaria* will be conducted using a pre-prepared evaluation sheet. The results of this evaluation will be used to improve the future organization and implementation of educational programs by Polyxena Association and Comune di Conversano.

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