

DORY - Capitalization actions for aDriatic marine envirOnment pRotection and ecosYstem

PA 3 – Environment and cultural heritage

Specific Objective 3.2 - Contribute to protect and restore biodiversity

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D.4.1.1 Guideline for the implementation of CB enhancing measures

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Introduction

This Guideline includes a best practices collection of the pilot actions implemented within the Ecosea project and a set of management indications for the implementation of new and improved pilot actions based on the evaluation of the most efficient, effective and replicable ones.

In general about DORY

DORY project, promoted by 4 Regions (IT), 1 County and 1 Development Agency (HR) and 2 Research Centres (IT,HR) intends to capitalize ECOSEA results and its cooperation network, to strengthen Adriatic institutional dialogue and promote the adoption of common management models for sustainable fisheries to reduce economic activities threats on Adriatic marine stocks, and knowledge based tools to enhance biodiversity in terms of priority and essential fish habitats and to halt aquaculture ecological impact. Focusing on Italian and Croatian area, DORY will carry out pilot activities to test the cross-border management model on high commercial value. Moreover, DORY will carry out pilot application of innovative techniques to reduce fishing activity impact on overexploited stock and reduce aquaculture activities ecological impact.

There are three (3) Specific objectives in DORY;

1. Promote science-based and common management models for sustainable governance of Adriatic fisheries
2. Test sustainable practices for biodiversity restoration and aquaculture ecological impact reduction.

The project intends to act at a twofold level to increase the vitality of the Adriatic marine stocks and the good status of sea habitats. Indeed, on one hand, DORY aims at enhancing the magnitude of shared ichthyic stocks, also increasing Adriatic biodiversity, by protecting priority and essential fish habitats. On the other hand, it is oriented to improve ecological sustainability of current aquaculture activities, therefore reducing their impacts on Adriatic ecosystems, by testing new methods and practices both in Italian and Croatian coastal area. Specifically, building upon the ECOSEA pilot activities in different Adriatic areas, the project aims to consolidate the best practices experienced and to spread their application in different high value and protected habitats. The specific objectives of the pilot projects are:

- Protection of commercial species nursery areas and improvement of biodiversity through the testing and adoption fish stock restoration measures;
- Reduction of ecological impact of mussel aquaculture through the testing and adoption of ecologically sustainable farming materials and methods.

3. Empower public actors towards integrated and ecosystem-based management of sea resources

ECOSEA outputs will be capitalized in the IT-HR CB area, through the DORY, by:

- strengthening the Advisory Board approach, within the PSC (WP1)that will steer and orient project actions and manage proposals
- further testing the cross-border model for Adriatic sustainable fisheries management on 2 other shared stock of high commercial value (Common Sole and Cuttlefish) towards a common management plan
- further testing the impact of the fisheries management measures trough the advanced MSP decision support tool (DISPLACE), proposing an integrated and complete range of options to evaluate the potential future impacts of alternative interventions in Adriatic and achieve the goals of ecosystem-based management;
- implementing in further CB areas the most effective pilot actions to enhance stock, increase biodiversity, protect priority and essential fish habitats and reduce ecological impact of aquaculture

Pilot actions in DORY

The previous ECOSEA project (Adriatic IPA CBC 2007-2013) has proposed solutions for a common vision in terms of sustainable management of fisheries resources and on the other hands has conducted several pilot actions oriented to revitalize the marine habitats

DORY will capitalize ECOSEA Pilot activities achievements that contributed to the improvement of the status of Adriatic fisheries habitats, improving the potential of nursery areas and testing sustainable aquaculture practices.

Since ultimate goal of the implementation of Work package 4 *CB enhancing measures: Pilot actions to enhance nursery areas and reduce aquaculture impact* is development of a common methodology and common guidelines based on a review and fine-tuning of the ECOSEA achievements which will easier the transfer process in other regions and organization outside the current partnership, a questionnaire was prepared for all projects Managers. Data collected by filling in the questionnaires was uniformed data, which facilitated the process of evaluation and guidance of acquired results.

Role of each beneficiary (from the DORY project application)

Veneto Region and Zadar County will jointly develop and test new techniques for sustainable aquaculture practices aimed at reducing ecological impact of mussel farms by the adoption of ecologically sustainable materials and methods, extending testing stage in different habitats of Adriatic Sea. Friuli Venezia Giulia will test active restocking techniques to enhance cuttlefish stock and



contribute to particular sensitive marine environments preservation, also monitoring the most important spawning periods and nursery areas. Emilia Romagna Region will test specific and improved devices to safeguard cuttlefish eggs development within marine areas allocated for shellfish farming and affected by the shellfish farms presence.

Identification of pilot projects (QUESTIONNAIRE)

	Veneto Region	Emilia-Romagna Region	Friuli Venezia Giulia Region	Zadar county
1. Pilot activity in the ECOSEA that will be capitalise on in DORY	WP 5.4 - Models for a sustainable management of the Adriatic fishery: The objective of the pilot action was to lower the environmental impact of mussel farms by experimenting the use of a new, highly automated and environment-friendly technology, and using biodegradable cotton mesh bags instead of plastic ones.	WP 4.2 – action 1 - Interventions aimed at safeguarding the development of eggs of cuttlefish (<i>Sepia officinalis</i>) inside areas with presence of shellfish facilities	WP 4.2 Restocking of cuttlefish in the Friuli Venezia Giulia Region	WP 5.4 Models for a sustainable management of the Adriatic fishery. Innovative and environmental sustainable techniques for aquaculture which were tested in Veneto and Puglia regions
2. TOR of pilot project, problem identification, project objective or purpose	Mussel farms in the Northern Adriatic presently generate a considerable amount of plastic waste, due to the plastic mesh bags used to cultivate the molluscs in the water column. The objective of Veneto Region's pilot action will be to test the effectiveness for mussel farming of mesh bags made of biodegradable bioplastic materials, and to assess their integration in the farming activity without the need for major	Cuttlefish is a species caught by small-scale fisheries using set nets and traps and by trawlers. Catches of this species are fluctuating over time, but a general decrease has been observed in the last few years. This action is aimed at protecting cuttlefish eggs and hence improving the recovery of the stock. Dedicated spawning substrata will be used inside mussel farms, where the potential	The capitalisation of the ECOSEA positive outcomes obtained from the restocking of cuttlefish will specifically regard the implementation of the most effective methodology to protect and possibly increase the cuttlefish stock. The oriented application of such methodology will be specifically aimed at collecting, preserving and verifying the	The pilot project proposes the use the existing long line mussel farm in allocated zone for aquaculture (AZA) to apply and adopt experiences of continuous line mussel farming technology, obtained through EcoSea project in Veneto region. The objective is to reduce plastic waste and to increase productive capacity of AZA. The main problem is the

	<p>modifications of the gear installed on-board, and of the productive process.</p>	<p>impact of human activities is very low.</p>	<p>hatching success of cuttlefish eggs.</p>	<p>size of the AZA that are not suitable for large-scale production. The equipment necessary for project implementation will be defined during the course of the project. It will be established what equipment is already at the disposal of Zadar County, what equipment needs to be provided by the farmer, and what equipment needs to be purchased.</p>
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<p>3. Why pilot project needs to be done</p>	<p>The results of EcoSea pilot action on the experimentation of “New Zealand-type” mussel farms showed the potential of the method for reducing environmental impact and streamlining the productive process, but also highlighted several criticalities that make the adoption of that method on a large scale difficult. Basically, the conversion to the New Zealand method would require large investments for the acquisition of new gear, the fitting of the existing vessels would be difficult due to dimensional constraints, and the farm operators would require extensive training to operate the new system. On the other hand, continuous-rope mussel farms are best suited to sheltered conditions such as those found in fjords or enclosed bays, while the open sea conditions of the Italian side of the Northern Adriatic Sea pose a threat of damage and production loss due to storms and other weather events.</p>	<p>The pilot action goals will be twofold: the study and production of collectors for cuttlefish eggs and validation of the efficacy of the system; and the raise of awareness and interest both among fishermen and shellfish farmers, which will be informed about the importance of the setup of action aimed at fostering the spawning of <i>Sepia officinalis</i>.</p>	<p>In a context characterised by a constant decrease of the cuttlefish stock, we intend to investigate and possibly reduce the causes of such decrease and moreover to train fishermen towards a more sustainable activity</p>	<p>Zadar County included aquaculture in its County Development Strategy 2016-2020 pursuant to the Common Fisheries Policy of the EU. In the spatial plan of Zadar County, aquaculture is listed in the group of economic activities of interest to the County, and a related integral management process has been initiated. This has resulted in the establishment of allocated zones for aquaculture (AZA). The selected area of Velebit Channel and Novigrad Sea has been allocated for shellfish farming. This is an especially sensitive area, located in the zone of many Natura 2000 areas both on land and in the sea. Considering that Zadar County pays special attention to the ecological sustainability of developmental projects, the development must be based on</p>
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	<p>Therefore, Veneto Region's pilot action aims to answer the need for a simpler method for reducing the environmental impact of the plastic waste produced by mussel farms: the goal is to identify an alternative material for the mesh bags, that must be totally biodegradable so to eliminate the plastic waste, while ensuring the same performance of plastic mesh and requiring no change in the production process, expertise required and/or gear employed.</p>			<p>the elements of the EU 2020 development strategy encouraging research, development, and investment in clean technologies. Shellfish farming based on the experience of application of the New Zealand technology in the Adriatic Sea, acquired through the "ECOSEA" project in the Veneto region, will surely present a challenge to Zadar County.</p>
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<p>4. Dynamics of implementation</p>	<p><u>Start of the pilot project</u> Within May 30th: signature of the contract for the experimentation service with a mussel-farming company. July-August: Start of experimentation</p> <p><u>Dynamics of procurement of external services</u> The mussel-farming company that will carry out the experimentation will be selected through public procurement. At least 5 companies will be asked to submit their best offer to perform a full production cycle using biodegradable mesh bags (see point <i>d</i> for details), to monitor the advancement of the experimentation, submit regular progress reports, and a final report.</p> <p><u>Dynamics of equipment procurement</u></p>	<p><u>Start of the pilot action</u> Between April / May 2019 (springtime). It should be planned in parallel with the reproduction cycle of <i>Sepia officinalis</i>, which means</p> <p><u>Dynamics of procurement of external services</u> Plan is to tender services out, through a procurement procedure aimed at selecting an economic operator from the regional territory. A market investigation will be carried out for the selection of the contractor, in consideration of the amount of the procurement and under the EU directives, the national procurement rules and the Programme rules for procurements (simplified procedure allowed under the regional procurement regulation).</p>	<p><u>Start of the pilot action</u> Spring 2018</p> <p><u>Dynamics of procurement of external services</u> Public advice</p>	<p><u>Start of the pilot action</u> Spring 2018</p> <p><u>Dynamics of procurement of external services</u> Procurement for The services of an expert with experience in the ECOSEA project implementation that are necessary for the purposes of the DORY project will start in April (single tender)</p> <p>Public procurement for selection of The mussel-farming company that will carry out the experimentation will start in April.</p> <p>Procurement for The services of an biologist will start in July</p>
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	<p>At least 5 manufacturers will be identified and required to ask to submit their best offer to provide the biodegradable mesh bags to be tested. If possible, several types of material will be sourced and put to test.</p> <p><u>Implementation dynamics of the most important tasks</u> Preliminary tasks: <i>Within May 30th</i> – Identification of the mussel farm that will host the pilot action <i>June/July</i> – Identification of the manufacturers and sourcing of the mesh bags</p>	<p><u>Dynamics of equipment procurement</u> Equipment will be acquired through appropriate procurement procedures, in consideration of the amount of the procurement and under the EU directives, the national procurement rules and the Programme rules for procurements (simplified procedure allowed under the regional procurement regulation), if necessary and not included in the tender specific terms for the service/monitoring providing.</p> <p><u>Implementation dynamics of the most important tasks</u> Main tasks of the pilot action are: the selection of the areas for the experimentation, the manufacturing, preparation and laying of the collectors in the areas chosen, the monitoring and evaluation of the performances and parameters as required. The</p>	<p><u>Dynamics of equipment procurement</u> Equipment will be directly procured by the external expertise</p> <p><u>Implementation dynamics of the most important tasks</u> Involvement of small scale fishermen in the collection and the maintenance of the cuttlefish eggs Involvement of biologists both for the collaboration with</p>	<p><u>Dynamics of equipment procurement</u> <i>Within June 30th</i> Equipment will be acquired through public procurement (Open procedures)</p> <p><u>Implementation dynamics of the most important tasks</u> <i>Within April 30th</i> – Identification of mussel-farming company that will carry out the experimentation <i>Within June 30th</i> – purchased equipment</p>
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	<p>Implementation of a full production cycle using biodegradable mesh bags, in detail: <i>July/August</i> – Fitting of at least 2 rows of 500m each of mussel farm with bioplastic mesh bags <i>Every two months</i> – on-site checks to monitor the development of the experimentations (conditions of the tested mesh bags, mussel growth, presence of plastic waste) <i>Late spring 2019</i> – Perform harvest trials for commercial purposes</p> <p><u>Planned term for presentation of results</u> June 2019</p>	<p>selection of the pilot action implementation areas will be carried out in agreement with the operators of aquaculture plants; the underwater and surface checks, as well as the analysis and evaluation of the results achieved, will be carried out with the support of the technical staff responsible for monitoring the project. Monitoring and evaluation activities will include the environmental parameters, the efficacy of the equipment, the results of spawning, according to the outputs of the previous ECOSEA project. <u>Planned term for presentation of results</u> April 2019 reporting of results - May 2019 final report</p>	<p>fishermen and for the monitoring and the evaluation of the results of restocking activity</p> <p><u>Planned term for presentation of results</u> June 2019</p>	<p><i>June 2019</i> – Perform harvest trials for commercial purposes</p> <p><u>Planned term for presentation of results</u> June 2019</p>
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<p>5. Experiences, skills and knowledge which will be transfer from ECOSEA to DORY</p>	<p>EcoSea allowed to test an alternative, low-impact and highly efficient method of mussel farming and made it possible to identify its inherent criticalities that prevent its introduction on a large scale in the northern Adriatic context. On the other hand, the project resulted in the establishment of an active exchange network between the PA and the mussel farming sectors, and the experience gained in the pilot actions of EcoSea WP 5.4 and also WP 4.3 (<i>Deployment of artificial reef structures under a mussel farm, to enhance biodiversity and nursery effect</i>) provided an in-depth understanding of the sector issues and needs in the area. Veneto Region's pilot action intends to build on this knowledge and network.</p>	<p>This pilot action will capitalize the previous experience of the ECOSEA project, which will be updated, improved and amended where appropriate.</p>	<p>Small scale fishermen, already trained in the ECOSEA project, will be again involved in the cuttlefish pilot action More fishermen will be involved in the pilot action, so extending the study area and also implementing the collection of cuttlefish eggs The involvement of more fishermen will allow to optimise the transferring of good practices to the cuttlefish small scale fishery sector</p>	<p>Zadar County will implement and adapt the pilot project of transfer of New Zealand mussel farming technology, tested within the ECOSEA project in the Veneto region, to the farming areas in Zadar County. Compared to the classic farming technology, the New Zealand technology in principle enables greater cost-efficiency in farming and a significant reduction of technological waste. One of the key steps in the implementation of this pilot project is the transmission of acquired knowledge, experience and necessary skills from the Veneto region to Zadar County.</p>
<p>6. Specify deficiencies or errors in ECOSEA that</p>	<p>Within the scope of the pilot actions on mussel farms, the main deficiencies were related to issues with public procurement procedures</p>	<p>The collectors used for the pilot action of the ECOSEA project should have met the needs not only of the cuttlefish, but also of</p>	<p>With respect to the two types of collection devices used in ECOSEA, we intend to focalise</p>	<ul style="list-style-type: none"> - Validation and estimation of the necessary equipment - Management gaps of continuous mussel farming

<p>will be supplement/correct through DORY</p>	<p>that caused substantial delays in the start-up phase, to the point of putting the realization of the pilot action at risk. Such issues will be dealt with in the present project.</p>	<p>other marine species (<i>Crassostrea angulata</i>, <i>Tritia mutabilis</i>). So, once the laying was carried out, the equipment was left at the bottom of the sea for years even after the end of the project activities; however unexpected problems arose on the anchorage resistance and these problems also had negative repercussions on the aquaculture plants production. With the pilot action DORY, we estimate to increase the number and efficiency of the collectors, strengthening their resistance against storms, as well as evaluating other possible alternatives (greater number of collectors per unit of length, greater number of long lines inside of clams farms, manifolds of different shapes, greater stability and resistance of the long line to the sea storms).</p>	<p>on the most effective device as the longline</p>	<p>- Solutions for handling problems with equipment and machinery Expert from Veneto region will be engaged with the intent to transfer experience and to recommend adaptations in technology and work methods.</p>
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7. New knowledge and/or skills and/or outlines that will be gain through pilot project	<ul style="list-style-type: none"> - Assessment of the feasibility of substituting the plastic mesh bags in mussel farms with biodegradable ones - Identification of the bioplastic material best suited to the task - Guidelines for the introduction and handling of the new mesh bags in the production cycle - Evaluation of the possible public measures/incentives/aids to favour the transition to the new material. 	A greater number of collectors per long-line unit, differently shaped collectors, the experimentation of stronger anchorages should allow obtaining a measurable improvement in the performances expected in terms of spawning increase and protection of <i>Sepia officinalis</i> and other marine species.	<p>Awareness of the importance of specific fishery procedures evaluated by the pilot action for the protection of cuttlefish eggs</p> <p>Maintenance of the best cuttlefish fishery practices also after the end of the project</p>	<ul style="list-style-type: none"> - Adaptation and adoption of continuous line mussel farming (New Zealand) technology in the AZA of Zadar County - Awareness of mussel farmers on the ecological importance and social and economic benefits - Possibility to define the production capacity of AZA in regards to the sustainability of the applied technology - Economic assessment of applied technology is foreseen
8. Potential problems	<ul style="list-style-type: none"> - Delays in the public procurement procedures - Difficulties in sourcing mesh bags of biodegradable material suitable for the required application 	The main technical problem consists in the difficulty to ensure constant qualitative standards of efficacy and resistance for the collectors tied to the long-line. It	Adverse marine conditions that seem to influence the timing and the consistency of cuttlefish stock moving from	<ul style="list-style-type: none"> - Delays in the public procurement procedures - Restricted surface of AZA is limiting factor for the investments and directs the

	<p>- Non-compliance of the public contractor</p>	<p>has to be evaluated whether the proposed technique of reproduction of <i>Sepia officinalis</i> is consistent with the peculiarities of the shellfish farming areas (i.e. distance from the coastal areas; depth of the sea; temperature and transparency of the water, etc.). Another technical-administrative issue could be to find out on the territory a range of economic operators adequately skilled, mostly with reference to the manufacturing and preparation of the collectors for the cuttlefish eggs. A scarcity of potential candidates for the selection of the service providers could hamper the results expected.</p>	<p>the deep sea to the coastal waters</p>	<p>scale of technology and costs of the equipment. However, minimal equipment is required for proper testing of new breeding technology. The assessment of the required equipment and modality of application, will also define the assessment of the output efficiency and recommendations for the adoption of such technology</p>
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VENETO REGION

The “Guidelines to incorporate and build upon ECOSEA results” recommends for capitalisation the innovative and environmental sustainable techniques for aquaculture, which were tested in Veneto and Puglia regions (WP 5.4). Specifically, this refers to the new technology for mussel farming, where biodegradable cotton mesh bags were used instead of plastic ones. Emphasis has been put on the objective of the Common Fisheries Policy is to ensure aquaculture activities that provide long-term sustainable environmental conditions, which are necessary for economic and social development contributing to increased productivity, a fair standard of living, stable markets, and availability of resources and that supplies reach consumers at reasonable prices. The results of ECOSEA pilot action in the Veneto Region showed the potential of the method for reducing environmental impact and streamlining the productive process, but also highlighted several criticalities that make the adoption of that method on a large scale difficult. Therefore, Veneto Region’s pilot action aims to answer the need for a simpler method for reducing the environmental impact of the plastic waste produced by mussel farms.

SWOT-analysis of the pilot project

Strengths	Weaknesses
<ul style="list-style-type: none"> • The EcoSea project resulted in the establishment of an active exchange network between the PA and the mussel farming sectors, and the experience gained in the pilot actions provided an in-depth understanding of the sector issues and needs in the area • Experiences, skills and knowledge obtained in ECOSEA project are the bases for further innovative attempt through the pilot project • Mussel farmers are interested in improving the sustainability of the production • Biodegradable plastic material is available. 	<ul style="list-style-type: none"> • Biodegradability of mesh bags can cause premature weakening of network material by consequent loss of farmed mussels. • Biodegradable plastic could be not as strong as the conventional one and increase the risk of production losses.
Opportunities	Threats
<ul style="list-style-type: none"> • The "DORY" project is the opportunity to apply the lessons learned from the "ECOSEA" project and to correct the identified problems. • New technology significantly reduces plastic waste 	<ul style="list-style-type: none"> • Delays in the public procurement procedures • Difficulties in sourcing mesh bags of biodegradable material suitable for the required application • Non-compliance of the public contractor

<ul style="list-style-type: none"> Adapting the breeding technology to the present capacities and usually used gears can significantly reduce the investments. 	
<p>Mitigation measures or/and alternative methods which will be used to reduce the impact if some negative situation affect the Dynamics of Implementation</p>	

Determining the needs based on SWOT analysis

The EU's Common Fisheries Policy as an integral part of Integrated Maritime Policy where sustainability of the economic growth primarily encompasses the objectives of the "EU Biodiversity Strategy to 2020" as well as the objective of good environmental status by 2020 in the Marine Strategy Framework Directive. The EU's priority to grow the sustainable aquaculture production. The objective of pilot action will be to test the effectiveness for mussel farming of mesh bags made of biodegradable bioplastic materials, and to assess their integration in the farming activity without the need for major modifications of the usually used gears.

Recommendations for implementing the pilot project:

- Duration of the pilot project should be for at least 14 months
The pilot project will be carried out in at least five farming companies selected through public procurement. Also at least five manufacturers will be identified and required to submit their best offer to provide the biodegradable mesh bags to be tested. For the proper evaluation of the applied technology through all seasons, at least a one-year breeding cycle should be tested.
- Comprehensive validation of the pilot project should consider the formal comparison between the existing and innovative breeding techniques.
Especially taking into account:
 - Time dependent comparison of the mechanical characteristics of used materials
 - Time dependent evaluation of biodegradation of new plastic material
 - Comparison of the yield of mussel production between classic and the applied innovative technology
- Economic evaluation of the project in terms of the comparison between classic and innovative technique of mussel farming would be useful for considering the use of the obtained results for other regions on the Adriatic Sea.
- Estimation of waste quantities difference between the existing and innovative farming
Technology per unit volume of production should be presented in the final report.

FRIULI VENEZIA GIULIA REGION

Following the “Guidelines to incorporate and build upon ECOSEA results” (WP 4.2) the pilot actions conducted within ECOSEA project oriented to protect and increase the cuttlefish stock will be capitalised in “DORY” project in the and *Emilia-Romagna* Region. The scope of capitalisation in the “DORY” pilot project of Friuli Venezia Giulia Region is selection of the most effective and efficient active cuttlefish restocking techniques, in order to enhance the availability wild population and to contribute to the preservation of particular sensitive marine environments. The application of selected methodology will be oriented to collect, preserve and verify the hatching success of cuttlefish eggs. Moreover, the pilot action will involve a wider number of operators and the testing stage will be extended to new study areas. The stakeholder will also monitor nursery areas and most important spawning periods.

SWOT-analysis of the pilot project

Strengths	Weaknesses
<ul style="list-style-type: none"> • Capitalisation of the ECOSEA positive outcomes obtained from the restocking of cuttlefish • The most effective methodology to protect and possibly increase the cuttlefish stock has been already identified in the ECOSEA project • Interest of small scale fishermen to be involved in the project • already trained fishermen during the ECOSEA project • The Adriatic spawning habitats of cuttlefish are known • The spawning period of cuttlefish in the Adriatic Sea is predictive. Catch analysis can help in fine tuning of deployment of the longlines • Cuttlefish is an important product of small-scale fisheries in Northern Adriatic 	<ul style="list-style-type: none"> • Analog transmission of conclusions from the limited experimental operation to the large-scale intervention could be erroneous. • Collection efficiency is expected to be dependent of the present spawning stock biomass (SSB). It means that lower SSB of cuttlefish would require larger restocking areas. • Long-term benefit could be insufficient to motivate fishermen to be engaged, on them own expense, in large-scale restocking activities, especially if the investment for the facilities would be included. • Deployment period of approximately 30 days (or more depending on temperature) contributes to the vulnerability of the deployed collectors • Adverse marine conditions that seem to influence the timing and the consistency of cuttlefish stock moving from the deep sea to the coastal waters • Allocating the nursery zones beyond the boundaries of the natural hatcheries could increase the exposure of the cuttlefish offspring to the natural predators

Opportunities	Threats
<ul style="list-style-type: none"> • The "DORY" project enables the transfer of knowledge and practices obtained from the "ECOSEA" pilot projects of restocking of cuttlefish • Estimation of cuttlefish eggs settlement in dependence on collector density • Estimation of the relation of the size of marine area allocated for restocking of cuttlefish and expected numbers of offspring • Regional management measures/activities of involved fishermen could be supported from EU fisheries found in the next financial period • Positive results in terms of cuttlefish stock size, and consequently more stable and abundant catch of cuttlefish • Temporarily closure for fishery in the allocated nursery areas • Development of eco-based management of fishery in the allocated zones for restocking of cuttlefish, with the purpose to target the predators of young cuttlefish during the nursery period. • Contribution to the future eventual regional small-scale fisheries management plan • Fishermen awareness of the importance of specific fishery procedures evaluated by the pilot action for the protection of cuttlefish eggs 	<ul style="list-style-type: none"> • Phytoplankton bloom in the North Adriatic during the recovery activities, and consequent oxygen depletion or even temporary hypoxia. • Fisheries derived damages. Uninformed fisherman could apply fishing activity in the allocated zone • The anchoring of recreational boats could damage the deployed longlines. • Concentration of incubated eggs into pilot cages can attract predators at the time of hatching which can significantly reduce survival of young cuttlefish.
<p>Mitigation measures or/and alternative methods which will be used to reduce the impact if some negative situation affect the Dynamics of Implementation</p>	

Main results of the analysis

The EU's Common Fisheries Policy as an integral part of Integrated Maritime Policy where sustainability of the economic growth primarily encompasses the objectives of the "EU Biodiversity Strategy to 2020" as well as the objective of good environmental status by 2020 in the Marine Strategy Framework Directive. Cuttlefish has important ecological and economic impact on the sustainable fishery in the Northern Adriatic area where a numerous protected areas have been declared. The allocated zones for egg collection and nursery areas are within those protected areas, which underlines the need for such innovation. The results of the cuttlefish restocking projects, within ECOSEA project, are encouraging

the implementation of the most effective methodology. This still represents the developmental stage of the idea to create an effective cuttlefish restocking programme with much clearer insight into possible final solutions.

The SWOT analysis analyses the ambience of the pilot project in terms of seated objectives as well as setting up the pilot project activities itself. The pilot project is based on the already obtained results from the ECOSEA project but is designed to clarify the missing fragments necessary for further practical application.

Recommendations for implementing the pilot project:

1. Pilot project duration should be at least 90 days
2. Pilot project activities should be consisted of procurement of the equipment, deployment of long-lines eggs collectors, monitoring of egg settlement, egg collection and transfer in the nursery area, monitoring of the hatching efficiency, monitoring of cuttlefish offspring abundance and evaluation of obtained data.
3. Bearing in mind that the assessment of eggs settlement and collection capacity will be carried out, it would be advantageous to estimate of the dependence of settlement on collector density, and such results could indicative in terms of the spawning cuttlefish density.
4. The presumptive problem of attracted predators on the settled eggs and especially on hatchlings, with a consequent predation, could greatly affect the pilot project objectives. Monitoring of the presence of predators, and if necessary, application of selective fishing activity targeting potential predators or additional barriers for predators would be recommended.
5. Estimation of necessary area surfaces, to obtain significant quantity of collected eggs, would be useful for the extended evaluation of the pilot project.
6. The possibility to transpose longlines with the cuttlefish eggs in the areas where hatchlings could find natural protection (seagrass beds, benthic communities rich with algae) and estimated comparison with obtained results should be commented within the final analysis.
7. Management recommendations should be important part of the final document

EMILIA-ROMAGNA REGION

Following the “Guidelines to incorporate and build upon ECOSEA results” (WP 4.2) the pilot actions conducted within ECOSEA project oriented to protect and increase the cuttlefish stock will be capitalised in “DORY” project in the Friuli Venezia Giulia Region and Emilia-Romagna Region. The aim of capitalisation in the “DORY” pilot project in Emilia-Romagna Region is to foster the numerical increasing of cuttlefish stock, by protecting spawning within the mussels breeding sites. The pilot action goals will be twofold: the study and production of collectors for cuttlefish eggs with concomitant validation of the efficacy of the system; and the raise of awareness and interest both among fishermen

and shellfish farmers, which will be informed about the importance of the setup of action aimed at fostering the spawning of *Sepia officinalis*.

SWOT-analysis of the pilot project

Strengths	Weaknesses
<ul style="list-style-type: none"> • Capitalisation of the ECOSEA positive outcomes obtained from the restocking of cuttlefish • The mussels breeding sites (long-line technology) are protected from fisheries derived damages. • The custom-made collectors for cuttlefish eggs were tested in the in the ECOSEA project • Interest mussel breeders to be involved in the project • The spawning period of cuttlefish in the Adriatic Sea is predictive. Catch analysis on the regional landing place can help in fine tuning of deployment of the longlines • Cuttlefish is an important product of small-scale fisheries in Northern Adriatic 	<ul style="list-style-type: none"> • Analog transmission of conclusions from the limited experimental operation to the large-scale intervention could be erroneous. • Collection efficiency is expected to be dependent of the present spawning stock biomass (SSB). It means that lower SSB of cuttlefish would require larger restocking areas. • Long-term benefit could be insufficient to motivate fishermen or mussel farmers to be engaged, on them own expense, in large-scale restocking activities, especially if the investment for the facilities would be included. • Deployment period of approximately 30 days (or more depending on temperature) contributes to the vulnerability of the deployed collectors • Adverse marine conditions that seem to influence the timing and the consistency of cuttlefish stock moving from the deep sea to the coastal waters • Hatching of the cuttlefish beyond the boundaries of the natural nursery areas could increase the exposure of the cuttlefish offspring to the natural predators
Opportunities	Threats
<ul style="list-style-type: none"> • The "DORY" project enables the transfer of knowledge and practices obtained from the "ECOSEA" pilot projects of restocking of cuttlefish • Estimation of cuttlefish eggs settlement efficiency in the off-shore shellfish farming areas 	<ul style="list-style-type: none"> • Phytoplankton bloom in the North Adriatic and consequent oxygen depletion or even temporary hypoxia. • The mussel farms emit mussel feces and pseudofeces, which settles on the seabed. Organic matter oxidative degradation of settled material can affect dissolved oxygen

<ul style="list-style-type: none"> • Estimation of the relation of the size of off-shore shellfish farming areas suitable for restocking of cuttlefish and expected numbers of offspring • Mussel farms will be possibly able to provide aquaculture environmental service to the fishery sector, which could be supported from EU fisheries fund. • Positive results in terms of cuttlefish stock size, and consequently more stable and abundant catch of cuttlefish • Development of eco-based management of fishery in the offshore shellfish farming areas during the restocking activities of cuttlefish, with the purpose to target the predators of young cuttlefish during the nursery period. • Contribution to the future eventual regional small-scale fisheries management plan 	<p>concentration in the bottom layer of the water column.</p> <ul style="list-style-type: none"> • Concentration of cuttlefish eggs, especially during post-hatching period can attract predators, which can significantly reduce survival of young cuttlefish.
<p>Mitigation measures or/and alternative methods which will be used to reduce the impact if some negative situation affect the Dynamics of Implementation</p>	

Main results of the analysis

The EU's Common Fisheries Policy as an integral part of Integrated Maritime Policy where sustainability of the economic growth primarily encompasses the objectives of the "EU Biodiversity Strategy to 2020" as well as the objective of good environmental status by 2020 in the Marine Strategy Framework Directive. Cuttlefish has important ecological and economic impact on the sustainable fishery in the Northern Adriatic area where a numerous protected areas have been declared. The allocated zones for egg collection and nursery areas are within those protected areas, which underlines the need for such innovation. The results of the cuttlefish restocking projects, within ECOSEA project, are encouraging the implementation of the most effective methodology. This still represents the developmental stage of the idea to create an effective cuttlefish restocking programme with much clearer insight into possible final solutions.

The SWOT analysis analyses the ambience of the pilot project in terms of seated objectives as well as setting up the pilot project activities itself. The pilot project is based on the already obtained results from the ECOSEA project but is designed to clarify the missing fragments necessary for further practical application.

Recommendations for implementing the pilot project:

1. Pilot project duration should be at least 90 days
Pilot project activities should be consisted of procurement of the equipment, deployment of egg collectors, monitoring of egg settlement, monitoring of the hatching efficiency, monitoring of ecological parameters in the bottom layer of water column under breeding installation and evaluation of obtained data.
2. The presumptive problem of attracted predators on the settled eggs and especially on hatchlings, with a consequent predation, could greatly affect the pilot project objectives. Monitoring of the presence of predators, and if necessary, application of selective fishing activity targeting potential predators or additional barriers for predators would be recommended.
3. The monitoring of the concentration of dissolved oxygen in the in the bottom layer of water column would be necessary to estimate the risk of the applied method for further application.
4. The possibility to transpose cuttlefish egg collectors with the cuttlefish eggs in the areas where hatchlings could find natural protection (seagrass beds, benthic communities rich with algae) should be commented within the final analysis.
5. Management recommendations should be important part of the final document

ZADAR COUNTY

The “Guidelines to incorporate and build upon ECOSEA results” recommends for capitalisation the innovative and environmental sustainable techniques for aquaculture, which were tested in Veneto and Puglia regions (WP 5.4). Specifically, this refers to the continuous rope system for mussel farming, using biodegradable cotton mesh bags instead of plastic ones. Emphasis has been put on the objective of the Common Fisheries Policy is to ensure aquaculture activities that provide long-term sustainable environmental conditions, which are necessary for economic and social development contributing to increased productivity, a fair standard of living, stable markets, and availability of resources and that supplies reach consumers at reasonable prices. The pilot project of implementation of continuous biodegradable rope system for mussel farming capitalizes the results from Veneto Region and test the applied techniques in existing allocated zone for aquaculture in Zadar County. The main objectives of the pilot project are to reduce the ecological impact of mussel farm and to increase productive capacity of the existing allocated zone for aquaculture (AZA). The testing is aimed at adaptation to the different habitat and specific aquaculture concept.

SWOT-analysis of the pilot project

Strengths	Weaknesses
<ul style="list-style-type: none"> • The ECOSEA project has already tested the method of continuous mussel farming in the Adriatic Sea • Experiences, skills and knowledge obtained in Veneto region will be capitalised in Zadar count • Aquaculture in the Zadar County has been declared a strategic activity • Zadar County implemented ICZM and identified and proclaimed AZA • Mussel farmers are interested in improving the sustainability of the production • Mussels are recognized on the local market with the significant share in the touristic gastro offer. 	<ul style="list-style-type: none"> • AZA are not large enough to develop the large scale industrial farming technology • Competition with tourism • Existing mussel aquaculture technology produces significant amounts of plastic waste • Primary production in the zones outside the Novigrad Sea significantly depends on the cumulative amount of precipitation • Huge amount of precipitation can significant reduce salinity ad endanger farmed mussels • Continuous line mussel farming is developed for large scale (industrial) mussel farming • Limited availability of equipment and services in the region.
Opportunities	Threats
<ul style="list-style-type: none"> • The "DORY" project is the opportunity for the transfer of knowledge, experiences and skills gained through the "ECOSEA" project. • New technology significantly reduces plastic waste • Adapting new breeding technology to smaller farms can significantly reduce the amount of plastic waste in mussel aquaculture in Zadar County • The usage of new rope-collectors for spat will significantly increase the production efficiency AZA • Part of the equipment used in the ECOSEA project Zadar County intends to engage in the DORY project 	<ul style="list-style-type: none"> • Truck cargo spill accidents on the nearby road • Marine traffic accidents • Spillage of fecal waters from nearby tourist resorts • Bivalve disease and attracted predators
<p>Mitigation measures or/and alternative methods which will be used to reduce the impact if some negative situation affect the Dynamics of Implementation</p>	

Determining the needs based on SWOT analysis

The EU's Common Fisheries Policy as an integral part of Integrated Maritime Policy where sustainability of the economic growth primarily encompasses the objectives of the "EU Biodiversity Strategy to 2020" as well as the objective of good environmental status by 2020 in the Marine Strategy Framework Directive. The EU's priority to grow the sustainable aquaculture production and decision of Zadar County to declare aquaculture to be a strategic activity, as well as the objectives of this project are the basics of the pilot project. Increased competition among potential beneficiaries in coastal area is expected. Therefore, innovative, economically and ecologically sustainable, technologies are needed to enable the growth of aquaculture and to reduce the possible tensions. The obtained knowledge, skills and practices, should be applied and upgraded specifically to the subject area.

Recommendations for implementing the pilot project:

1. Duration of the pilot project should be for at least 12 months
The pilot project consisting mussel spat collection and continuous line mussel production, should consider the entire growing cycle, and therefore should last at least 12 months.
2. Breeding technology should be adapted to the productive capacity and marketing strategy of the existing mussel farms.
The adaptation of the technology refers to the dimensioning of the investment with regard to the size of the farm; to the maximal theoretical production; to the request of available market; and to the present and planned infrastructure.
3. Comprehensive validation of the pilot project should consider the comparison between the existing and innovative breeding techniques.
Comparison of production results includes:
 - Comparison of spat collection between classical and new collectors
 - Comparison growth and condition of mussels farmed in classic and continuous line technique
 - Estimate of the annual yield per unit area of AZA
4. Economic evaluation of the project in terms of the production volume that economically justifies investment in tested breeding technology, and comparison between classic and continuous line technique of mussel farming.
Comparison of production results between existing and innovative breeding techniques includes:
 - Comparison of yields/income per unit area of AZA

- Comparison of production costs
 - Comparison of equipment requirements
5. Estimation of waste quantities difference between the existing and innovative farming technology. The assessment should compare the difference between input and output of raw materials / consumables / wasted equipment, per one productive cycle