

Deliverable Number D5.2.5

Protocol for the reduction of marine pollution

Project acronym: ARGOS

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Activity Title: WP5 “Improvement of fishermen operators’ behaviours”

Partner in charge: Marche Region PP3 with the scientific support of DiSVA – UNIVPM a

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Background and goals the ARGOS “Protocol for the reduction of marine litter”

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Marine litter threatens species and habitats, with impacts varying from entanglement and ingestion, to bio-accumulation and bio-magnification of toxics released from litter items, facilitation of introduction of invasive species, damages to benthic habitats, etc.

Marine litter has a negative impact on vital economic sectors such as fisheries, aquaculture, navigation, energy and tourism, while it may endanger human health and safety.

Looking at the fisheries and aquaculture compartments, on one hand they exert pressure on the environment in terms of contribution to marine pollution and, on the other hand, face various direct and indirect economic costs from marine litter. Fisheries and aquaculture are particularly reliant on plastic (gears, socks, packaging...) and a circular economy approach is thus becoming imperative to preserve income while protecting the marine environment.

The ARGOS “WP5 Sectorial know-how development and pilot project implementation”, foresees the implementation of pilot actions at regional level aimed at reducing marine pollution, improving the sustainable behaviours of fisheries and aquaculture operators. To this goal, the development of cross-border “Protocol” to support the creation and the adoption of a functional network among different operators (fishermen, local administration, waste disposal centres and researchers) could be very important for the Adriatic Sea sustainability. Specifically, the ARGOS “Protocol for the reduction of marine litter” prepared by Marche Region (project partner) and DiSVA - UNIVPM (scientific support body for the Marche Region pilot actions implementation according to an Agreement signed between the two public bodies) is aimed at promoting the development of an integrated system for the collection and management of marine litter. The objective of the Protocol is to acquire experience and knowledge useful for defining and consolidating an adequate co-management model for the interception, collection, transfer and disposal of marine waste with the direct engagement of local fishermen, public administrations, private and public research, social society.

In addition to the present Protocol for the reduction of marine litter, the project has explored technical and managerial opportunities to reduce the plastic use in the fisheries and aquaculture supply chain thanks to pilot actions carried out in the Adriatic Regions covered by the ARGOS activities.

As regards the aquaculture sector, in the Marche Region pilot actions were aimed to test new material, equipment's and practices as alternative solutions to plastic use in shellfish farming

and along the seafood supply chain. The regional pilot testing focused on testing compostable and biodegradable materials in mussels farming, oysters refinement and seafood packaging and was aimed to introduce this green approach at the aquaculture operators level. The pilot actions results were merged to outline the D.5.3.2 “Protocol for the diversification and labelling for more sustainable aquaculture practices” delivered by PP3 in cooperation with M.A.R.E. soc.coop.

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As regards to the fishing sector, the Marche Region Protocol for cuttlefish restocking (D.5.2.5) evidenced the microplastic contamination of cuttlefish embryos. A monitoring study for the evaluation of the quality of embryos laid by cuttlefish in front Marche Region coast and for the quantification of microplastic inside the embryos and their effects on embryonic development. The results obtained were published in a peer-review international journal <https://www.mdpi.com/2076-2615/13/1/95>. In this study, the presence of MPs in *Sepia officinalis* embryos from different sites of the central Adriatic Sea was observed for the first time. These preliminary results could suggest that the presence of MPs does not impact the embryo development and organogenesis. However, regardless of the pathway through which MPs enter the egg, a better understanding of their relationship with embryo and hatchling health and growth is required since these species will experience chronic exposure to MPs from the embryonic development to the adult phase. In this light, an annual monitoring program, including biometric, histological and molecular data, should be developed in order to assess the health status of cuttlefish embryos and the presence of MPs or other pollutants inside the yolk. This monitoring program should be extended to other sites of Italian and Croatian coasts to obtain a clear and complete assessment of the health status of the Adriatic cuttlefish stock.

Piloting marine litter reduction in fisheries: the ARGOS Protocol approach

The Protocol is conceived to capitalize the pool knowledge and tools already available and that have already proven to be successful into practices.

The Protocol for piloting marine litter reduction takes its ground from the desk survey of the best practices arisen from previous initiatives and projects carried out in Adriatic and at regional level as well as from the acknowledgment of the legislative framework.

The Protocol foresees the identification and the engagement of the key actors at very local level, taking into consideration their attitude, influence, and interest in the issue of marine litter reduction.

The main target group categories are shown in the box below.

- Fishermen
- Local administrations (e.g. Municipalities)
- Universities and Research centres
- Private advisory companies and business support organizations
- NGOs dealing with environmental protection
- Students
- Citizens

The Protocol is based on a set of desk activities and pilot actions carried out by Marche Region with the scientific support of the DiSVA – UNIVPM and the close cooperation with the local fishermen . The actions can be summed-up as follows:

1. *Preliminary activities*
2. *Collection at sea, packaging and disposal of marine litter after landing*
3. *Dissemination*

Preliminary activities

The first step of the present Protocol consisted in:

- pooling and leveraging the existing knowledge on the marine litter reduction initiatives in the Mediterranean, focusing on the fisheries and aquaculture compartments and the effective engagement of quadruple helix. The desk survey, carried out by PP3 and DiSVA- UNIVPM, enabled the identification of best practices potentially replicable to the Adriatic Regions and the ARGOS project context;
- providing a short overview about the operations/initiatives carried out with fishermen involvement financed in the programming period 2014/2020;
- outlining a common methodology for implementing a pilot collection and disposal of marine litter, in the identification of the pilot sites and in the engagement of local actors for the pilot action implementation at very local level.

The contribution of EU funds for marine litter reduction in the fisheries sector

Marine litter is generating increasing concern at international, regional, macro-regional and national levels. The European Union is playing its part in addressing the problem in particular by providing public support to mitigation actions undertaken by the fisheries sector through different funding opportunities.

In the programming period 2014/2020, the European Maritime Fisheries Fund supported operations of marine litter mitigation and this contribution was analysed in the Final report "Marine litter from the fishing sector "How is the fisheries sector using EU Funds to fight Marine litter?" delivered by the FAME Support Unit. The following considerations have emerged:

- actions for the mitigation of marine litter the EMFF had played only a minor role both in terms of the total number of EMFF operations and the budgets committed, and EMFF implementation progress has been slow as for the rest of EMFF operations.
- EMFF offered possibilities through different measures to involve the fishing industry in addressing the marine litter problem, the provision of facilities and equipment for marine litter collection, research studies, or awareness raising activities.

In conclusion, although interest by MS in utilising EU funding support to involve the fishing industry in the reduction of marine litter has drastically increased from the EFF to the EMFF programming period, indicators are lacking to evaluate the effectiveness and efficiency of the marine litter-related actions undertaken by the fishing industry itself or of direct benefit to that industry. Monitoring and evaluating such indicators would contribute to identifying the best approaches for

the involvement of the fishing industry in the reduction of marine litter in general, and of litter emanating from the fishing and aquaculture industry.

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Besides the EMFF, marine litter actions in the programming period 2014/2020 were also funded by other EU sources, namely:

- the EU LIFE Programme, the EU's financial instrument supporting environmental, nature conservation and climate action projects throughout the EU;
- the Horizon 2020 Programme, the EU's research and innovation funding programme 2014/2020;
- the INTERREG Programmes;
- the MARELITT Programme aimed at assisting EU Member States in achieving 'good environmental status' (GES) of all EU marine waters by 2020 by reducing the impact of marine litter on the coastal and marine environment, in particular MARELITT Baltic (Interreg Baltic Sea Region Programme; ERDF), reducing the impact of marine litter in the form of derelict fishing gear in the Baltic Sea.

Best practices

The issue of marine litter collection, disposal, and recycling in the Mediterranean (and Adriatic) regions has been, in fact, tackled by several EU projects and initiatives and their approaches and findings constitute a relevant stock of knowledge to be capitalized and leveraged. The desk survey took into consideration those projects dealing with fisheries and aquaculture sectors, reported in the following boxes:

The **FISH4FISH** project (<http://fish4fish.dbcf.unisi.it/>), co-funded by the European Maritime and Fisheries Fund 2012/2020, provided innovative, active, and sustainable packaging material based on chitinolytic derivative, using marine biomass waste.

De-Fish Gear project (<https://defishgear.net/>), funded by the IPA cbc Programme 2007/2013, undertook the challenge to address the emerging threats of microplastic and the need for accurate, coherent and comparable scientific data on marine litter in the Adriatic-Ionian macroregion. The project also targeted the recovery of “ghost nets” from the sea with the involvement of fishermen, establishing derelict fishing gear management schemes to collect and recycle lost or abandoned fishing nets and other gear. The DeFish Gear has extended the “Fishing for litter” Program (<https://fishingforlitter.org/>), launched by KIMO on 2004, to the Adriatic. Fishing for litter initiatives were undertaken by fishermen while performing their daily fishing activities, not only leading to removal of marine litter but also raising awareness on the issue within the fishing sector and the wider public.

In-No-Plastic (Innovative approaches towards prevention, removal, and reuse of marine plastic litter), a Horizon 2020 project, was aimed to develop and demonstrate nano-, micro-, and macro-plastic clean-up technologies in the aquatic ecosystems, piloting innovative approaches towards prevention, removal, and reuse of marine plastic litter. The project laid the foundation for new circular solutions of macro plastics mechanical and chemical recycling (<https://www.innoplastic.eu/circular-solutions>).

The **Clean Sea project** (<https://cleansealife.it/?lang=en>), co-funded by the LIFE Programme, was aimed to increase awareness of marine litter, empowering citizens to become part of the solution. The project carried out pilot actions in 4 Italian municipalities not only to remove a considerable amount of waste from the environment, but also to identify with fishermen and local authorities a feasible management process for marine litter. The project assisted both branches of the Italian Parliament to fine-tune the ‘Salva Mare’ law by testing the draft regulation during the project’s pilot fishing for litter activities and providing evidence-based reports; the law was finally approved in May 2022.

Collection at sea, packaging and disposal of marine litter after landing

The second step of the Protocol consisted in:

- the definition of a common methodology for implementing a pilot collection and disposal of marine litter
- the identification of the pilot sites at regional level
- the engagement of local actors for the pilot action implementation at very local level
- in the effective implementation of pilot actions for the collection at sea, packaging, and disposal of marine litter after landing in n. 2 pilot sites at regional level in cooperation with local fishermen, public administrations, NGOs, waste companies.

Material and methods

About the operators engagement for the implementation of the Protocol, priority has given to those fishermen already involved in the ARGOS pilot action for cuttlefish restocking (Project Deliverable D.5.2.6) and other initiatives aimed to adopt more sustainable practices in the fisheries activities. The overall goal was to consolidate their sustainable behaviours and the role of marine resources and traditions stewardship. Fishermen were engaged in the pilot testing directly by the DiSVA-UNVPM that was also responsible for the engagement of company which carried out waste collection, transport and treatment. For the pilot activity at San Benedetto del Tronto, PICENAMBIENTE SPA was selected not only because this company was already engaged in the “clean sea life” project but also because it together with the municipality of San Benedetto del Tronto, it continues to bear the costs of waste disposal despite the fact that the project has finished.

In addition, search and joint activities with NGO have been implemented. An international NGO “Project rescue Ocean” <https://projectrescueocean.org/>. DiSVA-UNIVPM operators met this NGO in Barcelona during the "seafood" international fair. This NGO supplies jute bags to be filled with waste collected on the beach or at sea anywhere in the world and then, via a specific Qr code, to share coordinates, date, weight and contents of the bag. After the pilot actions implementation and the results elaboration, a dissemination multilevel programme has been developed. Several dissemination activities have been planned and organized. Among them, interventions and interviews in television broadcasts, organization of social events, lessons for school groups and university seminars, have been organized as described in the Dissemination section.

Two pilot/demonstrative actions have been implemented in two pilot sites: San Benedetto del Tronto and Fano.

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The pilot action developed in San Benedetto involved two different fishermen using both trawling gears, but in different area of the Adriatic Sea. One fishing inshore, in front of San Benedetto coast, and one fishing offshore, Pomo/Jabuka Pit.

The pilot action developed in Fano involved the fishermen (trawling gear, inshore Fano coast) already involved in the ARGOS pilot action for cuttlefish restocking (Project Deliverable D.5.2.6) and other initiatives.

A set of 50 garbage bags has been delivered to each fisherman involved (n.5 in total). The garbage bags were coded for the collection of waste collected on board.

Once waste was collected during fishing operations, on board fishermen should collect it by separating in different bags:

- A. plastic fish packaging (bottles, flasks, bags, jars, etc.), if free from sludge and algal blooms
- B. glass, metal and wooden items), if free from sludge and algal blooms
- C. other types of waste

According to this Protocol, once in the port, the operators must take care to deposit the bags correctly in the special differentiated bins for the different types of waste. It is forbidden to deposit waste other than that envisaged in the protocol in the bins.

The discharge of the fished wastewater must obligatorily take place inside the bins using the bags delivered to each fisherman.

In case of collection of bulky waste, the fishermen must deposit it on the ground next to the bins. An *ad hoc* questionnaire for the monitoring of marine litter has been developed in order to characterize, classify and quantify waste collected by fishermen.

On a monthly basis, UNIVPM-DISVA operators have been responsible for classifying collected marine litter and for the questionnaire submission and compilation.

Location: _____ Date: _____ Operator Name: _____

Vessel Name: _____ Fishing gear: _____

Coordinates date and time of marine litter recovery: _____

waste classification:

Typology		Total weight	Number	Presence (Yes/No)
L1 plastics	a. bags			
	b. bottles			
	c. food wrappers			
	d. sheet (table covers etc)			
	e. hard plastic (crates, containers, tubes, lids – specify)			
	f. fishing nets			
	g. fishing lines			
	h. other fishing related (pots, floats - specify)			
	i. ropes, trapping bands			
L2 rubber	a. tyres			
	b. other (gloves, boot shoes, oilskins - specify)			
L3 metal	a. beverage cans			
	b. other food cans/wrappers			
	c. middle size containers (paint, oil, chemicals)			
	d. large metallic object (barrels, pieces of machinery, electric appliances – specify)			
L4 glass / Ceramics	a. bottles			
	b. pieces of glass			
	c. ceramic jars			
	d. large obj - specify			
L5 Cloth (textiles) / natural fibers	a. clothing (cloche, shoes)			
	b. large pieces (carpets, mattresses – specify)			
	c. natural ropes			
	d. sanitaria (diapers, cotton buds etc)			
L6 wood processed	Pallets, crates etc			
L7 paper and cardboard				
L8 others	Specify			

Origin of the waste:

	FISHERIES	AQUACULTURE	CIVIL	INDUSTRIES	OTHER
YES					
NO					

NOTE:

PHOTO:



During these activities DiSVA-UNIVPM operators classified marine litter collected by different operators and filled the questionnaire.





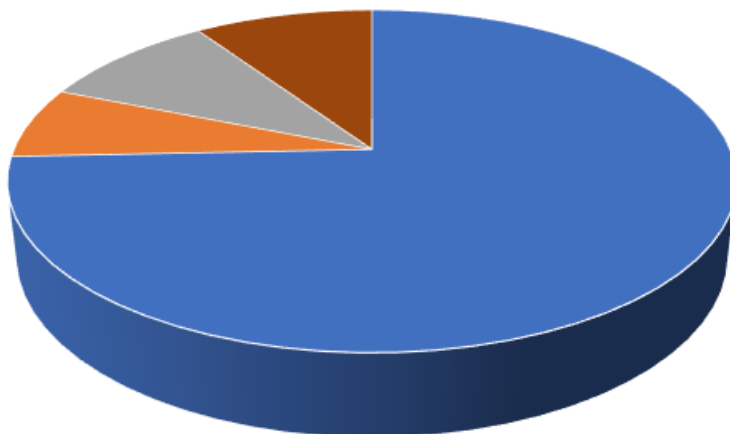
During this activity, the bag received by NGO “Project Rescue Ocean” has been filled and data have been shared directly with the NGO using the QR code.

Results

Data collected have been elaborated and a monitoring and comparative programme has been developed to develop recommendations to improve these activities at national and international/transnational level.

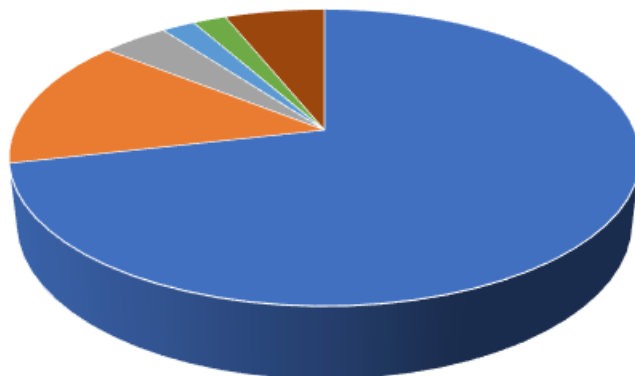
Data collected by filling questionnaire have been elaborated and reported in the following graphs.

Marine litter count-inshore Fano (%)

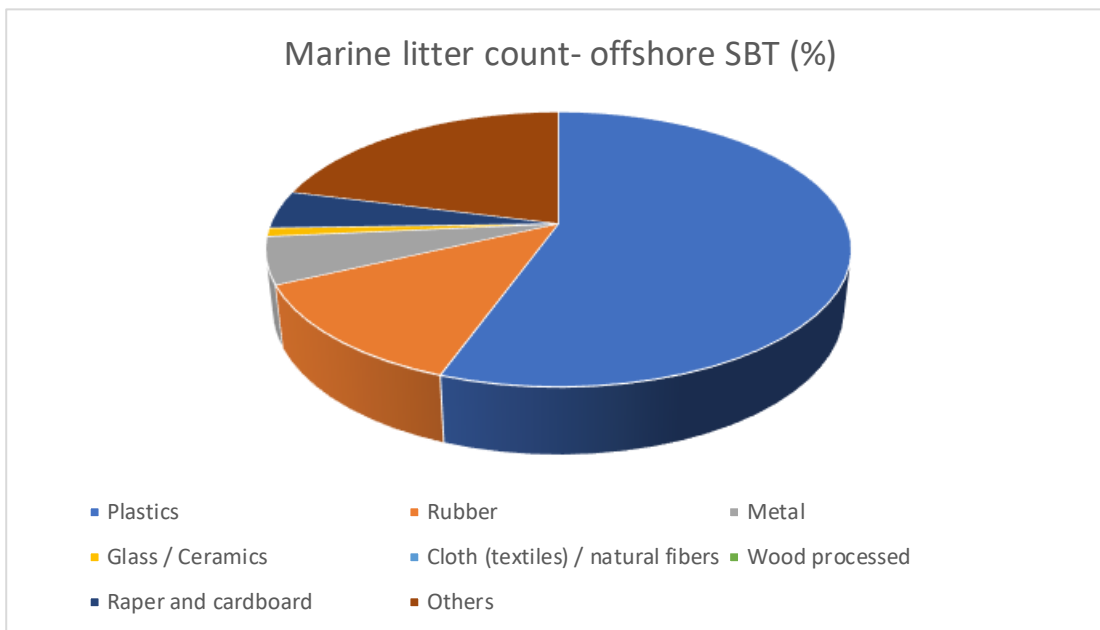


- Plastics
- Rubber
- Metal
- Glass / Ceramics
- Cloth (textiles) / natural fibers
- Wood processed
- Paper and cardboard
- Others

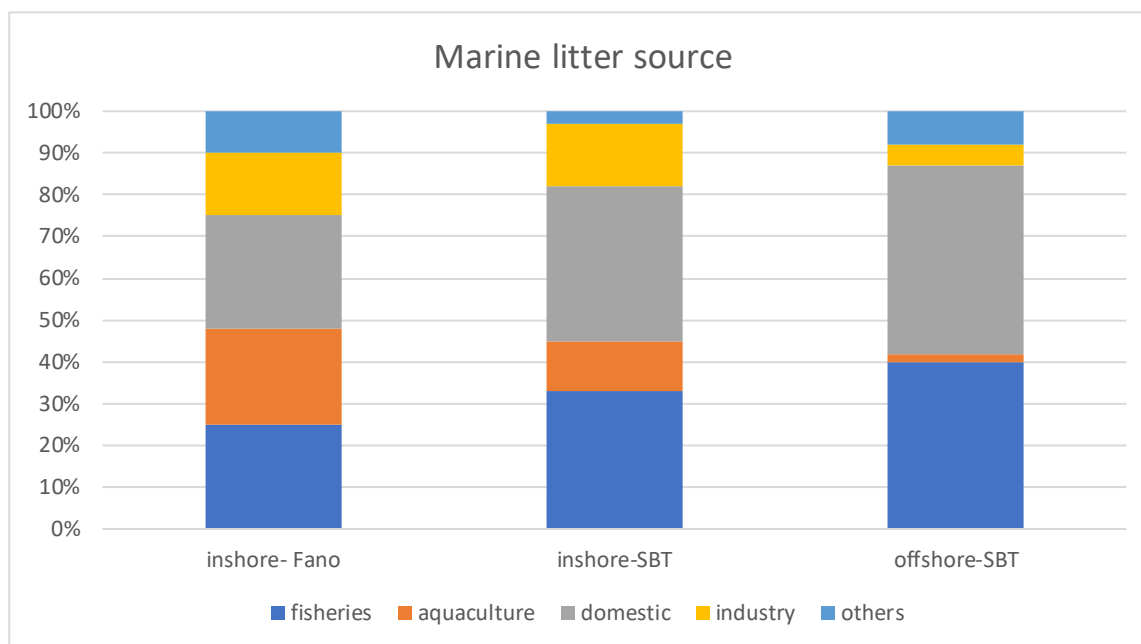
Marine litter count-inshore SBT (%)



- Plastics
- Rubber
- Metal
- Glass / Ceramics
- Cloth (textiles) / natural fibers
- Wood processed
- Paper and cardboard
- Others



From these preliminary results, plastic was the main component of marine litter both considering coastal catches (North and South of the Marche region, 74% and 72% respectively) and considering the distance from the coast (offshore 55%). Rubber and Others (undifferentiated) are the second most frequent components of marine litter both at in and offshore.



Analysing the source of the marine litter we observed that:

- marine litter derived by aquaculture practice was highly fished inshore of Fano (mainly from mussel farming) and lowly fished offshore;
- marine litter derived from fisheries activities (mainly fishing net) was highly fished offshore and lowly fished inshore of Fano;
- marine litter derived by domestic use (mainly plastic bottles) was the highly fished waste in all observed areas.



Within the marine litter have been found several dead marine organisms (invertebrates and vertebrates) because they were trapped especially in fishing and aquaculture nets.

In this light the questionnaire was implemented with a new section for “dead marine organism trapped” count and classification.

The total amount of marine litter fished offshore was higher with respect to the inshore one, but this result mainly depends on the duration of the fishing activities (3 days vs 1,5 day). In any case, fishermen noted that the total amount of marine litter fished during their fishing activities has decreased over the years.

This observation may not necessarily reflect a real decrease in marine litter. It could also depend on a change in the "migration" of marine litter towards other areas of the Adriatic.

This result makes it even more necessary for fishermen to continue and/or start fishing for marine waste, not only as a cleaning activity but also as a possibility to monitor the current state of the Adriatic Sea.

Dissemination

The third step consisted in the implementation of dissemination actions during which activities developed and results obtained have been presented.

Demonstration and dissemination activities have been carried out to raise awareness not only among the fishing community but throughout the local population.

- School groups were invited to participate in the activities, discussing with the students the nature and the impact of marine litter and strategies for recycling and proper waste disposal;



- Local TV (RAI 3 Regionale) has been involved in the dissemination of the activities and on 28 April the regional TG3 produced a report, making video footage of all the activities carried out in San Benedetto and an interview to explain the objectives of the project. <https://www.rainews.it/tgr/marche/notiziari/video/2023/04/TGR-Marche-del-28042023-ore-1400-01b6e466-7488-4725-907f-5a49dcb30c38.html>
- A dissemination event has been organized on 21st of May as part of the regional event “Tipicità in blu” at the Mole Vanvitelliana (Ancona). The event has been attended by fishermen involved in the activity and other professional figures (researchers, local

administrators...) who shared their experience during the marine litter collection.



ancona
21 maggio '23
 mole vanvitelliana

La S.V. è invitata all'evento R.S.V.P
 giorgia.plosschil@staff.univpm.it

DALLE 11 ALLE 13
 Sostenibilità, tutela della biodiversità e innovazione in Adriatico: il contributo del progetto ARGOS (Programma INTERREG Italia - Croazia 2014/2020)

DALLE 13
 Show cooking: mangiare cozze fa bene all'ambiente: le cozze protagoniste dello "show cooking" ARGOS (Programma INTERREG Italia - Croazia 2014/2020)

Logos: Comune di Ancona, Fidec, CAMERA DI COMMERCIO DELLE MARCHE, REGIONE MARCHE, UNIVERSITÀ POLITECNICA DELLE MARCHE, tipicità in blu





Dissemination: follow-up initiatives

- > Data collected by questionnaires will be presented to students in a workshop organized at UNIVPM at the end of June. This workshop targets representatives of research institutes involved in the European marine litter strategy, fisheries operators and waste managers. During this workshop, a representative net containing some waste collected in the ARGOS activities and accompanied by a descriptive plaque of the ARGOS project, will be deposited at DISVA UNIVPM inside "MobyLitter" a whale skeleton that over time has filled with plastic collected on the beaches and in the sea.



- Finally, a “traveling photographic exhibition” has been realized with the most suggestive and representative photographs of the activities carried out in the context of the pilot action. photos were printed on wooden panels. the exhibition is available to schools that want to host it for short periods and to non-profit associations that deal with environmental sustainability and respect for the environment.

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