



## **ARIEL PROJECT COD.278**

### **TECHNICAL AND POLICY RECOMMENDATIONS PAPER**

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## THE ARIEL PROJECT

ARIEL is a project co-financed by the INTERREG V B ADRION 2014-2020 Programme – Axis 1 Smart and innovative region (<https://www.adrioninterreg.eu/>).

ARIEL aims to promote technological and non-technological solutions for innovation speed-up and up take in small-scale fisheries and aquaculture among scientists-policy-makers-entrepreneurs, acting as a knowledge network and considering in a single frame the complex ecological, economic and societal challenges.

The **ARIEL partnership** is composed by 8 scientific and institutional organizations from 4 Countries:



Lead Partner: CNR-IRBIM Ancona (IT)

1. Marche Region, Region of Sicily (IT)
2. Institute of Oceanography and Fisheries (HR)
3. Public Institution RERA SD for Coordination and Development of Split Dalmatia County (HR)
4. Hellenic Centre for Marine Research (GRE)
5. Region of Western Greece (GRE)
6. Ministry of Agriculture and Rural Development (MEN)
7. University of Montenegro – Institute for marine biology (MEN)

**Project duration:** 36 months (01.01.2018 - 31.12.2020)

**Project budget:** € 1.249 234.50



## **THE ARIEL POLICY AND TECHNICAL RECOMMENDATIONS PAPER**

This paper has been prepared within the ARIEL technical WP3 “Transferring” and it aims at providing strategic and operational guidelines to promote innovation speed-up and uptake in small-scale fisheries and aquaculture of the ADRION area.

The paper takes its grounds on the activities carried out and results achieved by the project institutional and scientific partners in the period 2018-2020. After more than 2 years of implementation and interactive cooperation with small-scale fisheries (hereafter SSF) and aquaculture (hereafter AQ) key players, the ambition is to contribute to a more sustainable and science-based governance of these two key sectors by sharing transferable strategic and operational measures tested within the project.

The paper is built on:

- a framework analysis that allowed an in-depth knowledge of the small-scale fisheries and aquaculture sectors in the ADRION countries involved in terms of current data and dynamics for a better understanding of the framework conditions for innovation actions.
- the findings of a set of pilot actions for innovative and sustainable management of SSF and AQ operations conducted in pilot areas of Italy, Croatia, Montenegro and Greece in close cooperation with enterprises.

### **The ARIEL Vision**

...for an open innovation in small-scale fisheries and aquaculture sectors in the Adriatic and Ionian area



## **POLICY AND TECHNICAL RECOMMENDATIONS FOR SMALL-SCALE FISHERIES AND AQUACULTURE SECTORS OF THE ADRIATIC AND IONIAN AREA**

⇒ **Data collection should be deepened and widened**

### **SSF challenges:**

Small-scale fishing in the Mediterranean has been recognized as the main fishing sector providing food and livelihoods. This type of fishery is usually family-based and fishermen's incomes are generally lower than their country's GDP per capita. At a national level it seems that the sector has so far not received the support it deserves, even though it is trying to thrive in the same fishing areas exploited by different actors. Although the demand for statistical information on fisheries has undergone a significant increase in recent years, due to following the growing attention paid to management aspects and the number of interested national, EU and international parties, subjects for whatever reason interested in the sector, the data collected on the SSF, including information on biological indices, catch trends and socio-economic indicators, is still fragmented and incomplete. This certainly requires a significant, timely and detailed monitoring system that can play a central role in supporting the development and definition of management strategies aimed at ensuring a correct proper balance between the conservation of fish resources and the economic benefits deriving from the use of the resources.

However, information on SSFs and their catches is not readily available and collecting reliable data on SSFs is notoriously difficult. Small-scale fisheries operators are often difficult to reach and current discrepancies between official data (e.g. number of vessels vs active vessels) have a negative impact on the flow of institutional information. Furthermore, the available data are often perceived as coming from above. Local and regional socio-economic data on SSF and AQ are rarely available and mostly outdated and incomplete.

The need for a differentiated approach to managing small-scale fisheries through a dedicated EU action plan, and the need for national allocation systems adequately taking into account the needs of small-scale fisheries are two key elements raised at the level of the EU for the next programming period of the European Maritime and Fisheries Fund (EMFF). Since 2018 the EU has started discussions for the reform of the basic Regulations related to fishing and aquaculture for the period after 2020. A long discussion is taking place with the Member States and stakeholders to replace Regulation 508/14 of the EMFF. In the context of these discussions, there is the will of all parties to continue the Common Fisheries Policy and the financial support that will support the economic, social and environmental sustainability of the industry.

The strategy for the development of profitable and sustainable, small-scale coastal fishing should be structured in the following areas:

- a) adapting and managing fishing ability,
- b) promoting low impact and low carbon dioxide fisheries practices resistant to climate change, which minimize damage to the marine environment,
- c) strengthening and promoting marketing strategies,

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- d) promoting skills, knowledge, innovation and capacity building,
- e) improving health, safety and working conditions on fishing boats,
- f) increased compliance with the requirements of collection, traceability, monitoring, control and data surveillance,
- g) fishermen's involvement in marine management, including protected marine areas and Natura Network 2000 sites,
- h) diversification of activities in the wider sustainable blue economy,
- i) collective organization and participation in decision-making and counselling processes.

**SSF Policy Recommendations:**

- ⇒ Given the centralized system in European Maritime and Fisheries Fund, a steady provision of updated data on SSF and aquaculture sectors from the national authorities is needed for any further analysis and elaboration
- ⇒ Socio-economic data should be collected at regional, national and transnational level in a systematic way since they enable a better understanding of the sector's dynamics for current interventions and future programming
- ⇒ Application of new technologies to collect more data on fish stocks, in order to optimize resource efficiency, and reduce the ecological impact of the sector on the marine environment
- ⇒ Participation of SSF fishermen in data collection can be a first step towards them having greater involvement in fishery management decisions and thereby making them more likely to comply, which will ultimately lead to more sustainable practices

**SSF Technical Recommendations:**

- ⇒ Create an information system on the SSF that can monitor over time the progress of the granting of fishing licenses, the catch areas, the fishing period, the volume of the catch in absolute and in the annual period, the fishing gear used and the tools for the sighting and attraction of the catch



⇒ **New approaches to innovation and SSF and AQ actors engagement**

**SSF challenges:**

Fishing and aquaculture are productive activities that are part of a broader and more complex economic chain, through which fish products travel from the sea to the consumer's table. The operators that are part of it correspond to the different segments and sectors of the supply chain itself. Despite their relevance and potential for the sustainable growth of coastal communities that will be reaffirmed in the proposals of the next EMFF programming period, SSF operators are often not aggregated, not well represented and not familiar with the consequent marginalization of the SSF sector in decision-making processes. This affects their access to innovation and funding opportunities to innovate their business. AQ operators and/or SSF fishermen can no longer operate without being informed and kept up to date: for example, it is necessary to know how to use increasingly advanced navigation instruments, as well as to know about the opportunities and limitations provided for by both Community and national legislation, or the results and evidence coming from countless applied research activities on environmental problems and the abundance or scarcity of resources.

**SSF Policy recommendations:**

- ⇒ SSF practitioners should be reached and get involved in a systematic way to collect data, detect needs and promote the aggregation and mutual exchange of experiences and ideas to be put into practice. In this context, public institutions can act as mediators of public innovation, facilitating this bottom-up process and providing common tools for networking and partnership.
- ⇒ National and local administrations establish the conditions for adequate representativeness of SSF actors in national and local tables.

**SSF Technical recommendations:**

- ⇒ The research sector should interact with AQ and SSF operators in order to detect their needs and at the same time inform them about innovation by promoting a cultural and professional evolution as well as a contextual recognition of the social role played by the fishermen themselves, taking into consideration the distinctive value of their activity not only in purely productive and quantitative terms, but also by virtue of their contribution to employment, nutrition, environment, green tourism and culture, and therefore to society as a whole
- ⇒ Local administrations should promote the abilities for fishermen to organize themselves into companies, associations, cooperatives etc., because being supported by the creation and strengthening of trade associations and representative bodies will make it easier to carry out bureaucratic procedures and/or facilitate access to credit, incentives and contributions.



### **AQ challenges:**

AQ operators generally demonstrate a good aptitude for technological and organizational innovation. In the ADRION area, the level of entrepreneurship is relatively high, compared to SSF. In general, the sector is made up of SMEs and large multinationals that exploit economies of scale, have a high level of modernization and often have their own research and development departments. Most companies have benefited from EU policy measures and participate as partners in research projects and many entrepreneurs are relatively open to new ideas and clusters / networks. However, there are still a number of producers who do not recognize the benefits of associations / clustering initiatives. The main challenge is to systematically increase their engagement in cooperation and clustering initiatives so as to further unlock their innovation potential. There is a strong expectation of system and process innovation; in fact, market demand requires both a greater quantity of farmed fish as well as a greater variety in farmed species. In the EU proposal for the modification of Regulation 508/14 of the EMFF (European Maritime and Fisheries Fund) the sector of aquaculture has a key role. First of all, there is a renomination of the Fund to EMFFA instead of EMFF. The basic difference of the newly proposed regulation is that instead of listing the measures selected from a menu of eligible actions as currently, the national programmes should focus on the strategic priorities chosen by each Member State. High administrative burdens remain the main barrier to the development of the sector, together with procedural requirements (for both licensing and access to funding) which are notoriously complex. Also, a strong support was expressed to the continuation of the current EU-support to aquaculture in the next fund, through direct grants in parallel with financial instruments and Invest EU. The EMFFA may therefore support the promotion and the sustainable development of aquaculture for the farming of aquatic animals and plants for the production of food and other raw material. Complex administrative procedures in some Member States remain in place, such as difficult access to space and burdensome licensing procedures, which make it difficult for the sector to improve the image and competitiveness of farmed products. Support should be consistent with the multiannual national strategic plans for aquaculture developed on the basis of the CFP Regulation. In particular, support for environmental sustainability, productive investments, innovation, acquisition of professional skills, improvement of working conditions, compensatory measures providing critical land and nature management services will be eligible. Public health actions, aquaculture stock insurance schemes and animal health and welfare actions will also be eligible. However, in the case of productive investments support will be provided only through financial instruments and through Invest EU, which offer a higher leverage on markets and are therefore more relevant than grants to address the financing challenges of the sector.

Food security also relies on efficient and well-organised markets, which improve the transparency, stability, quality and diversity of the supply chain, as well as consumer information. For that purpose, the EMFFA may support the marketing of fishery and aquaculture products, in line with the objectives of the Common Market Organisation (CMO). It may in particular support the creation of producer organisations, the implementation of production and marketing plans, the promotion of new market outlets and the development and dissemination of market intelligence



### **AQ Policy Recommendations:**

- ⇒ The setting-up of AQ stakeholder boards at local level should be promoted
- ⇒ Policy makers should promote the use of advanced tools for spatial planning at local level
- ⇒ Research bodies should promote the practical advantages arisen from the use of advanced tools and models
- ⇒ The identification of Allocated Zones for Aquaculture (hereafter AZA) should be based on administrative, social, economic and environmental information and co-management

### **AQ Technical Recommendations**

- ⇒ AQ breeding systems should be updated to an adequate information level to reach the levels of "AQ2.0" where the creation of continuously monitored systems can determine big data to be stored on dedicated Clouds to manage them through the Learning machine to obtain forecast data and fine-tune breeding techniques. In addition, a great effort still needs to be made to improve health aspects, restrict the use of pharmaceutical drugs in breeding programs to a minimum, develop species-specific vaccines and better vaccination protocols, and promote the use and development of innovative fish feeds and increase feed conversion efficiency through selective breeding programs of Mediterranean species in order to exploit less food resources of natural origin and use those coming from the circular economy.



**SSF and AQ Policy recommendations:**

- ⇒ The experiences, initiatives and methodologies of different sectors (e.g. AKIS in agriculture, EIP-AGRI) that have been adopted to promote the transition from a linear model of innovation to an interactive one should be capitalized in the SSF and AQ sector. The experience of the EIP-AGRI has shown that success in innovation generation depends on the combined performance of consultants, agricultural training and education systems, researchers and farmers' organizations (AKIS).
- ⇒ Policy tools should facilitate and accompany the creation of a regional and national knowledge and innovation system in SSF and QA
- ⇒ Permanent stakeholder boards at regional and local level should be set up by local governments

**SSF and AQ Technical recommendations:**

- ⇒ The research sector should know the needs of operators in the R&D path and propose innovations



## ⇒ Co-management should be put into practice

It is widely recognized that involvement of fishermen in co-decision making and co-creation contributes to the acceptance of technical and management measures. In addition, building blocks for innovation are expected to come from science as well as from practice and intermediaries. Therefore, the direct involvement of fishermen enables the valorisation of existing knowledge.

### **SSF challenges:**

The characteristics of craftsmanship, strong multi-specificity and competition for fishing with different gear for the capture of the same species require the adoption of management strategies which are necessarily different from those for industrial fishing situations characterized by monospecific stocks where there is no competition between fishing gear for the capture of the same species.

In particular, for many years the often-mentioned specificity and management complexity of the Mediterranean fish resources has limited the choices of competent authorities solely to the control of fishing efforts and the introduction of technical measures. The General Fisheries Commission for the Mediterranean (GCPM) has also emphasized the importance of fishing efforts as the main control variable for management purposes. The European Commission and the Mediterranean countries have shared the same approach. However, the variations in capacity have not been defined according to the exploitation status of individual stocks or groups of stocks. Instead, so far mostly strategies for generalized reduction of fishing capacity have been adopted, which is unlike other production contexts and quite surprising when bearing in mind the strong multi-specificity of, for example, Italian fishing.

As mentioned earlier (p. 5), the need for a differentiated approach to managing small-scale fisheries through a dedicated EU action plan, and the need for national allocation systems adequately taking into account the needs of small-scale fisheries are two key elements raised at the level of the EU for the next programming period of the European Maritime and Fisheries Fund.

### **SSF Policy Recommendations:**

- ⇒ The direct involvement of small-scale fisheries representatives in shaping the Actions Plans (APs) should be ensured. To this, the setting-up of regional SSF stakeholder discussion boards is advisable, preferably from the designing phase of the Aps.
- ⇒ Small-scale fisheries representatives should be encouraged to practice or perform co-management

### **SSF Technical Recommendations:**

- ⇒ The governments of the countries should prepare careful and continuous analyses of the ecosystemic environment where the SSF operates. Each territory should have a fisheries management plan and all plans should share their knowledge so as to co-establish a homogeneous information network. In this regard, the DISPLACE tool

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could be used to produce the analyses: a dynamic, individual-based model for spatial fishing planning and effort displacement - integrating underlying fish population models (<https://www.nrcresearchpress.com/doi/abs/10.1139/cjfas-2013-0126#.X3r67i8QNBx>).

**AQ challenges:**

Within the aquaculture sector, the emerging challenge is to find a way to balance the drive for economic growth while fulfilling the promise of aquaculture as a tool for social empowerment. In this context, community-led approaches can contribute to the process, helping to reduce conflicts between different users of marine resources and to address social concerns.

**AQ Policy Recommendations:**

- ⇒ The setting-up of AQ stakeholder boards at local level should be promoted
- ⇒ Policy makers should promote the use of advanced tools for spatial planning at local level
- ⇒ Research bodies should promote the practical advantages arisen from the use of advanced tools and models
- ⇒ The identification of Allocated Zones for Aquaculture (hereafter AZA) should be based on administrative, social, economic and environmental information and co-management



⇒ **Ecosystem based approach to fisheries should be operationalized**

**SSF and AQ challenges:**

The principles of a so-called Ecosystem based Approach to Fisheries (hereafter EAF) are widely recognized and its application could help the valorisation of small-scale fisheries compared to large-scale fisheries. The FAO Code recognizes *“the important contributions of artisanal and small-scale fisheries to employment, income and food security, States should appropriately protect the rights of fishers and fishworkers, particularly those engaged in subsistence, small-scale and artisanal fisheries, to a secure and just livelihood, as well as preferential access, where appropriate, to traditional fishing grounds and resources in the waters under their national jurisdiction.”* The FAO and international aquaculture experts have also applied – in the last decade – the Ecosystem based Approach to Aquaculture (hereafter EAA), focusing on how to move towards greater sustainability of the AQ sector. The identification of reliable indicators that take into account the ecological and human dimension is – in fact - the subject of several studies. The EU policy framework supports the achievement the EAF and EAA objectives mainly through the Common Fisheries Policy. However, it cannot act as stand-alone policy and a comprehensive strategy is required. The ecosystem models are important tools to set the EAF and EAA in terms of dynamics, the status quo and scenarios, and in this context the main common challenge is the definition of more place-based operational objectives and implementation process<sup>1</sup>.

**SSF and AQ Policy Recommendations:**

- ⇒ Institutional stakeholders recognize the opportunity deriving from the application of models and tools to support and facilitate decision-making and implementation of EAF and EAA, however a strong cooperation with scientific bodies shall be ensured as well as socio-economic stakeholder consultation to guarantee a more efficient co-decision and co-management of sea resource.
- ⇒ National and local governments and research institutions should define an operational Roadmap for the EAF and EAA implementation at local and cross-border level. Socio-economic stakeholder involvement should be the ensured horizontally.
- ⇒ Co-management should be put in practice to address the EAF and EAA components
- ⇒ The implementation of EAF and EAA can bring added value to seafood products, as a unique selling proposition for the market
- ⇒ Institutional stakeholders recognize the opportunity deriving from the application of models and tools to support and facilitate decision-making and implementation of EAF and EAA. However, a strong cooperation with scientific bodies as well as socio-economic stakeholder consultation shall be ensured to guarantee a more efficient co-decision making and co-management of sea resources.

<sup>1</sup>Hornborg S., van Putten I. Novaglio C., Fulton E., Blanchard J., Plagányice E., Bulman C., Sainsbury K. Ecosystem-based fisheries management requires broader performance indicators for the human dimension. Marine Policy, Volume 108. 2019 a RISE Research Institutes of Sweden, Agrifood an



- ⇒ National and local governments and research institutions should define an operational Roadmap for the EAF and EAA implementation at local and cross-border level. Socio-economic stakeholder involvement should be ensured horizontally.
- ⇒ Co-management should be put in practice to address the EAF and EAA component
- ⇒ The implementation of EAF and EAA can bring added value to seafood products, as unique selling proposition for the market

### ⇒ Capitalization and better valorisation of practical knowledge

#### **Common Challenges for SSF and AQ:**

Currently, a whole range of projects funded by a number of national and EU funding instruments, even within the same project lines, cover similar issues. Very often, they overlap in such a way that the activities are led by the same partners, case studies take place in the same areas, and the targeted or surveyed population of actors is identical. In such cases, it would be necessary to review and consolidate the results obtained in order to move on to future projects from an improved position. This would, on the one hand, avoid unnecessary repetition and spending costs, and on the other hand achieve a much-needed harmonization and rationalization.

In addition to capitalization, knowledge valorisation is a topic tackled by a range of academic publications. Several steps have been made by research and/or other institutions to unlock the innovation potential of practical knowledge of the socio-economic operators of different sectors. However, a further effort is necessary to make knowledge suitable and/or available for economic and/or societal use and translate that knowledge into competitive products, services, processes and entrepreneurial activity (van Drooge and de Jong, 2015)<sup>2</sup>.

#### **SSF and AQ Policy Recommendations:**

- ⇒ Leveraging and joining complementary resources in terms of knowledge and funds
- ⇒ Capitalization and cross-fertilization of previous and on-going initiatives and projects at regional and ADRION level should be adopted in a systematic way so as to avoid duplication of efforts, save costs, increase the impact of EU and national/regional funding and speed up innovation.
- ⇒ Making the best use of the stock of knowledge and experiences: methodologies and approaches (from the same sector and different ones) that prove successful in practices should be capitalized in the current and next programming periods.
- ⇒ The valorisation the SSF and AQ operators practical and existing knowledge should be pursued in a systematic way. To this, the setting-up a permanent dialogue between the institutional, technical and socio-economic stakeholder is desirable.

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<sup>2</sup> Leonie van Drooge and Stefan de Jong. Valorisation: researchers do more than they realise - E-publication with examples and guidelines for valorisation. The Hague: Rathenau Instituut, 2015.



⇒ **Capacity building**

**Common challenges for SSF and AQ:**

Designing and implementing innovation in the fisheries sector requires the development and enhancement of capacity building measures. Unfortunately, capacity buildings in general are rare, occurring only occasionally, and are rarely narrowly focused. They are mainly organized as one-offs during ongoing project activities or related to current hot topics (usually national harmonization with EU regulations or similar).

Fisheries and aquaculture research and framework policies evolve rapidly while knowledge transfer into governance is sometimes out of step.

**SSF and AQ Policy Recommendations:**

- ⇒ To be effective, capacity building process and operational steps require long-term planning.
- ⇒ The setting-up of a capacity building programme (or the integration if it already exists) for a periodical upgrading of skills and for building capacity at least on the following topics: EU policy context and financial opportunities for SSF and AQ sectors, ecosystem-based approach to fisheries and aquaculture, **and** advanced tools and model for planning and management, socio-economic dynamics.
- ⇒ Extension services can play an important role in this issue. It can provide enterprises with new organizational and marketing tools and can significantly contribute **to** raising of human capital level.



⇒ Improving access to market and adding value

**SSF challenges:**

The sector plays an important role in the EU's fish production and can be considered as the best choice in order to promote the development of regional specialty products and marketing. From a consumers' perspective, SSF embodies quality, freshness as well as authenticity and traditional value. Despite its relevance for the socio-economic growth of coastal communities, from various surveys conducted among fishermen several difficulties emerged with respect to accessing markets:

- competition from low-priced imported products;
- lack or poor infrastructure and logistic (from dedicated areas for small-scale fisheries to transportation and refrigeration);
- lack or scarce knowledge of the market and marketing tools
- lack or scarce use of ICT.

In addition, SSF is characterized by micro-enterprises which are often not aggregated into associations and/or cooperatives.

**SSF Policy Recommendations:**

- ⇒ Supply and value chain approaches have been suggested as effective approaches for SSF market analysis and development
- ⇒ Shortening of the value chain
- ⇒ Seafood certification schemes should be promoted and their adhesion supported by grants
- ⇒ Raising awareness and education campaigns targeted on SSF should be developed and implemented by national and local administrations
- ⇒ ICT skills should be developed/fostered at fishermen level
- ⇒ Direct selling of SSF fishery products should be regulated and supported within the policy framework
- ⇒ Services and facilities for fishermen and users should be fostered at local level (e.g. designated areas for SSF in integrated coastal management plans)



**AQ challenges:**

The landscape of the aquaculture sector is diversified and includes traditional artisanal and family businesses, medium-scale fish companies and multinational mariculture companies<sup>3</sup>. This heterogeneous approach to AQ has led to ineffective development policies which resulting in a lack of efficiency in production activities.

**AQ Policy Recommendations for AQ:**

- ⇒ Supply and value chain approaches have been suggested as effective approaches for AQ market analysis and development
- ⇒ Shortening of the value chain
- ⇒ Seafood certification schemes should be promoted and their adhesion supported by grants
- ⇒ AQ firms should invest in diversifying their product offerings. To do this, governments need to invest in research and in the creation of networks that share the results of research in the breeding of new fish species.

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<sup>3</sup> Varadi, L., Szucs, I., Pekar, F., Blokhin, S. & Csavas, I. 2001. Aquaculture development trends in Europe. In R.P. Subasinghe, P. Bueno, M.J. Phillips, C. Hough, S.E. McGladdery & J.R. Arthur, eds. Aquaculture in the Third Millennium. Technical Proceedings of the Conference on Aquaculture in the Third Millennium, Bangkok, Thailand, 20-25 February 2000. pp. 397-416. NACA, Bangkok and FAO, Rome.



## TECHNICAL RECOMMENDATIONS FROM THE ARIEL PILOT ACTIONS

One of the main goals of the project is to test innovative technological and non-technological solutions to address day-by-day needs of small-scale fisheries and aquaculture operators in Italy, Croatia, Montenegro and Greece.

To this, small-scale fisheries and aquaculture operators, institutions and research worked together from 2019 to 2020 to implement the following pilot actions:

SECTOR	PILOT ACTION	LOCATION
<b>SMALL-SCALE FISHERIES</b>	Testing pingers to reduce/prevent dolphin damages: Dolphin Dissuasor Devices (DDD)	Italy, Croatia
	Evaluation of the "Rainbow network" used by Thyrrhenian Sea fishing fleet to minimize the capture of bycatch	Region of Sicily (Italy)
	<ul style="list-style-type: none"> <li>- Testing trammel nets provided with a technical device aimed at reducing the bycatch</li> <li>- Testing selective trammel nets having a 80 mm and 84 mm mesh size (stretched) aimed at reducing the bycatch</li> </ul>	Croatia
	Testing innovative trammel nets specifically designed for the caramote prawn ( <i>Melicertus kerathurus</i> )	Montenegro
	VirMa: virtual marketplace for improving small-scale fisheries access to market	Italy
	Fishing tourism business plan	Greece



SECTOR	PILOT ACTION	LOCATION
AQUACULTURE	Installation of AKVA underwater cameras to increase the efficiency of feeding procedure	Greece
	Acoustic pingers pilot studies aimed at reducing the impact of the gilthead seabream <i>Sparus aurata</i> on mussel farming	Croatia
	Experimental farming of the sea sponge <i>Aplysina aerophoba</i>	Montenegro

## Technical recommendations for small-scale fisheries

**Practice:** Pingers to reduce/prevent dolphin damages on the set nets: dolphin dissuasor devices (DDD)

### Technical Recommendations:

- ⇒ The DiD01 (Dolphin interactive Deterrent) effectively keep the dolphins away from fishing nets, thanks to an efficient technique of interaction with their echo-localization system (sonar). The used pingers were produced by <http://www.stm-products.com/prodotti/fishing-technology/dissuasori-per-delfini-green/did-01~54.html>.
- ⇒ For 1 fisherman working with 1,000 m length of gillnets or trammel nets, 2 pingers are needed. Before using the device, you should perform a complete battery charge for 20 hours at least. The use is very simple, DiD01 have to be hang to the fishing net (at the beginning and at the end). The devices have to be placed on the fishing equipment according to the best strategy considering the emission area and type of fishing. Don't place a DiD less than 500 m from another DiD. The DiD behaviour may be influenced by the presence of another DiD units in the area so it may continuously produce signals, reducing drastically the battery duration and desired effect on the mammals. The DiD must be placed minimum 20-30 m above fishing gear. The DiD will be activated when it touches the water. After a first sound emission, useful to know the devices battery is charged, it remains in reception mode till the event of a mammal presence recognition, then it reacts by producing special variable ultrasound signals for about 50-60 seconds. The emission of random modulated signals, makes difficult to the mammals to adapt themselves to the signal.



**Practice:** "Rainbow network" used by Thyrrenian Sea fishing fleet to minimize the capture of bycatch

**Technical Recommendations:**

- ⇒ The use of LED light indicators (e.g. OLYMPUS - WR 509 LEDs) mounted on a trammel net has provided valid indications in relation to reduce the capture of unwanted species in the small-scale fisheries.
- ⇒ Fishermen using 1000-meter-long trammel nets should equip a minimum of 100 coloured LED lights in the entire fishing net, fixed using wire and tape and placed in the middle of the fishing net at a fixed distance of 5-10 meters from each other. Different colours are available (white, blue, green and red) but our analyses did not show significant differences among them.
- ⇒ The use of these bycatch reduction devices is very simple as the switching on and off of these LED indicators occurs immediately when they are immersed or not in the water, avoiding further tasks for the fishermen. Furthermore, having a maximum duration declared by the manufacturer of 50 hours, it is possible to reuse them over and over again, reducing management costs.
- ⇒ Equipping LED lights in trammel nets appears to be effective in reducing unwanted catches, however further studies are needed in order to draw more definitive conclusions

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**Practice: Trammel nets to reduce bycatch**

- *Trammel nets with a special construction to reduce bycatch*

**Technical Recommendations:**

⇒ The selectivity of trammel nets intended for catching cuttlefish, *Sepia officinalis* with additional net add in the lower part of the net (so-called *alceta*) effectively reduced the retention of by-catches (eg. *Mollusca*, *Holothuria*, *Echinodermata*,..). The additional part was constructed as a gill net with minimum mesh size of 64 mm (stretched), maximum height up to 0.5 m and made of a thicker string

- *Trammel nets selectivity 40mm/42 mm to reduce bycatch*

**Technical Recommendations:**

⇒ Target species, the common sole *Solea solea* was represented in the total catch with 92.6 % in the 80 mm and 92.1% in the 84 mm trammel nets called *listara* in terms of abundance, while in biomass this percentage was 91.4% for a *listara* with 80 mm minimum mesh size, or 90.3% for a 84 mm min mesh sizes (stretched). However, this higher proportion of individuals by number and biomass in the smaller mesh size was expected, while all other indicators are more on the side of the larger minimum mesh size.

⇒ By increasing the minimum mesh size of the *listara* trammel nets from 80 mm to 84 mm, SSF would catch 3% longer individuals and 11% more in total biomass, and it is therefore valid and justified to consider changing the legislation in terms of increasing the minimum mesh size from 80 mm to 84 mm.

**Practice: Trammel nets for Karamote prawn (*Melicertus kerathurus*)**

**Technical Recommendations:**

⇒ Monitoring of the efficiency and bycatch composition in small-scale fisheries using trammel nets for the caramote prawn *Melicertus kerathurus* have shown that such nets, when used for targeted fisheries of this species and in the time, period proposed (April – June) have catches in line with the expected results. Both the target species and bycatch are predominantly above the prescribed minimum legal catch sizes, and discard is composed mainly of species normally found in other trammel nets with larger mesh sizes (*Hexaplex* sp., various species of small crabs). These findings make for an excellent basis in future policy recommendations regarding commercial exploitation of this economically very valuable species.



**Practice:** VirMa: virtual marketplace for improving small-scale fisheries access to market

**Technical Recommendations:**

- ⇒ Increase the value chain of the small-scale fishery sector is the main focus of this activity. To pursue this target, it is essential do not forget essential principles such as socio-economic and environmental benefits, that must be parallely followed. To do that, such considerations must be taken in order to adapt to local conditions of the small-scale fishery sector, in particular:
- Consider stakeholder participation as pivotal.
  - Increase the awareness of customers and citizens in general about the quality of seafood products derived from that artisanal activity.
  - Avoid any practices that could, in a certain way, produce competitiveness among fisherfolks.
  - Knowledge of local needs is essential in order to develop a shared strategy for the value chain increase.
  - ICT technologies must be specifically designed for the small-scale fisheries sector.
  - Continuous improvement of procedural schemes as well as specific tools adopted (e.g. ICT tools) during the activities must be performed, in order to maintain the functionality of the system.

**Practice:** Fishing tourism

**Technical Recommendations:**

- ⇒ The diversification of activities by the implementation of fishing tourism is clearly a promising activity for individual SSF fishermen. Depending on various factors e.g. the capacity of the vessel (number of tourists/passengers, the ability of fishermen to provide an remarkable experience, the fishing tourism can provide an important source of income and so, minimize income risk and uncertainty for the fishing family business. In addition, it seems that there is a threshold on the capacity of the vessels that can be utilized in fishing tourism. In the case of very small vessels, that can host three or less tourists, it is questionable if the loss of money due to fishing activity reduction is counterbalanced by the fishing tourism activity.
- ⇒ From a macro-perspective view, individualistic efforts in fishing tourism cannot significantly affect the whole local society, because of the small share of fishers that can actually involve successfully in this activity. Therefore, it is suggested that a holistic regional strategy for sustainable development, including integrated coastal management practices for fisheries diversification options (such as fishing tourism) needs to be adopted; only through such an approach, the long-term goal towards economic growth, social cohesion and protection of the environment may be effectively pursued.



## Technical recommendations for aquaculture

**Practice:** AKVA underwater cameras to increase the efficiency of feeding procedure

### Technical Recommendations:

- ⇒ Feeding is the most important cost factor in aquaculture (about 60-65% of the total costs). The food quality, the total amount of food consumed during the life cycle of the fish population and the adopted feeding strategy, are the most crucial factors for the fishes' growth rate and their convertibility,
- ⇒ The main purpose of the pilot action is the cost minimization, through a more efficient feeding process, based on the elimination of food waste. This is achieved by the use of an underwater camera that allows for the monitoring of the feeding process. A complementary objective of this experiment would also be the observation of the behavior of the fish population, its mobility as an index of health and welfare, as well as the determination of the cage nets cleanness (and their replacement necessity) as an additional well-being factor that influence nutrition and development rate.
- ⇒ In the case of Sea Bream, the conventional use of underwater cameras is not efficient in reducing food loss due to the species greediness. However, the alternative usage of the submersible camera with controlled feeding until the observation of a significant volume of fecal discharge is considered successful proving the usefulness of the camera during feeding. The equipment allows the nutritionist to offer the maximum food ensuring zero loss and producing an improved conversion rate.
- ⇒ The cost of the establishment of underwater cameras can be counterbalanced even from the first year of operation by the increased profitability. In addition, the applied method didn't have any negative impacts in terms of quality since the fat standards were kept below the commonly accepted limits.

**Practice:** Experimental farming of sea sponge *Aplysina aerophoba*

### Technical Recommendations:

- ⇒ Although no successful results of the pilot action in experimental farming of sea sponge *Aplysina aerophoba* in the Boka Kotorska Bay were collected, due to higher power, the data available will be used in future attempts at controlled cultivation of this or other porifers. The idea of exploitation of such organisms remains attractive, and further efforts will be invested in finding appropriate conditions, in which such organisms would achieve growth. Efforts made within the frame of the ARIEL project will provide a basis for future research.



## Conclusions

With the ADRION area, the access to innovation of SSF and AQ operators is a growing challenge. Different policy and research instruments have been put in place by governments and scientific organizations, however further steps are needed to unlock the innovation potential of fisheries and aquaculture.

From the exchange of experiences and pilot actions carried out within ARIEL as well as within blue growth projects co-financed by the INTERREG Programmes, it is clear how innovation governance of these two sectors must rely on science-based policy, co-management, cooperation and interactive involvement of institutional, socio-economic and scientific actors.

ARIEL web-page: <https://ariel.adrioninterreg.eu/>

### **DISCLAIMER**

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