

# AdriAquaNet

Enhancing Innovation and Sustainability in Adriatic Aquaculture

**Deliverable 2.2.7 PROTOCOLS**

**Udine and Trieste, 30.06.2022**

## PART 1

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### A. Introduction

This document presents a series of protocols that SMEs active in the aquaculture value chain can and should implement for enhancing the sustainability of their business, which is interconnected with environmental, animal and human health sustainability.

This is a **synthetic overview** of the main innovation needs and technological gaps that AdriAquaNet Partners have addressed in response to the demands from the Adriatic aquaculture business, which was consulted during the preparation phase of this project.

**The applicability domains and other details of the innovations developed by the AdriAquaNet Partners are exhaustively described in the Scientific and Technical reports**, published on the [project's website](#), [section Docs&Tools](#). In particular, innovations were aimed at:

**Objective 1:** improving fish farm management.

How these have been developed is described in documents of **WP3 - IMPROVE ENVIRONMENTAL SUSTAINABILITY OF FISH FARMING**

**Objective 2:** improving fish health management.

How these have been developed is described in documents of **WP4 - R & I TO IMPROVE HEALTH AND SUSTAINABILITY IN AQUACULTURE**

**Objective 3:** improving fish market management.

How these have been developed is described in documents of **WP5 - IMPROVING QUALITY AND MARKETING OF FRESH AND PROCESSED FISH**

## B. The target groups of these recommendations are:

### **Policy makers** at all levels of government

The seamless adoption of these innovations and any other necessary improvement, refinement and further development need to be supported by the public policy makers at all levels of government, in order to design and implement actions that ensure favorable conditions of cooperation between relevant actors of the innovation endeavor, such as the R&I sector (Research and higher education institutions) and the users (SMEs) at both sides of the Adriatic Sea basin.

### **SMEs and professionals** active in the aquaculture value chain

They may find it useful to know what technologies are available and who are the reference persons who can support them in implementing these innovations.

### **Researchers and scientists** addressing manifold issues of aquaculture sustainability by a multi-disciplinary approach

They may find it useful to understand what are the most urgent innovation needs of the aquaculture business, in order to transfer knowledge and ideas from their scientific domains to the applied sciences.

## C. European policy framework

This document reflects the collective effort of the AdriAquaNet project partnership to tackle concrete issues relevant for the aquaculture value chain, in line with the [Common Fisheries Policy \(CFP\)](#). It is clear that the AdriAquaNet objectives perfectly overlap with those of CFP, which are [to increase productivity, to stabilise the markets, to provide a source of healthy food and to ensure reasonable prices for consumers](#).

## PART 2

### Protocols for Aquaculture in the Adriatic Sea

In order to improve the sustainability of aquaculture in the Adriatic Sea, fish farms are recommended to implement new technologies and applications developed in this project, covering 5 areas:

1. Fish feeding
2. Fish health management and welfare
3. Energy efficiency
4. Fish products
5. Consumer information

#### 1. Fish feeding

- Prefer the use of new feeds for rearing Mediterranean fish with proteins derived from poultry industry by-products, insects and other by-products to reduce the use of protein sources from fisheries, increasing their sustainability in accordance with the principles of the circular economy.
- Evaluate the reduction of environmental impacts with new mathematical models using a variety of data, such as fish growth, oxygen demand and ammonia excretion rate, temperature and other (easily measurable) parameters. These mathematical models make it possible to keep environmental quality of farms under control.
- Assess the economic and zootechnical performance of the new formulations, which must be at least equivalent to those of the feeds on the market.

**FIVE TECHNICAL DELIVERABLES are available in the project's website, section Docs and Tools, as support for the protocols suggested above, sub-section [WP3 – IMPROVE ENVIRONMENTAL SUSTAINABILITY OF FISH FARMING](#):**

1. D 3.1.1 New environmentally sustainable dietary formulations for cultured marine fish to be proposed to the aquafeedmill industry
2. D 3.1.2 Manual for adopting new low polluting feeding protocols for marine fish farmers
3. D 3.2.1 Technical-scientific report on the potential of biogas technology applied to wastewater from fish farms, and assessment of energy recovery and environmental impact reduction
4. D 3.2.2 Technical-scientific report on the energy use in intensive aquaculture
5. D 3.2.3 Development of the model for simulation of environmental impact of fish cages

## 2. Fish Health & Welfare

- Implementing multiple bio-safety measures for the containment of infectious diseases, using available targeted vaccines. In case of emerging pathogens, apply new autologous vaccines. Vaccination is one of the most effective tools for preventing animal diseases, promoting animal health and well-being and, at the same time, improving the production of safe food to protect the final consumer.
- According to the "One Health" approach in the control of infectious diseases in aquaculture and in order to reduce the risk of the onset of antibiotic resistance, the responsible and conscious use of veterinary drugs and the application of effective prophylaxis measures is essential. In the future, it will be possible and profitable to use new molecules with anti-bacterial and immunostimulating action, to be incorporated into the feed.
- Fish welfare is one of the main productivity indicators in modern fish farms. Aquaculture operators are recommended to use assessment tools that are easily applicable and measurable in the field on a daily basis (Operational Welfare Indicators). Equally important is the continuous training of breeders and operators in the sector on the physiological and ethological needs of fish.
- Implement multiple biosecurity measures to contain infectious diseases using available targeted vaccines. In case of emerging pathogens, apply new autologous vaccines. Vaccination is one of the most effective tools for preventing animal diseases, promoting animal health and welfare, and at the same time improving the production of safe food to protect the end consumer.
- In keeping with the "One Health" approach to infectious disease control in aquaculture and to reduce the risk of antibiotic resistance emergence, use veterinary medicines responsibly and consciously; apply effective prophylactic measures. In the future, it will be possible and profitable to use new molecules with antibacterial and immunostimulatory effects added to feed.
- Fish welfare is one of the most important productivity indicators in modern fish farms. Exploit assessment tools that are easy to use daily in the field (Operational Welfare Indicators). Equally important is the continuous education of farmers and operators in the sector on the physiological and ethological needs of fish.

## 3. Energy efficiency

- New technologies and the use of alternative energy sources must form the basis for the future development of Adriatic aquaculture in terms of energy efficiency. The combined use of solar panels, heat pumps and photovoltaic systems can guarantee significant savings and reduce the environmental impact of traditional energy sources. In this sense, it is also necessary to promote the electrification of the engines used in aquaculture farms, with innovative solutions and careful planning of company logistics.

- In order to increase the recyclability of the production processes, it is also necessary to promote the use of by-products and wastewater from water cycles in aquaculture farms as raw materials for the production of biogas.

**TEN TECHNICAL DELIVERABLES** are available in the project's website, section Docs and Tools, as support for the protocols suggested above, sub-section [WP 4 – R & I TO IMPROVE HEALTH AND SUSTAINABILITY IN AQUACULTURE](#):

1. D.4.1.1 Autologous “tailor-made” vaccines against *Tenacibaculum maritimum*
2. D.4.1.2 Autologous “tailor-made” vaccines against *Vibrio harveyi*
3. D.4.1.3 Brochure on the vaccination strategy in hatchery/farm
4. D.4.2.1 Technical-scientific Report on efficacy of naturally extracted pyrethrins on the fish and parasites
5. D.4.2.2 Technical-scientific Report of the fish microbiome, probiotic candidates and the effect of feeding trials on the fish growth and immunity
6. D.4.2.3 Standardized protocol for the in vitro and in vivo evaluation of new substance effectiveness in fish
7. D.4.2.4 Patent application on drug candidates
8. D.4.3.1 Technical-scientific Report on OWI applicability
9. D.4.3.2 Manual for use on field Operational Welfare Indicators (OWI)
10. D.4.3.3 Manual for use on field of a “bivalent monitoring tool”

#### 4. Fish products

- It is recommended that aquaculture companies develop fish products characterized by greater ease of use, pleasing to the appetite and with a self-life adequate to current distribution and marketing methods, capable of satisfying the needs of a wider range of consumers (juvenile catering, smoked products, etc.).

#### 5. Consumer information

- It is necessary to inform and educate consumers about the environmental sustainability of aquaculture, in order to increase its social acceptance, focusing on values of farmed fish products, such as traceability and transparency of the production process, freshness, availability on the market, and high nutritional value.

**SEVEN TECHNICAL DELIVERABLES are available in the project's website, section Docs and Tools, as support for the protocols suggested above, sub-section [WP 5 - IMPROVING QUALITY AND MARKETING OF FRESH AND PROCESSED FISH](#):**

1. D 5.1.1 Technical-scientific report (Microbial and chemical quality indexes; Product safety value; Chemical and nutritional properties; Dietetic value)
2. D 5.1.2 Manual of Raw meat standardization for fish production
3. D 5.2.1 Technical-scientific report on a new type of farmed fish packaging for extended shelf-life
4. D 5.2.2 New types of packaging
5. D 5.2.3 Innovative products (hamburgers, fillets)
6. D 5.3.1 Set of tools for market research analysis
7. D 5.3.2 Technical-scientific report on the application of the market research tools and data about the perception of fish food consumption by catering SMEs, catering customers and general public;  
a) Brochure about nutritional value and health benefits of fish consumption, which will be bilingual, written in English and translated in Croatian/Italia, b) Promotion video about fish production and nutritional value; c) Dissemination material

## A. CONTRIBUTION TO EUSAIR

This document reflects the collective effort of the AdriAquaNet project partnership to tackle concrete issues relevant for the aquaculture value chain, in line with the [EUSAIR pillar of Blue Growth](#). To contribute to this pillar, AdriAquaNet has progressively achieved the EUSAIR objectives 1 and 2, such as “*To promote research, innovation and business opportunities in blue economy sectors, by facilitating the brain circulation between research and business communities and increasing their networking and clustering capacity*” and “*To adapt to sustainable seafood production and consumption, by developing common standards and approaches for strengthening these two sectors and providing a level playing field in the macro-region*”.

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## B. CONTRIBUTION TO HORIZONTAL PRINCIPLES

*Please provide a description of the project contribution to the horizontal principles of equality between men and women, non-discrimination and sustainable development.*

The project engaged technical and administrative staff based on personal characteristics, complying with the equal opportunities and without discriminations, such as gender, race, nationality, ethnic origin, religion or belief, disability, age or sexual orientation. The employment relationship was based on the principle of equal opportunity and fair treatment, including type of contract, wages and benefits, working conditions and terms of employment, access to training, promotion, and termination of employment as for any other Italian or Croatian staff hired. The staff and external services involved were formed without any kind of discriminations based on personal characteristics, genre, age, belief, race, nationality, ethnic, religion and belief, sexual orientation, etc. 15 persons were employed temporary or through fellowship in the project activities and most of them were women. All questionnaires used for marketing research activities, focus groups and other tools such as promotional materials were done without discriminations, such as gender, race, nationality, ethnic origin, religion or belief, disability, age or sexual orientation.

## C. COMMUNICATION ACTIVITIES

*Please refer to the Final Communication Report template and provide a summary on the main achievements trying also to identify which were the most successful communication tools in reaching general public/decision makers/other target groups.*

This document is available on the [project's website, section Docs&Tools, WP2 - COMMUNICATION AND DISSEMINATION](#)

## D. NATURA 2000

*Please describe, if it is the case, measures foreseen and implemented by the project:*

**a) In case the project involved Natura 2000 sites, describe what measure the project envisaged and implemented to avoid any negative impact:**



No Natura 2000 sites are included in the areas where the project activities have been carried out; therefore, no measures have been envisaged and implemented during the project in order to avoid negative impacts.

**b) In case the project had a positive effect on Natura 2000 sites, please describe which measure the project has foreseen and implemented in order to reach a direct or indirect positive impact:**

No Natura 2000 sites are included in the areas where the project activities have been carried out; therefore, no measures have been envisaged and implemented during the project in order to avoid negative impacts.

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#### E. TYPES OF ACTIONS ADDRESSED (as defined in the Cooperation Programme)

These are our primary objective's types of actions, that we addressed by the Project:

<i>Specific Objectives</i>	<i>Types of action</i>	<i>the most relevant one within the SO addressed by your project</i>
1.1 Enhance the framework conditions for innovation in the relevant sectors of the blue economy within the cooperation area	Joint projects and actions aimed at creating platforms, networks and at supporting exchange of good practices in order to enhance the knowledge transfer and capitalization of achieved results in the field of blue economy	X
	Actions aimed at cluster cooperation, joint pilot initiatives in order to boost the creation of marketable innovative processes and products, in the field of blue economy	X

## F. TYPES OF OUTPUTS PRODUCED

Specify the types of outputs generated by your activity that are reported here and provide a brief description

Output typology	Description
Trainings	N.A.
Monitoring systems	N.A.
SMEs clusters	N.A.
New networks	N.A.
Platforms	N.A.
Adaptation plan	N.A.
Building renovation	N.A.
Others (please specify)	Opinion paper

## G. TYPOLOGY OF IMPACTS

Please indicate what type of impact(s) your project has had. You can choose more than one answer. For each tangible impact selected, please provide a concrete example from your project, where possible supported by quantitative information.

### TANGIBLE IMPACTS

Tangible impacts	Example/ quantitative information
Improved access to services	N.A.
Cost savings	N.A.
Time savings	N.A.
Reduced energy consumption	See Deliverables 3.2.1 and 3.2.2
Reduced environmental impact	See Deliverable 3.1.1 and 3.1.2 See Deliverables 3.2.3
(Man-made, natural) risk reduction	N.A.
Business development	See Deliverables 5.3.1 and 5.3.2
Job creation	15
Improved competitiveness	See Deliverables 5.1.1 and 5.1.2., See Deliverables 5.2.1, 5.2.2 and 5.2.3
Other tangible impacts (specify)	N.A.

### INTANGIBLE IMPACTS

Intangible impacts	Example/quantitative information

Building institutional capacity	Increased research capacity of institution, networking and increased possibilities for future cross-border collaboration
Raising awareness	The project has stimulated the attention of fish farmers and producers regarding the wide opportunities of adopting innovations in order to promote competitiveness and sustainability (see deliverables 3.3.1, 4.4.1 and 5.4.1, all on knowledge transfer to the business sector).
Changing attitudes and behaviour	Closing the gap between research and industry, by knowledge and technology transfer.
Influencing policies	The communication activities have engaged and informed policy makers (see Deliverable 2.4.3).
Improving social cohesion	N.A.
Leveraging synergies	The project led to the strengthening of relations between Italian and Croatian research groups, as well as between universities or centres of excellence and fish farmers. This collaboration may be exploited in the future for the drafting and implementation of new research projects aimed at improving aquaculture farming systems and waste/energy management in fish farms.