# AdriAquaNet

Enhancing Innovation and Sustainability in Adriatic Aquaculture

## Deliverable WP4 task 4.3.1

## Technical-scientific report on Operational Welfare Indicator (OWI) applicability based on designated indicators tested at least in 2 fish farms (experimental trials)

**PP4 IZSVe - Legnaro, 20.06.2022**

| | |
|---|---|
| **Project number:** | **10045161** |
| **Project Acronym:** | **AdriAquaNet** |
| **Project Title:** | **Enhancing Innovation and Sustainability in Adriatic Aquaculture** |
| **Start of the project:** | **01/01/2019** |
| **Duration:** | **42 months** |
| **WP/activity:** | **WP4, Activity 4.3.1** |
| **Deliverable name:** | **D.4.3.1 Technical-scientific Report on OWI applicability** |
| **WP leader:** | **PP1 (VHI)** |
| **Author (s):** | **Amedeo Manfrin (PP4), with the collaboration of PP8 and PP10** |
| **Delivery date:** | **20/06/2022** |
| **Status:** | **Final** |

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## A. REPORT HIGHLIGHTS

**Please provide a cumulative short overview of the project WP task's achievements**

*In recent years, there has been a growing demand in the aquaculture sector for ethical and animal welfare products. Consumers want to be sure that they are eating food that is safe, healthy and that has raised to ensure their well-being and a dignified life.*

*Even the producers know that a healthy fish is a fish that tends to get less sick, reaches commercial size sooner and in some cases has a longer shelf life; all of which sums up to lower management costs, less antibiotic expenditure and greater demand for their product from the discerning consumer.*

*Currently there is no specific regulation or standards concerning the welfare of farmed fish. In the last 2/3 years, papers on welfare indicators in salmon and a few other species have been published.*

*For these reasons, one of the objectives of the AdriAquaNet project was to develop Operational Welfare Indicators (OWIs) for sea bass and sea bream bred in sea cages, and testing them in two farms (PP8 and PP10 project partners) to assess the health status of the animals and promptly help the farmer in case of discomfort.*

*Istituto Zooprofilattico Sperimentale delle Venezie (IZSVe) - Project Partner 4 (PP4) had the aim of drawing up OWIs based on visits to the two farms involved in the project and located in Croatia: PP8 Friškina Ltd and PP10 Orada Adriatic Ltd. On the basis of the information collected, specific OWIs were written for this type of farm and used by the farm manager to monitor the welfare status of their animals based on environmental (temperature, salinity, oxygen, turbidity checked by a multiparametric probe - Oxybuoy) group and individual observations (abnormal swimming, mortality, deformities, fin erosion, diseases, etc.). AdriAquaNet researchers, in agreement with fish farmers involved in the project, developed a* ***practical check list with 25 indicators*** *and an evaluation grid. Based on the score obtained, the farmer can easily identify some critical issues and immediately prepare corrective actions to improve the welfare of fish. For example, if the score is high due to many Non Conformities (NC), it will be necessary to intervene by adjusting some parameters; if more serious cases are present it will be necessary to alert the competent veterinarian who will evaluate whether to send samples to the laboratory for diagnostic analysis or not.*

*In the last months of the project, the scores of the two farms included in the project have been monitored to assess the overall welfare status of the fish. To this extent, OWIs have been used as a reference tool to track and evaluate the welfare/health conditions of the fish. In this way, the farmer can easily understand whether the fish is healthy, in terms of both welfare and absence of disease. In addition, the farmer can spend this knowledge to promote the product, informing the consumers that the fish they are going to buy is healthy and was farmed respecting its welfare and natural needs.*

*In parallel, PP4 researchers purchased two electric outboard engines equipped with rechargeable batteries by solar panels (see also WP 3.2). The immediate advantages, personally encountered also by the operators of the smaller in-shore sea bass and sea bream plant (PP8 Friskina) were: zero environmental impact (silent and non-polluting), the engines were rechargeable by solar panels (no use of fossil fuels) and they were not very stressful both for the fish and the operators.*





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## B. WP PROJECT OUTPUTS AND RESULTS

### Specific 2: Promote fish health and provide "healthy and safe" fish to consumers

**Summary and presentation of activities and results**

PP4 visited the two facilities involved in the project for a first inspection on 21 May 2019 at Orada Adriatic – Cres island and on 28 August 2019 at Friškina – Rogoznica (Split).

During the first meeting at PP 10 Orada Adriatic, have been evaluated the characteristic of the breeding of sea bream (*Sparus aurata*) and sea bass (*Dicentrarchus labrax*) (total production 1700 tons/year). The farm consisted of sea cages located far from human activity and urbanization; the depth of the water was around 50-60 meters, the density of fish was 10-12 kg/m$^3$, the turbidity was around 20 meters and the water current was 1 m/sec. Apart from a few events of winter disease in sea bream, the facility appeared to enjoy good health and good breeding practices. They also had a processing laboratory where the fish is gutted, filleted and packed under ice for sale and marketing.

**Orada Adriatic net cages – Cres, Croatia**

PP8 Friškina farm is smaller (100 ton / year) than PP10. Similarly, it consists of sea cages where sea bass and sea bream are farmed. It is located near the coast (in-shore) a few miles from Rogoznica (Split); the depth of the sea varies from 10 to 25 meters; the breeding density was less than 15 kg / m$^3$. During 2018 summer they had problems of low oxygen in the water, and mortality was 15-20% with the presence of *Tenacibaculum maritimum*, red rush and algal biofilms.





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**PP8 Friskina farm - Rogoznica**

During the two meetings, we evaluated together with the farm managers and staff, the environmental, group and individual based parameters that should appear in the OWIs check list according to the characteristics of the facilities. The problems that they encountered during production such as temperature variations, oxygen, salinity, presence of diseases, biometric surveys, and presence of deformities have also been assessed.

Based on these evaluations, we considered more appropriate to monitor the environmental parameters remotely by a multiparametric probe. Tecnos S.a.S., an Italian company supplied us with two Oxybuoy device, one for each farm. Oxybuoy has the possibility of anchoring it on the edge of the cage in the sea or placing it in the middle of the tank with a float. The device is equipped with a photovoltaic panel and a SIM card connected to the telephone network, sending the recorded data to a specific web-cloud: www.fishcontrol.com. An oxybuoy was provided to each farm and installed in July 2020. This enabled us to start remote environmental and visual (by a submersed video camera) monitoring of fish together with the farmers.



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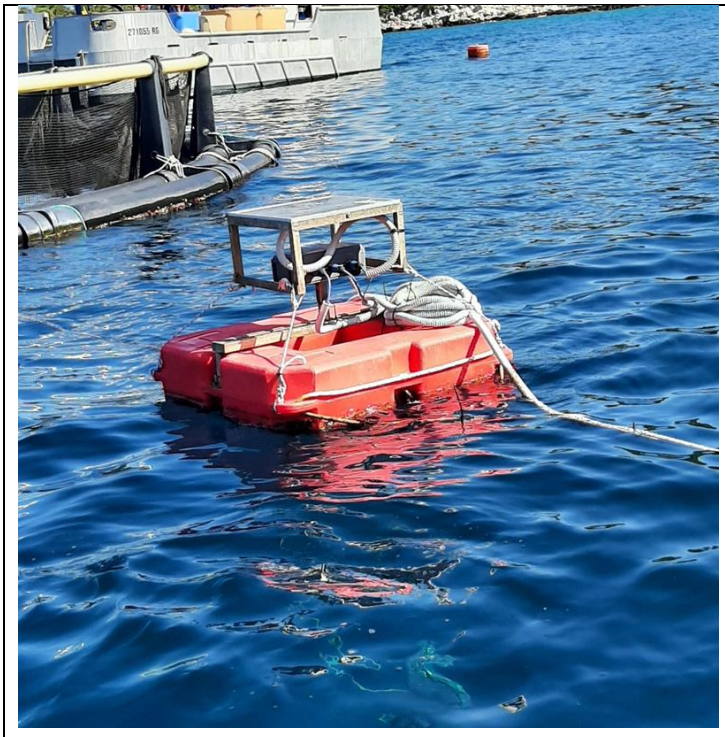
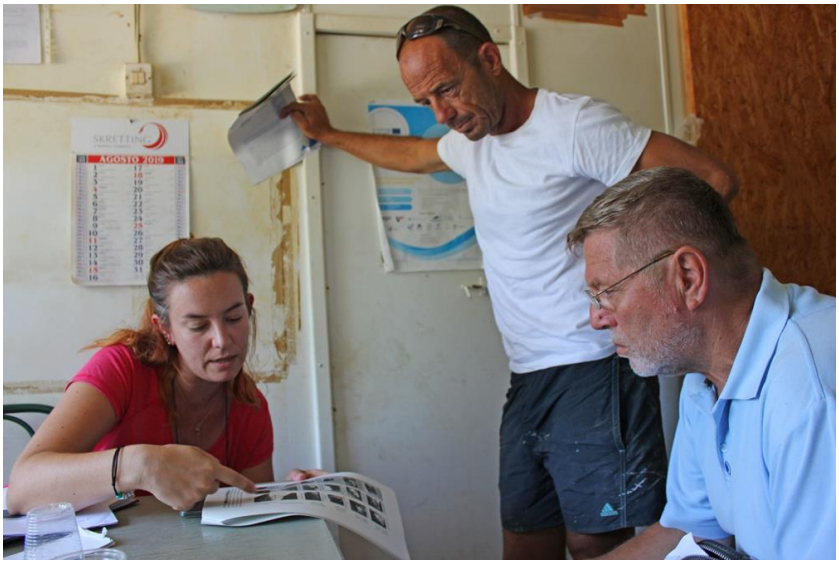


During the farm visit in 2020, we administered the OWIs check list and evaluated their feasibility and ease in filling out the form by the farmer. In fact, one of the objectives was to draw up a list of parameters that could be easily monitored and that would not take too long to be controlled, so as not to burden the workers' or the plant manager's working day.





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In agreement with the fish farmers involved in the project, a practical data sheet with 25 indicators and an evaluation grid was developed. Based on the score obtained according to the number of Non Conformity (NC), the farmer can easily identify some critical issues and immediately prepare corrective actions to improve the welfare of his fish.

Environment based: 5

Animal based (group): 8

Animal based (individual): 12

**TOTAL OWIs: 25**

| SCORE (number of NC) | CONCLUSIONS |
|---|---|
| 0 ≤ NC ≤ 5 | Very good welfare |
| 6 ≤ NC ≤ 10 | Good welfare |
| 11 ≤ NC ≤ 15 | Poor welfare |
| 16 ≤ NC ≤ 25 | Very bad welfare |

Although it is a qualitative-quantitative system, it is possible to carry out an evaluation in a few hours even of large plants and, in case of need, ask for the help of a veterinarian or a laboratory.

In poor welfare conditions, it is necessary to adopt some biosecurity measures or to improve environmental parameters such as activating oxygen pumps, reducing density, etc. In the case of very bad welfare, it is necessary to change the management of the farm and, if a disease outbreak is present, to contact the competent authority for possible sampling and laboratory diagnosis.

The breeders of the 2 involved farms showed interest and confirmed that the compilation of the form we suggested was easy, intuitive and did not take too long time to be filled in. In association with the remote monitoring of environmental parameters, the OWIs have proved to be an excellent aid in assessing the welfare state of sea bass and sea bream reared in net cages at sea.

**Reasons of discrepancies between planned and realized outputs (if any)**
We had no discrepancies

**Impact of outputs underachievement on project results**
N.A.

**Additional results (was the project able to reach additional outputs /results besides those foreseen in AF?**
Old gasoline-powered outboard engines were used in small boats for daily operations (cage control, manual feed distribution, transport of divers, etc.) in PP8 Friskina farm causing water pollution and, due to their noise, a huge stress to fish farmed in net pens.

PP4 AdriAquaNet researchers chose to purchase two electric outboard engines equipped with rechargeable batteries by solar panels. Zero environmental impact, no use of fossil fuels and no stress both for the fish and the operators were the most important advantages. Furthermore, the model used was light (16 kg of which 6 kg of removable battery against 25/30 kg of a classic petrol outboard), always ready to use thanks to a small solar panel available on board and finally there was no fuel costs. The purchase price was comparable to a classic petrol model of 4 HP, but the power was lower and not




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suitable in bad weather conditions. Its use is therefore limited to the inspection of off-shore cages, even in larger plants, where they can act as a support to larger boats used for the most important operations (for example, distribution of feed or harvesting of animals for selling to the consumers).

## C. DURABILITY AND TRANSFERABILITY OF THE PROJECT AND ITS RESULTS



*Please describe shortly:*

**How will the outputs and results be maintained and developed further after project end?**

Friškina and Orada Adriatic breeding management were evaluated given a practical information about the welfare status of the animals during farming practices. This OWIs approach is quite flexible and can still be used in the tested farms as a routine procedure and also be transferred to other farms with sea cages regardless their location. We recommend filling out the checklist twice or at least once a month and keeping track of it in order to evaluate the progress of the health/welfare status of the fish during all the production cycle.

**How has the availability of project results and outputs for general public and other stakeholders been ensured during the project life and eventually after the project end?**

The prototype checklist with OWIs was delivered to PP10 Orada Adriatic and PP8 Friškina; the final edited and graphically corrected version will be ready before the end of the project. A specific manual on OWIs will be publicly available online in the AdriAquaNet project website.
Environmental parameters have been recorded by probes (Oxybuoy equipment) and all the data are available to companies and PP4 researchers. During the project, training sessions were open to the public and with remote connection (due to the pandemic), where the results and the work performed have been presented.
The use of OWIs during the production process is also an added value to the final consumers as it can be demonstrated that the animal welfare is totally respected.

## D. CAPITALISATION OF RESULTS

*Please provide information about capitalisation*:

**Was the project able to capitalise or influence future calls or other projects? Please specify main results or output to be considered for future capitalisation action.**
**Are there any obstacles of legal or administrative nature that the project has encountered and which hampered cooperation? Is there any room to solve these obstacles?**
The results of this project will be useful if other research groups will decide to study and apply the OWIs also to other species farmed in the Mediterranean countries, such as trout, carp and tilapia. No obstacles have been encountered.



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## E. PARTNERSHIP COOPERATION

*Please provide an assessment of the participation and involvement of the partners in the project, answering the following questions*:

| |
|---|
| **Which Partners were active in your WP and the activities related to the report? Were all the Partners involved also active?**<br>Besides PP8 and PP10 (fish farmers), PP 1 (Central Veterinary Institute Zagreb), PP2 University of Trieste and PP3 (Oceanographic Institute Split) were active in this WP too, while Shoreline (Trieste), a private company, was also involved as PP4 subcontractor. |
| **Were they all able to attract other local/regional actors and involve them in the project activities?**<br>No, but the results are available to Italian and Croatian fish farmer associations. |
| **What was the added value given by the cooperation?**<br>With the collaboration of Shoreline, we analysed the sediments of the farm including those underneath the cages reared at different densities and/or with different feeds. We studied the environmental impact of the farm and carried out some ecotoxicological tests (see also Technical report n. 13: "Manual for use on field of a "bivalent monitoring tool"). |
| **Which were the main problems encountered?**<br>Due to Covid19 movement restrictions, only a limited numbers of visits to PP8 and PP10 were possible in 2020 and 2021. |
| **Was the project able to create links with other projects?**<br>The OWIs developed in this project have been shared with ISPRA-Italy researchers involved in PerformFISH Horizon 2020 project. |
| **Will the PPs cooperate in the future even without funding (if yes explain the main aims of this cooperation)?**<br>Yes, but only in training and results dissemination |

## F. TARGET GROUPS INVOLVEMENT

*Please list the main target groups that benefited from your WP project's achievements as inserted in the relevant Report Section in SIU that you will find on the left (the numbers are our project numbers). In few word provide further details on how they were able to make use of the outputs/ results of the project.*

| ***TARGET GROUPS*** | ***Description*** |
|---|---|
| *SMEs (50)* | *2 farms directly involved in OWIs tests, 5 SMEs (Fanin, Bluefarm, GasClimaService, Skretting, RINA Service) participating to Padova training,* |
| *Universities, technology transfer institutions, research institutions (10)* | *LP, PP1, PP2, PP3, PP4, PP5 UNI FIRENZE, UNI PADOVA, UNI BOLOGNA, UNIPVM (see also LP and PP2 reports)* |
| *NGOs, associations, innovation agencies, business incubators, cluster management bodies and networks (5)* | *Italian Fish Farmers association (API) (see also LP and PP2 reports)* |
| *Centers of R excellence (5)* | *ISPRA and IRBIM-CNR (see also LP and PP2 reports)* |



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| | |
|---|---|
| *Local, regional and national public authorities (10)* | *4 local veterinary services, Friuli Venezia Giulia Region (see also LP and PP2 reports)* |
| *General public (1000)* | *Dissemination of results on the IZSVe online channels (website, social network and newsletter) and on the AAN project website (see also LP and PP2 reports)* |





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**PART 2**

## A. CONTRIBUTION TO EUSAIR

*Please provide a description of the project contribution to the EUSAIR in terms of synergy with the Strategy's pillars and alignment of implemented project's activities with the Action Plans and labelled projects.*

The AAN project contributes to the EUSAIR strategy within the first "blue growth" pillar, which aims at enhancing aquaculture in the Adriatic area, in particular the development of a strong, high-quality sector that is economically sustainable and environmentally friendly, contributes to job creation and to supply of healthy food products, respecting the EU and international rules. OWIs and sediment analyses will help to produce quality, environmentally friendly food.



## 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.*

Within the project, no distinction was made based on gender, culture, religion or origin. The focus was on the one common goal, or rather on the promotion of a healthy and sustainable product from the Adriatic regions, bringing together farmers, scientists, consumers, veterinarians and experts in the field.

## 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.*

All the activities performed to reach the present DL have been documented with photos and videos taken by PP2 subcontractor and PP4 communication specialists. The material has been uploaded on the Intranet website of the project. Some of the materials was used to produce this report (see above), and to produce communication materials (e.g. the project video released by Divulgando and presented at Barcolana 2021; some social media posts on the AAN pages and accounts).
The aforementioned activities have been presented at the training event held in Padua in November 2021 (for details see the promotional news items on the IZSVe website ITA | ENG) and in a similar training events (Ostuni 6-7 May and Zadar 02 June 2022). During the final conference in Zadar (3 June 2022) and Udine (20 June 2022) a summary of the most important results have been presented by PP4 researchers (WP 4.3 welfare monitoring task leader).
Finally, this work will be further and in depth explored in a specific manual focusing on the development and validation of the OWIs, which will be published at the end of the project. This manual will be given visibility through the project communication channels.
Numerous reports, meetings, brochures, training courses, conferences, a website and a YouTube channel have been produced to communicate the results.



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## 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:**<br>N.A. |
| **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:**<br>N.A. |





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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:

| ***Specific Objectives*** | ***Types of action*** | ***the most relevant one within the SO addressed by your project*** |
|---|---|---|
| *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 | 5 training sessions have been performed *(see also LP and PP2 reports)*: OWIs have been explained and practical example on how to fill them have been performed. |
| Monitoring systems | OWI to monitor the welfare status of farmed animals and multi-parameter probe to measure environmental parameters that may affect the health status of fish. |
| SMEs clusters | N.A. |
| New networks | N.A. |
| Platforms | N.A. |
| Adaptation plan | N.A. |
| Building renovation | N.A. |
| Others (please specify) | Use of electric outboards engines powered by solar energy (environmental friendly approach) |





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## 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 | -- |
| Cost savings | Lower petrol costs thanks to the boat electric engine, powered by solar panels, used to move around the facility. |
| Time savings | -- |
| Reduced energy consumption | See Cost saving row |
| Reduced environmental impact | Reduced environmental impact thanks to the electric boat engines |
| (Man-made, natural) risk reduction | -- |
| Business development | -- |
| Job creation | -- |
| Improved competitiveness | -- |
| Other tangible impacts (specify) | Improved health and welfare status of farmed sea bass/bream |

### INTANGIBLE IMPACTS

| **Intangible impacts** | **Example/quantitative information** |
|---|---|
| Building institutional capacity | -- |
| Raising awareness | -- |



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| | |
|---|---|
| Changing attitudes and behavior | With OWIs, more importance will be given to the overall health/welfare fish status of the farm, taking into account the environmental and behavioural parameters, reducing mortality or disease and unnecessary suffering of the farmed fish. |
| Influencing policies | -- |
| Improving social cohesion | -- |
| Leveraging synergies | -- |
| Other intangible impacts (Specify) | The awareness of the final consumer on this new approach to fish farming, respecting its well-being, is increasing. |





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