AdriAquaNet

Enhancing Innovation and Sustainability in Adriatic Aquaculture

Deliverable WP4 task 4.3.2

Manual for use on field Operational Welfare Indicators (OWIs) of Sea bass (*D. labrax*) and Sea bream (*S. aurata*) breeding in sea cages

Legnaro, 30.06.2022

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 4.3.2**
Deliverable name:	**Manual for use on field Operational Welfare Indicators (OWI)**
WP leader:	**PP4 (IZSVe)**
Author (s):	**Amedeo Manfrin**
Delivery date:	**30/06/2022**
Status:	**Final**

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In recent years, there has been a growing demand in the aquaculture sector for ethical and animal welfare products. Consumers want to be sure they are eating a food that is safe, healthy and that farmed animals were ensured "a life worth living". Even the producers acknowledge that a healthy fish is a fish that tends to get sick less, reaches commercial size first and in some cases has a longer shelf-life; all this translates into lower operating costs, lower spending on the purchase of antibiotics and greater demand for their product from the discerning consumer. There are currently no specific regulations or standards regarding the welfare of farmed fish. In recent years, there have been publications on welfare indicators in salmon (Noble C., et al. 2018) and a few other species. For these reasons, one of the objectives of the Interreg Italy-Croatia AdriAquaNet (AAN) project was to develop operational welfare indicators (OWI) for sea bass and sea bream reared in sea cages and to test them in two Croatian farms to assess the health and welfare of the animals, promptly helping the farmer in case of need. ***Operational Welfare Indicators*** *are practical Welfare Indicators that can realistically be used on sea bass and bream farm. They can be Environment based (observations made on the environment, infrastructure and processes), Animal based (group and individual - observations made on or from the animals) and Laboratory based (analysis performed by specialized laboratories like cortisol, cathecolamine, lysozyme, bilirubine, etc).*

Istituto Zooprofilattico Sperimentale delle Venezie (IZSVe) - Project Partner 4 (PP4) was responsible for drafting OWIs based on the inspections to the two farms involved in the project and located in Croatia: PP8 Friškina and PP10 Orada Adriatic. On the basis of the information collected, specific OWIs were written for this type of farm and used by the farm manager during the project to monitor the welfare and health status of the animals based on environmental (temperature, salinity, oxygen, turbidity checked by a multiparameter probe - Oxybuoy) group and individual observations (abnormal swimming, mortality, deformities, fin erosion, disease, etc.).

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PP8 Friškina farm – Rogoznica

PP10 Orada Adriatic net cages - Chers

The OWIs were presented to breeders and operators of the Italian-Croatian fish sector during the conferences, meetings and training courses organized in the framework of the AAN project, being these professional figures the main target groups of this activity. They welcomed with high interest the initiative, and asked for accessible, clear and easy to consult OWIs, in order to boost their use. Therefore, we decided to create this practical manual.

There are currently no manuals on specific welfare indicators for farmed sea bream and sea bass. A very interesting paper was published in 2018 by Noble and collaborators in the framework of the FISHWELL project; we took a cue from that manuscript, discussed it with farmers and identified 25 OWIs (5 environmental, 8 group and 12 individual based) for sea bass and sea bream reared in sea cages.

The 25 OWIs are summarized in the following table:

OPERATIONAL WELFARE INDICATORS (OWIs)		
ENVIRONMENT BASED	**ANIMAL BASED**	
	GROUP BASED	**INDIVIDUAL BASED**
• Oxygen (mg/L) • Temperature (°C) • Salinity (ppt) • Turbidity • Other……	• Appetite • Growth • Mortality • Abnormal swimming • Abnormal behavior • Diseased fish • Emaciated fish • Other……..	• Emaciation state • Fin damage • Skin loss/ulcers • Eye status (exophtalmus, haemorragies) • Deformities • Abnormal pigmentation • Opercular damage • Mouth/Jaw damage • Gill status • Ectoparasites • Feed in intestine • Visceral fat

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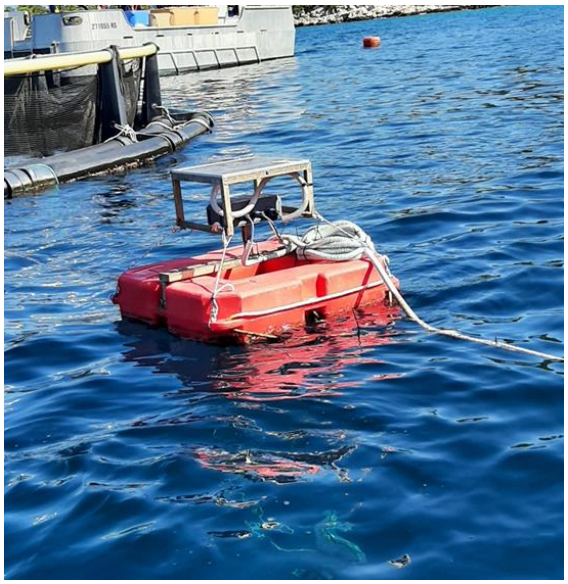
Each indicator was assigned a score (0-1) indicating the presence or absence (Non Conformity) of the welfare indicator. The environmental parameters have a range based on the characteristics of the farm and fish species: if the measurement of the environmental parameter is within the range, a score of 0 will be given; if, on the contrary, the measured value is out of range, that parameter will be assigned a score of 1.

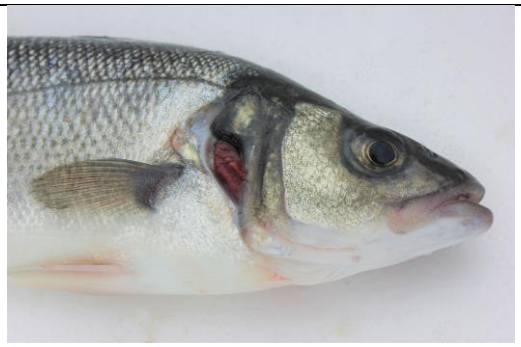
In order to monitor environmental parameters and control the behavior, we provided our partners Friškina and Orada Adriatic with multi-parameter probes equipped with a submersed video camera and powered by solar panels, which can transmit all measured data and recorded videos with a SIM card, so that they can also be monitored remotely.



Oxybuoy device by Tecnos S.a.S. company -ITALY

For group or individual based indicators if present (Non Conformity) the score will be one; if it is not present, the score will be zero.

The pictures below show the presence or absence of some OWIs and the scoring example:

OPERCULAR DAMAGE	
	
Presence: 1	Absence: 0

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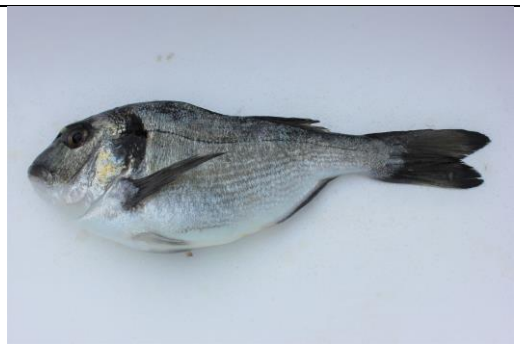
SKIN LOSS/ULCERS	
	
Presence: 1	Absence: 0
MOUTH/JAW DAMAGE	
	
Presence: 1	Absence: 0
DEFORMITIES	
	
Presence: 1	Absence: 0

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	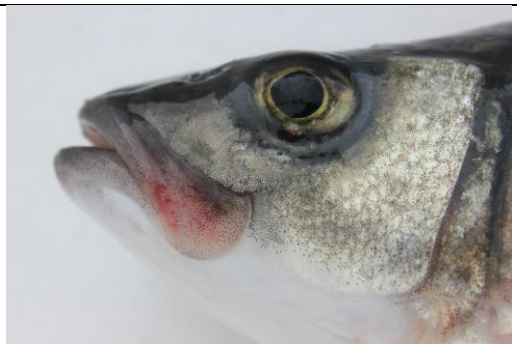
Presence: 1	Absence: 0

EYE STATUS (i.e.: exophtalmus, haemorragies)

Adding up all the scores, the closer to 25, the more we will be in a poor animal welfare condition; the lower the score obtained, the more we will be in a favorable welfare condition.

The table below shows the scores and the relative welfare situation of the animals.

SCORE (NC)	WELFARE SITUATION	SUGGESTION
0 ≤ NC ≤ 5	OPTIMAL WELFARE	Keep it up!
6 ≤ NC ≤ 10	GOOD WELFARE	Check the environmental parameters, the density and the possible presence of viral, bacterial or parasitic diseases.
11 ≤ NC ≤ 15	LOW WELFARE	Check the environmental parameters, check the doses of feed administered and exclude the presence of viral, bacterial or parasitic diseases by sending samples to the laboratory.
16 ≤ NC ≤ 25	BAD WELFARE	Review the management of the farm, check the environmental parameters, check the doses of feed administered and exclude the presence of viral, bacterial or parasitic diseases by sending samples to the laboratory. Do blood and / or tissue tests on animal samples to check the presence of stress biomarkers.

Close to each OWI, there are some suggestions on how to solve negative welfare indicators. If the negative situation persists, it will be advisable to contact the competent veterinarian. He will take some samples to be

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sent for laboratory analyses in order to exclude the presence of viral, bacterial and parasitic diseases. If deemed necessary, blood and/or tissue samples can be analysed for the presence of stress biomarkers, such as cortisol, catecholamines, Heat Shock Protein 70, bilirubin, immunoglobulins, etc.

We suggest filling out the OWIs and data collection sheet at least once a month. It is recommended to keep track of the measurement of the OWIs in order to demonstrate the health and welfare status of the farm.

ENVIRONMENT BASED OWIs

Date	Species	Fish age	Parameter	Optimal range	NC	Corrective action	Final remarks
__/__/___	☐ Sea bass ☐ Sea bream	Months _____	Oxygen (mg/L) _____	6-8	☐ Yes ☐ No	☐ Aeration ☐ Liquid oxygen ☐ Feed reduction ☐ Net cleaning / changing ☐ Other _____	☐ Resolved ☐ Not resolved
Cage Number N°_____		Weight (g) _____	Temperature (°C) _____	18-26	☐ Yes ☐ No		☐ Resolved ☐ Not resolved
		Size (cm) _____	Salinity (ppt) _____	30-35	☐ Yes ☐ No		☐ Resolved ☐ Not resolved
			Turbidity (NTU or m) _____	0,12 NTU or 10 m	☐ Yes ☐ No		☐ Resolved ☐ Not resolved
			Other _____		☐ Yes ☐ No		☐ Resolved ☐ Not resolved

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GROUP BASED OWIs

Date __/__/__ –	Species	Fish age	Parameter	Optimal	NC	Corrective action	Final remarks
	☐ Sea bass ☐ Sea bream	Months _____	Appetite ☐ High ☐ Normal ☐ Lower ☐ Absent	Normal	☐ Yes ☐ No	☐ Water testing ☐ Fish examination ☐ Exclude diseases ☐ Change in feed ☐ Selection ☐ Other _____	☐ Resolved ☐ Not resolved
Cage Number **N°_____** –							
Number of fish **N°_____** –		Weight (g) _____	Growth ☐ High ☐ Normal ☐ Lower	Normal	☐ Yes ☐ No	☐ Water testing ☐ Fish examination ☐ Change in feed ☐ Selection ☐ Exclude diseases ☐ Other _____	☐ Resolved ☐ Not resolved
		Size (cm) _____	Mortality ☐ < 5 % ☐ 5-10% ☐ > 10%	< 5%	☐ Yes ☐ No	☐ Water testing ☐ Fish examination ☐ Exclude diseases ☐ Change in feed ☐ Selection ☐ Therapy ☐ Other _____	☐ Resolved ☐ Not resolved

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			Abnormal swimming ☐ **Present** ☐ **Absent**	**Absent**	☐ **Yes** ☐ **No**	☐ **Water testing** ☐ **Fish examination** ☐ **Change in feed** ☐ **Selection** ☐ **Exclude diseases** ☐ **Other** _____	☐ **Resolved** ☐ Not resolved
			Abnormal behavior ☐ Present ☐ Absent	Absent	☐ Yes ☐ No	☐ Water testing ☐ Fish examination ☐ Change in feed ☐ Selection ☐ Reduce density ☐ Other: _____	☐ Resolved ☐ Not resolved
			Diseased fish ☐ Present ☐ Absent	Absent	☐ Yes ☐ No	☐ Therapy ☐ Water testing ☐ Fish examination ☐ Change in feed ☐ Selection ☐ Reduce density ☐ Other _____	☐ Resolved ☐ Not resolved

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			Emaciated fish ☐ Present ☐ Absent	Absent	☐ Yes ☐ No	☐ Water testing ☐ Fish examination ☐ Exclude diseases ☐ Change in feed ☐ Selection ☐ Other _____	☐ Resolved ☐ Not resolved
			Other _____ ☐ Present ☐ Absent		☐ Yes ☐ No	☐ Water testing ☐ Fish examination ☐ Exclude diseases ☐ Change in feed ☐ Selection ☐ Reduction density ☐ Other _____	☐ Resolved ☐ Not resolved

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INDIVIDUAL BASED OWIs

Date __/__/___	Species	Fish age	Parameter	Optimal	NC	Corrective action	Final remarks
Cage Number N°_____	☐ Sea bass ☐ Sea bream	Months _____	Emaciation state ☐ Present ☐ Absent	Absent	☐ Yes ☐ No	☐ Water testing ☐ Fish examination ☐ Exclude diseases ☐ Change in feed ☐ Selection ☐ Other _____	☐ Resolved ☐ Not resolved
Number of fish N°_____		Weight (g) _____	Fin damage ☐ Present ☐ Absent	Absent	☐ Yes ☐ No	☐ Water testing ☐ Fish examination ☐ Change in feed ☐ Selection ☐ Excluded diseases ☐ Reduction density ☐ Other _____	☐ Resolved ☐ Not resolved
		Size (cm) _____	Skin loss / ulcers ☐ Present ☐ Absent	Absent	☐ Yes ☐ No	☐ Water testing ☐ Fish examination ☐ Exclude diseases ☐ Change in feed ☐ Selection ☐ Reduction density ☐ Other _____	☐ Resolved ☐ Not resolved

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			Eye status (i.e.: exophtalmus, haemorragies) ☐ Present ☐ Absent	Absent	☐ Yes ☐ No	☐ Water testing ☐ Fish examination ☐ Exclude diseases ☐ Change in feed ☐ Selection ☐ Other _____	☐ Resolved ☐ Not resolved
			Deformities ☐ Present ☐ Absent	Absent	☐ Yes ☐ No	☐ Water testing ☐ Fish examination ☐ Change in feed ☐ Selection ☐ Other: _____	☐ Resolved ☐ Not resolved
			Abnormal pigmentation ☐ Present ☐ Absent	Absent	☐ Yes ☐ No	☐ Water testing ☐ Fish examination ☐ Exclude diseases ☐ Change in feed ☐ Selection ☐ Other _____	☐ Resolved ☐ Not resolved
			Opercular damage ☐ Present ☐ Absent	Absent	☐ Yes ☐ No	☐ Water testing ☐ Fish examination ☐ Change in feed ☐ Selection ☐ Other _____	☐ Resolved ☐ Not resolved

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			Mouth/Jaw damage ☐ Present ☐ Absent	Absent	☐ Yes ☐ No	☐ Water testing ☐ Fish examination ☐ Change in feed ☐ Selection ☐ Other _____	☐ Resolved ☐ Not resolved
			Gills status ☐ Bright red ☐ Red with haemorragies ☐ Pale ☐ Pale / Red with necrosis	Bright red	☐ Yes ☐ No	☐ Water testing ☐ Fish examination ☐ Exclude disease ☐ Selection ☐ Other _____	☐ Resolved ☐ Not resolved
			Ectoparasites ☐ Present ☐ Absent	Absent	☐ Yes ☐ No	☐ Therapy ☐ Water testing ☐ Fish examination ☐ Selection ☐ Other _____	☐ Resolved ☐ Not resolved
			Feed in intestine ☐ Present ☐ Absent	Present	☐ Yes ☐ No	☐ Change in feed ☐ Fish examination ☐ Selection (density) ☐ Other _____	☐ Resolved ☐ Not resolved
			Visceral fat ☐ Too much ☐ Normal ☐ Low	Normal	☐ Yes ☐ No	☐ Change in feed ☐ Fish examination ☐ Selection (density) ☐ Other _____	☐ Resolved ☐ Not resolved

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Conclusions

Welfare Indicators that can be used in an on-farm welfare assessment are termed Operational Welfare Indicators, OWIs (see Noble et al., 2018).

They must:
i) provide a valid reflection of fish welfare
ii) be easy to use on the farm
iii) be reliable
iv) be repeatable
v) be comparable
vi) be appropriate and fit for purpose indicators for specific rearing systems or husbandry routines.

This simple manual is a practical tool that can be used by farmers to assess the welfare of fish in a few hours. A check list consisting of only 25 indicators and a simple consultation table to estimate the final score (poor welfare-good welfare) represent an easy-to-use operational tool that can be used regardless of the location of the facilities (inland, in-shore or off-shore sea bass and bream farm).

References

Noble, C., Gismervik, K., Iversen, M. H., Kolarevic, J., Nilsson, J., Stien, L. H. & Turnbull, J. F. (Eds.) (2018). Welfare Indicators for farmed Atlantic salmon: tools for assessing fish welfare. FISHWELL project sponsored by Norwegian Seafood Research Fund.

Note

This Manual is a project deliverable that helps reaching and the fulfilment of the project specific objective nr.2 thanks to development of easy, rapid and effective methods for farmers and veterinarians to safely assess the fish health and welfare, so as to ensure quick decisions and apply remedial measures in farms, avoiding important economic losses.

The Manual content and application is coherent with the EUSAIR action plan and S3 strategies of both countries involved.

The Manual has been translated in Italian and Croatian in order to be distributed locally and get in use in everyday practice. This contributes to the indicator CO04 (improving the productivity of the sea bass and sea bream farming as well as the improvement of the quality and marketing of the fresh and processed fish products and provide safe products to consumers). 20 enterprises of the sector were directly involved in this non-financial support.

Also it contributes to the indicator CO44 and the number of the participants that joined local trainings events and the programme indicators 1.104 and 1.101.

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