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Deliverable 3.6

Methodology for assessing welfare in MMFF

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Summary

The DL provides an introduction to fish welfare in aquaculture and results from the systematization of knowledge for sea bass and sea bream, evaluating risk factors and welfare indicators. A comparison of the main certification schemes and standards production and good practices used in SBB and SBG companies is further assessed with respect to health and welfare principles and indicators applied. The DL reports on the process of selection and validation of OWIs by the PerformFISH Consortium. The methodology to assess and score fish welfare at different life stage and farming system is provided. A first benchmarking of welfare status of farmed bass and bream for MMFF is given based on OWIs data collection on farm and from PerformFISH Gateway D4Science(W-KPIs from WP7).

Most part of the work is completed and the list of OWIs is consolidated (task 3.5.1, 3.5.2). However, due to the Covid-19 pandemic, activities related to OWIs implementation on farm and elaboration of welfare scoring (task 3.5.3) have been suspended on February 15th.

The present DL is thus submitted as a draft version. It is estimated that the DL3.6 will be finalized within 6 months after pandemic restrictions are lifted.

1 Introduction

Animal welfare is a strategic issue for the competitiveness and sustainability of EU livestock production, including aquaculture (CFP Reg. EU 1380/2013; EMFF Reg. EU 508/2014; EFSA strategy 2020; EC Food 2030). Improving welfare of farmed fish deals with consumer's expectation for more ethical production systems (see results from WP5) and pressing from Animal Protection NGOs to enhance public awareness and promote the implementation of EU policies, stakeholder dialogue and applied research on fish welfare issues (e.g. EuroGroup for Animals; Compassion in World Farming).

Recently the EU Commission published studies on welfare of farmed fish and reported on fish welfare during transport and at slaughter to the EU Council and Parliament (SANTE, 2017; SCAR FISH, 2018; COM 87 final (2018). The European Aquaculture Advisory Council has adopted in 2017 the position paper '*Farmed Fish Welfare During Slaughter in the European Union*' and in June 2019 has provided a new recommendation for optimising fish welfare at slaughter (AAC, 2019). FEAP represented the strict need for operational and applicable parameters to measure welfare. Both industry and certification bodies is now looking for **suitable Operational Welfare Indicators (OWIs) for measuring the welfare of farmed fish** and improving standard and welfare friendly practices.

A set of suitable OWIs is a useful tool to: i) assess and benchmark the fish welfare by farmers and health managers, ii) improve husbandry practices, iii) comply with legal framework, iv) define standards of production, v) increase public perception of aquaculture.

Some OWIs (and reference values) have recently been identified for Salmonids (Noble 2018, 2020), but are still lacking for sea bass (BSS) and sea bream (BSG).

The aim of "Task 3.5: Welfare Evaluation (WP3)", is to develop a user-friendly methodology based on OWIs to assess and benchmark the welfare of BSS and BSG at different life stages in different farming systems.

2 Materials and methods

2.1 Systematization of welfare knowledge for sea bass and sea bream

The extensive review on welfare of sea bass and sea bream refers to the Task 3.5.1 have been completed on M36. The systematization of welfare knowledge based on:

- **Scientific papers**

Available knowledge on welfare for sea bass and sea bream have been reviewed based on **analysis of peer-reviewed papers on BSS and BSG published in scientific repositories** from late '80s onwards. Papers have been chosen based on cross queries of selected key words (e.g. welfare, well-being, stress, cortisol, behavior, coping style, health, performances, European sea bass, *Dicentrarchus labrax*, Gilthead sea bream, *Sparus aurata*) found in title, key words, abstracts. Those papers reporting relevant results for fish health and welfare have been further selected.

- **EU research projects focusing on animal welfare**

Public technical reports/deliverables came out from EU research project focused on welfare indicators in farmed fish (e.g. WEALTH, WELLFISH, BENEFISH, COPEWELL, AQUAEXCELL) and other livestock productions (e.g. Welfare Quality®, AWIN) were consulted.

- **Legal framework & Official technical papers**

The systematization of knowledge has further included the **consultation of current legislation, recommendations** and **technical documents** for sea bass, sea bream and Salmonids, including OIE Aquatic Code, EU recommendations, EFSA opinions, AAC position papers, Technical guidelines and Codes of Conduct (FAO, FEAP).

- **Standard of production & benchmarking systems**

Certification schemes (RSPCA, ASC, Global GAP, BAP GAA, FOS, Organic), Benchmarking systems (GAPI, GSSI), Welfare Handbook for Atlantic salmon and rainbow trout (Noble et al., 2018; 2020) have been considered with special regard to direct (animal-base) and indirect welfare indicators potentially useful for MMFF sector.

The systematization of welfare knowledge allows the selection of the most promising indicators as Operational Welfare Indicators (OWIs) for BSS and BSG.

2.2 OWIs validation

The choice OWIs and the validation by PerformFISH Consortium have been performed in task 3.5.2 through several step:

- **Validation of Welfare Key Performance Indicators** (W-KPIs) (WP7; Task 7.1)

During the first period (M1-M18), a first set of welfare indicators for BSS and BSG proposed by P20 was approved in the KPI Rome meeting consisted of 28 WE-KPIs, 75% of were animal-based indicators and 25% were indirect indicators. Most of selected WE-KPIs were already in use in one or more aquaculture certification schemes. Out of 28 KPIs, a total of **9 WE-KPIs were selected at "A-level" as ready to use**, taking into account their robustness, repeatability, cost-effectiveness and feasibility. 19 WE-KPIs were selected at "B-level", as relevant KPIs to be implemented during the project (e.g. severity of injuries, degree of parasite infestation, abnormal behaviour) within the scope of WP3 - task 3.5.

- **Technical questionnaires for Producer Associations and the LTPs**

Two questionnaires were submitted to the five Producer Associations and to the aquaculture companies involved as TLPs in PerformFISH to implement the OWIs list. The questionnaire for the Associations requested information on fish welfare in respect to national legal framework, provisions and recommendations from national Competent Authorities, Code of Conduct and Guidelines. Questions focused on BSS and BSG welfare at farming, transport and slaughter. The questionnaire for Companies aimed to acquire information related to main fish welfare topics (Farming system, Stocking density, Handling, Grading, Environmental monitoring, Feeding, Transport, Harvesting, Slaughter, Emergency killing, Staff training, Certification schemes) and related direct and indirect indicators.

- **Validation of selected OWIs through a Welfare Survey**

An **on-line welfare survey** was submitted in July 2019 to the PerformFISH Consortium in order to identify among further **48 selected OWIs**, those most suitable to assess BSS and BSG welfare bass on farm.

The complete list of OWIs was defined on the basis of the results of the systematization of knowledge in task 3.5.1, consultations on KPIs in Task 7.1 and expert judgment.

The survey was prepared by ISPRA in collaboration with UAB, ULPG and API and was available on web from July to October 2019. Consultation was open only to scientists, farmers and producer's Associations belonging to PerformFISH Consortium.

The **48 OWIs** proposed in the survey cover **9 different areas of fish welfare**: health (n=8), growth (n=3), behavior (n=5), housing (n=7), transport (n=8), harvest (n=5), stunning/slaughter (n=8), staff training and compliance with recommendations (OIE and EU) (n=4).

The set of OWIs includes **animal-based indicators (46%)** and **indirect indicators (54%)** related to environment and husbandry management and practices. The OWIs include both **quantitative indicators (47%)**, providing numerical values for welfare scoring and **qualitative indicators (53%)**, related to the use of best management practices during farming, transport and slaughter.

Most of selected OWIs (80%) for BSS and SBG are already included into certification schemes and are used in farmed Atlantic salmon and rainbow trout. However threshold value for several welfare indicators are often missed, in particular for BSS and SBG.

The suitability of each OWI was scored according to the following OWI attributes: Informative, Reliable, Cost effectiveness, Labor effectiveness, Repeatable, Comparable, Easy to apply. Experts were asked to **score the overall suitability of each OWI** as low, medium, high. No answer was also an option if the expert did not have knowledge/expertise to give an answer.

2.3 OWIs Implementation

The methodology for set up a **welfare score system for BSS and SBG** was developed according to methodologies applied to other animal food systems (e.g. Welfare Quality®, AWIN, for beef, dairy cattle, pigs, turkeys) and aquaculture (Welfare Index Model SWIM, Stien et al., 2013; Folkedal et al., 2016).

Activities related to OWIs implementation on farm and elaboration of welfare scoring (task 3.5.3) have been suspended on February 15th due to Covid-19 pandemic. The overall methodology will be finalized within the next 6 months.

3 Results

3.1 Systematization of welfare knowledge

The available knowledge on fish welfare for BSS and SBG was systemized and updated by ISPRA for identifying all potential animal based-indicators (e.g. physical, productive/performance, ethological, physiological, molecular) and indirect indicators (e.g. environment, management practices etc.) in respect to main production risk factors affecting stress and welfare. About 400 scientific papers published within the last two decades were collected and consulted (Figure 1).

A **scientific Welfare Database (WDB)** have been realized (Figure 2) and filled with several information related to BSS and SBG life stages, experimental/rearing conditions, animal welfare area, welfare risk factors (Figure 3) and indicators applied (Figure 4). In the WDB over 140 indicators of stress, health and welfare have been coded within 6 different categories and related subcategories (Table1).

Figure 1. Key words frequency analysis in scientific literature on BSS welfare

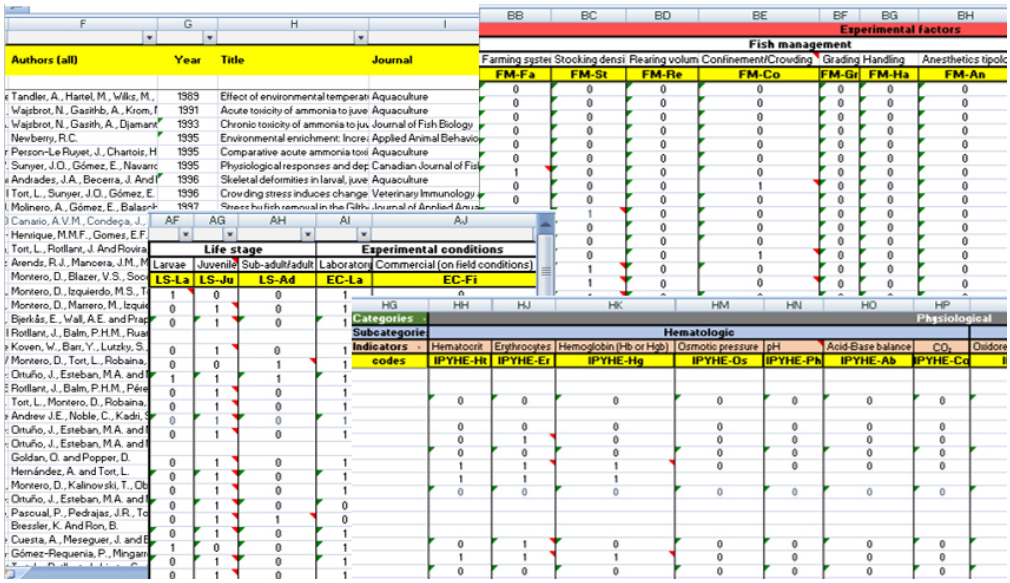

Figure 2. Sea bass and sea bream WDB

Behaviour • Swimming • Escape • Feeding • Social • Consciouness • Anesthesia • Indices of electrical activity **Production** • Growth • Feed efficiency • Health	**Physical** • Health • Histology **Physiological** • Hormonal • Hydromineral • Metabolic • Hematological • Enzimatic • Neurotransmitters	**Immunological** • Non-specific • Specific **Molecular gene expression** • Metabolism • Health

Table 1. Categories of welfare indicators for sea bass and sea bream included in the WDB

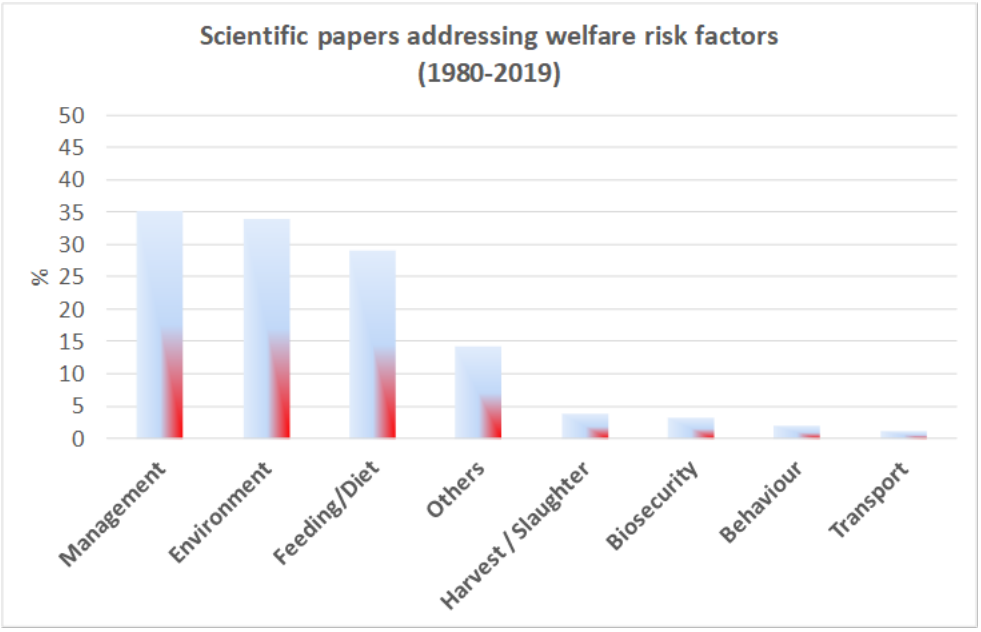

Figure 3. Percentage of scientific studies investigating different welfare risk factors in sea bass

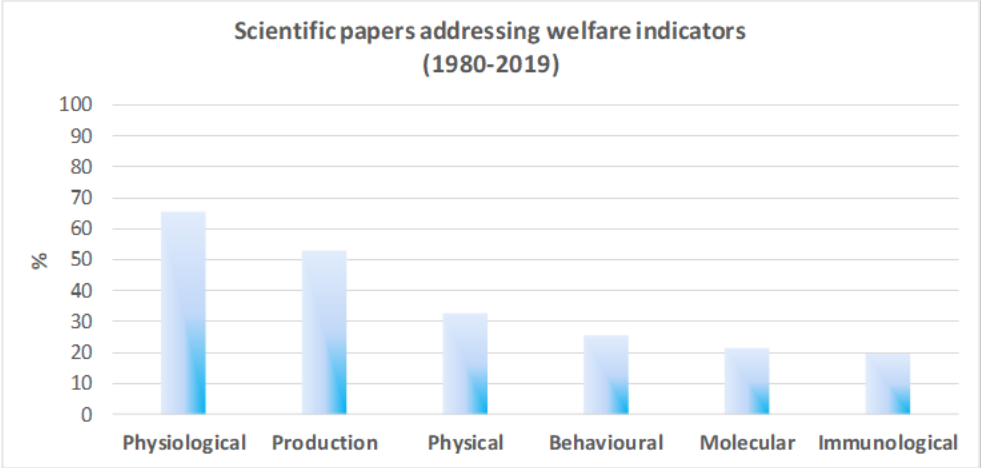

Figure 4. Percentage of scientific studies investigating different welfare indicators in sea bass. OWIs were selected among Production, Physical and Behavioral categories of welfare indicators

3.2 OWIs data collection

3.2.1 Welfare Key Performance Indicators (W-KPIs)

The collection of data useful for assess welfare of BSS and SBG was started by PerformFISH companies using the set of 9 Welfare Key Performance Indicators (W-KPIs) validated by the Consortium in Task 7.1 (Table 2). Production data of fish batches closed in 2016-2019 were provided by 15 companies using the KPI excel form provided by P20 for grow-out system and are now available in the KPI-VRE hosted in PerformFISH Gateway D4 Science.

Analysis and comparisons of welfare performance among different batches and farms will allow to gain a first benchmarking of welfare condition of BSS and BSG across different farming system, farming area and at different life cycle. Production data will be further used to elaborate welfare indices and scoring in Task 3.5.3.

*The **9 "ready to use" W-KPIs***

1. *Mortalities-total*
2. *Mortalities first 3 days after transport and stocking*
3. *Mortalities first 10 days after transport and stocking*
4. *Vaccinated fish – by disease*
5. *Number of antiparasitic treatments (total & by disease)*
6. *Number of antibiotic treatments (total & by disease)*
7. *Feed Intake (FI)*
8. *Stocking density*
9. *Oxygen depletion persistence days*

Table 2. Welfare KPIs already validated in WP7 (DL 7.1)

3.2.2 Results from Welfare Survey

PerformFISH Consortium participated actively in the survey, providing at least 1 expert judgments from scientists, industry (e.g. managers, biologists, farm vets) and representatives of Producer's Associations belonging to PerformFISH Consortium, for a total of 36 full filled surveys. **Most of PerformFISH OWIs proposed by P20 (n=48) were judged suitable for BSS and BSG** (Figure 5). In particular, high suitability was given to Health, Housing, Harvest and Transport OWIs. Vet Management Plan, BPs and Staff Training resulted highly recommended. Abnormal feeding/swimming behaviour are considered suitable qualitative OWIs. SGR can be an informative OWI if tailored to Mediterranean climate zones.

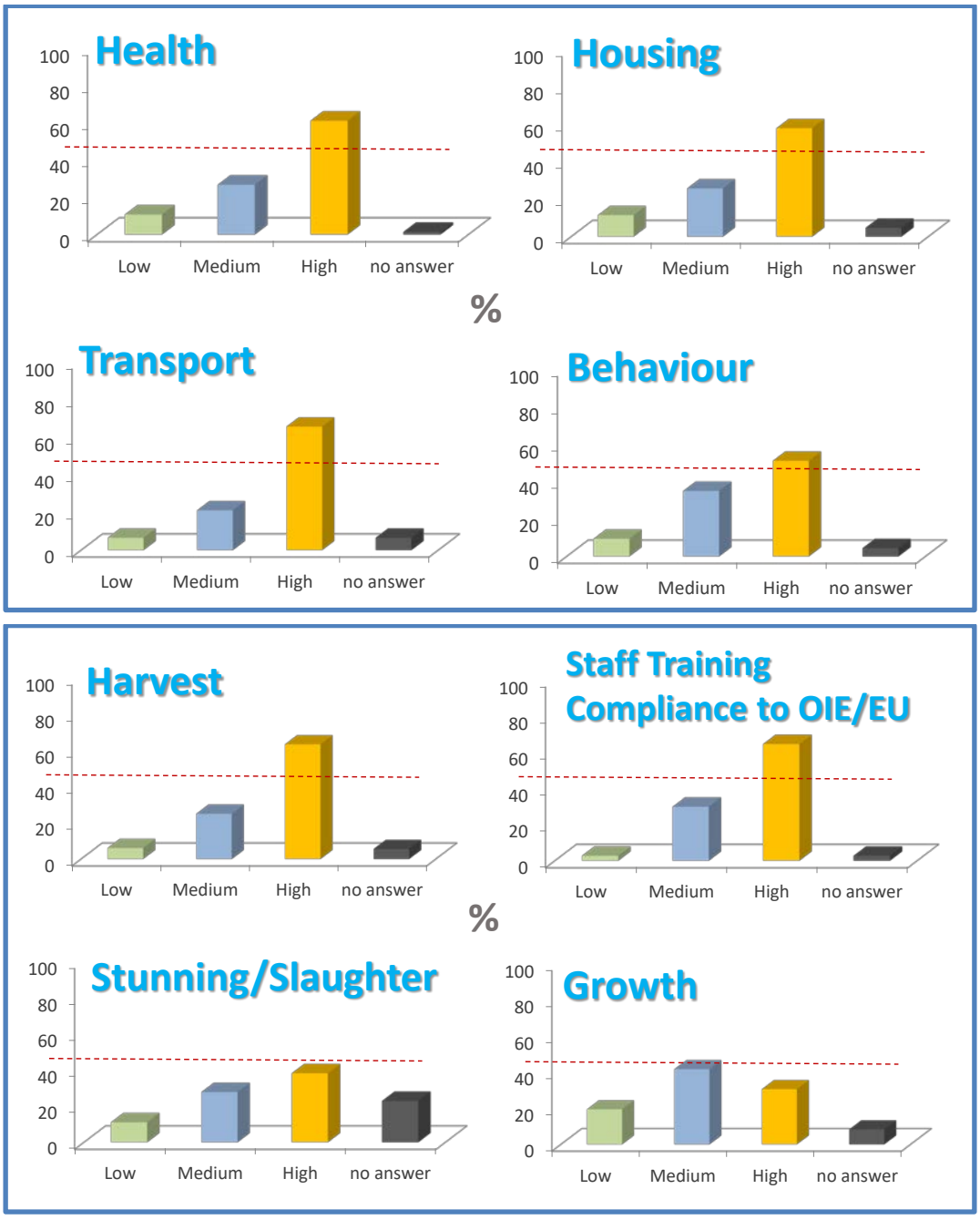

Figure 5. Suitability (%) of overall OWIs according to the welfare area

Lack of knowledge and uncertainty resulted as the most evident results for the choice of stunning/slaughter OWIs. As slaughtering procedures on farm are still a controversial topic in MMFF sector (AAC, 2017) and PerformFISH welfare scoring system focuses only on grow-out, from farming to harvesting phase, only few OWIs for slaughter have been included and scored in the survey. However, the analysis of survey questionnaires already provide a good picture of the perception of MMFF sector, which strongly recommended the use Code of Conduct and Best Practices and new research for the validation of reliable OWIs at slaughter, not yet available for BSS and BSG.

Preliminary results from the welfare survey were disseminated by poster at the EAS congress in Berlin (October 2019) and by oral presentation during the H2020 workshop held in Gaeta (Italy) during the national conference of SIPI – Società Italiana di Patologia Ittica (October 2019). Results were appreciated by the Aquaculture Advisory Council in Bruxelles (February 2020), by both NGOs and Industry.

3.3 OWIs Implementation

The elaboration of the welfare scoring and refinement of OWIs panel to be transferred to the industry (Handbook) will be finalized as soon the production data for the welfare KPIs will be available for P20 in anonymised way in the KPI-VRE. Most part of the work is completed and the list of OWIs is validated. However, due to the Covid-19 emergency, activities related to OWIs implementation on BSS and BSG farm has been delayed and the elaboration of welfare scoring have been suspended on February 15th. It is estimated that the DL3.6 will be finalized within 6 months after pandemic restrictions are lifted.

4 References

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