Quality assurance of Welfare Monitoring and Data Collection

AI Aqkva

Barbo Klakegg & Hans Berg Nåvik

zenodo.org/records/10451144

Accuracy and Validity

Original Source data is not misleading or corrupt

Completeness

All data are complete and there is no missing data

Consistency

Information follows a given set of standard in all organisations

Up-to-date

There is no obsolete data and all information is up to date

JOHNNY MILLER / MILLEFOTO

LUSEPRAKSIS

To improve the salmon lice situation, precise control of lice numbers is required. Operation personnel at the sites find that there often can be a huge difference between the last count of lice before treatment and counts in connection with treatment. The difference is so large that stage shift cannot be the entire cause. It is pointed out that the uncertainty in the lice numbers is not due to miscounting, the reason is rather that the selection of fish that is counted before treatment is not representative.

Brukserfaringer – Lusepraksis

DNV

Health data must be uniform

Full Scientific Report

Journal of Veterinary Diagnostic Investigation
1–11

DOI: 10.1177/10406387241310900
jvdi.sagepub.com

Assessment of a semiquantitative scoring system for mild-to-moderate gill lesions in Atlantic salmon reared in recirculating aquaculture systems in Norway

Thomas Amlie, Alf Dalum, Marit Stormoen, Øystein Evensen[1]

Abstract. Compromised gill health is a critical cause of forfeited welfare in Atlantic salmon farming. Detecting and quantifying the early onset of gill disease is important to reveal initial inflicting stimuli. We collected gill samples of 45 Atlantic salmon from 2 commercial recirculating aquaculture systems (RASs) spanning fry-to-market-size fish with no clinical signs of gill disease. Gill samples were assessed histologically by 3 independent raters with different levels of experience. Semiquantitative scoring for 7 types of gill changes was carried out for 10 filaments per gill (450 filaments total) over 3 rounds on anonymized samples. Scores were summarized for each type of gill change. The assumed clinical relevance for each change was transformed into a category score, followed by an assessment of agreement within (intra) and between (inter) raters. A generalized linear model estimated the difference in score levels between raters. For each rater, intra-rater agreement was high for 6 gill changes and moderate for 1 gill change. Inter-rater agreement was moderate to almost-perfect, except for 2 gill changes; generalized linear model regression revealed systematic differences in score usage between the raters. Our scoring protocol worked satisfactorily for mucous cell amount, lamellar clubbing, lamellar hypertrophy and/or hyperplasia, and aneurysms, despite different levels of expertise in histologic evaluation. Intra-rater agreement was consistent, but differences existed for interlamellar hypercellularity, lamellar inflammation, and degeneration. Scoring subclinical gill changes is a challenge, and our scoring system for mild-to-moderate lesions may enable early intervention to limit the detrimental effects of poor gill health in RAS farming.

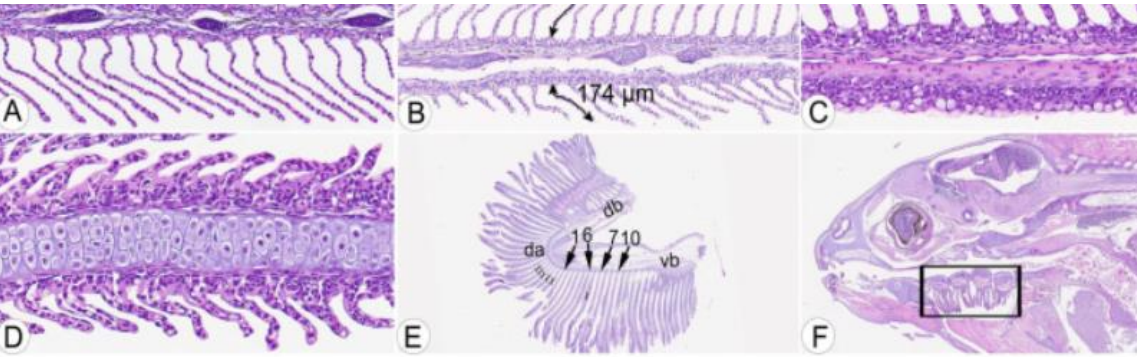
Even a simple thing like measurements of ulcers and wounds needs to be standardized:

- Where are they located
- What is the size
- What about the depth
- How far are they in the healing process?
- Is it injury or infection

Assessment of a semiquantitative scoring system for mild-to-moderate gill lesions in Atlantic salmon reared in recirculating aquaculture systems in Norway

Thomas Amlie [1,2], Alf Dalum [3], Marit Stormoen [4], Øystein Evensen [5,]

Journal of Veterinary Diagnostic Investigation



2021

Veileder i registrering av dødsårsaker i akvakultur

LAKSVEL

Standardisert operasjonell velferdsovervåking for laks i matfiskanlegg

RAPPORT FRA HAVFORSKNINGEN NR. 2022-14

ÅKERBLÅ Akvademiet

Dødfiskkategorisering | Nettbasert

Klassifisering Av Taps – Og Dødsårsaker

Kurset gir deltakeren en grundig innføring i hvordan man kategoriserer dødfisk knyttet til lakseoppdrett.

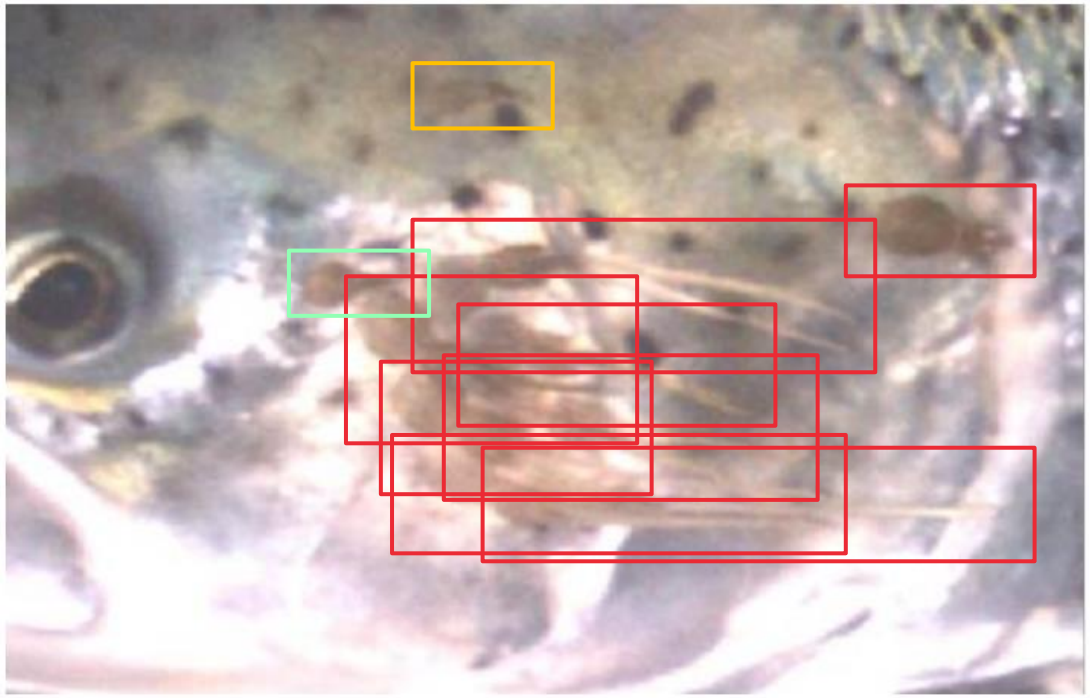
The future of fish health and welfare monitoring

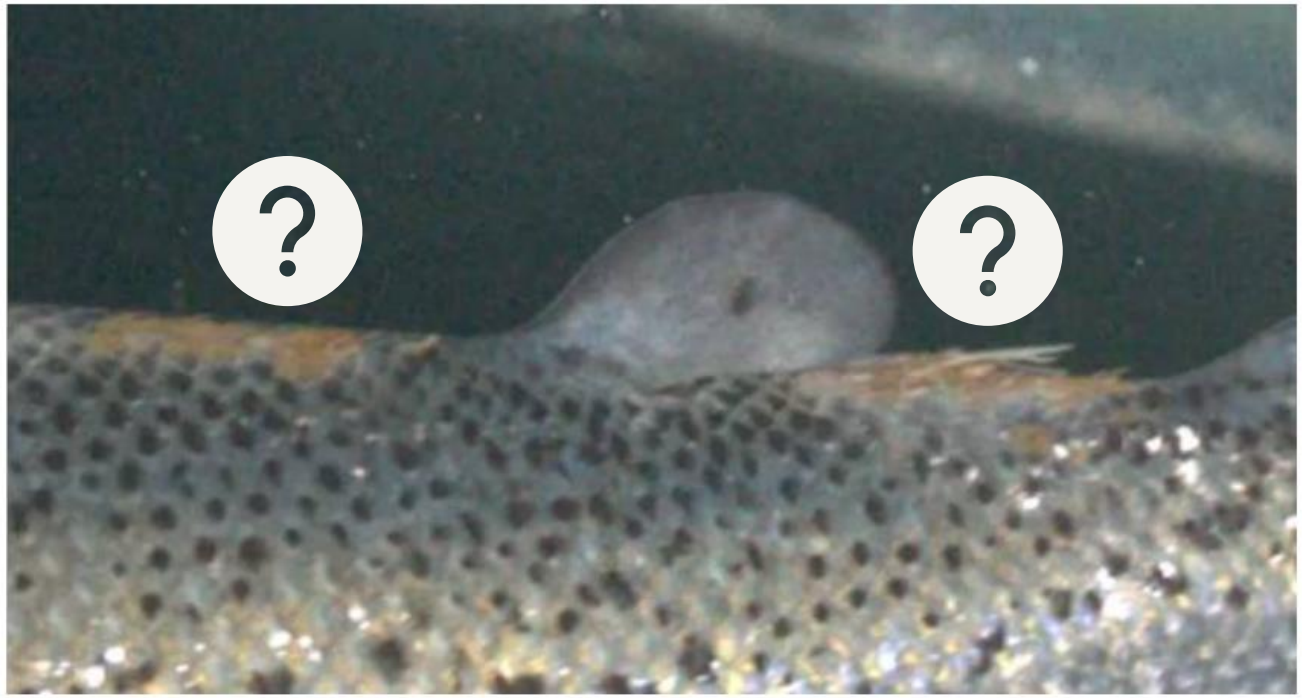
- Distance to the fish is increasing, exemplified by submerged and exposed production systems
- Robust monitoring is crucial for valid information
  - Inaccurate information *will* lead to a worsened situation, for the fish and/or the farmer
- AI-enabled systems enable the opportunity to obtain robust estimations and valid information, ***however…***
- Assurance of technology and methodology is necessary to enable trustable data collection and estimations. Assurance also support a fair and fact-based regulation.

"***Without good control and standardized counts, there will not be possible to introduce fees on pollution nor tradable quotas***"

Government white paper on aquaculture

The future of fish health and welfare monitoring





"***Without good control and standardized counts, there will not be possible to introduce fees on pollution nor tradable quotas***"

Government white paper on aquaculture

Bui S., Folkedal, O., Nerbø, I. S., & Barrett, L. T. (2024) *Standardisation of manual louse counts for validation of automatic camera systems*. Rapport fra havforskningen (2024-61). Havforskningsinstituttet.

Assurance and validation

- The goal is to collect samples of a representative population
- Known issues with trust regarding sea lice estimation
  - Lack of uniform estimation between providers
  - Lack of clear requirements
- Evaluation of fish welfare parameters are scattered and unstandardized
- Different assessments require different AI-based models and system-based assurance
- Without standardization and verification, can we expect consistent output from different systems?

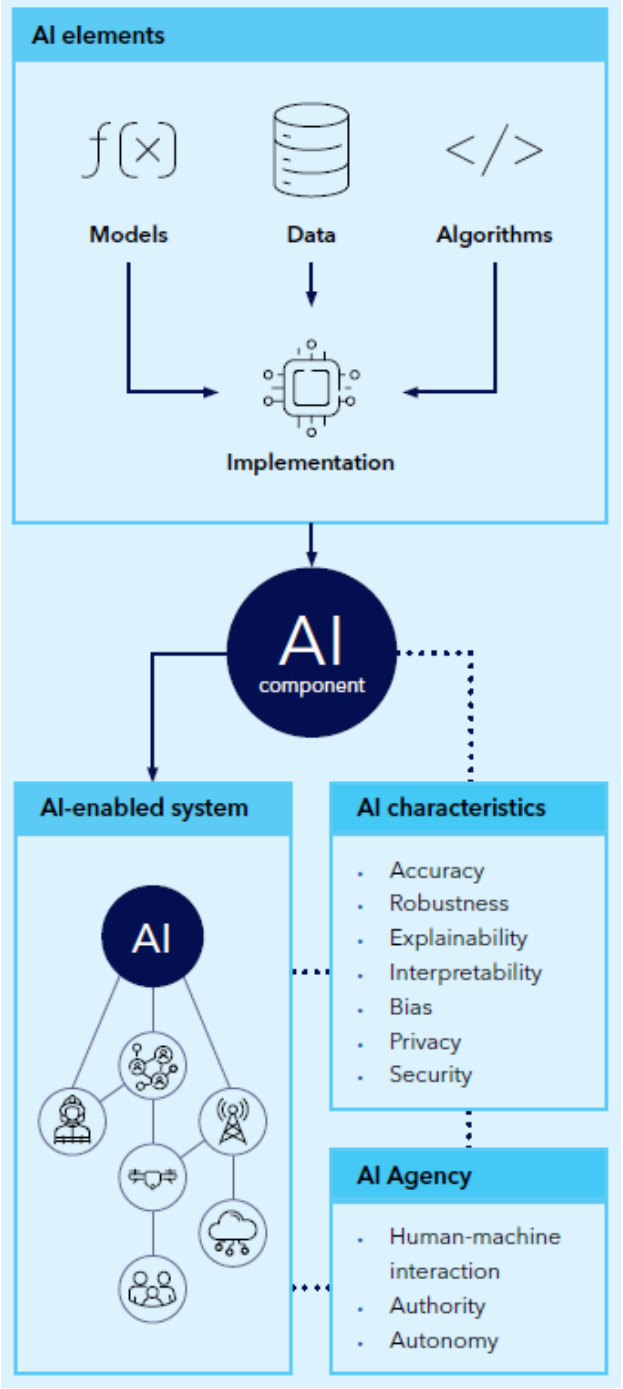


Illustration from the recommended practice DNV-RP-0671 “Assurance of AI-enabled systems”

Continuous assurance

- The monitoring systems are in rapid development, and will remain so, *as is the nature of AI-enabled systems*
- To ensure functional requirements are maintained, and increase certainty in claims, a continuous assurance process is needed
- This is of particular importance in AI-enabled systems as performance can drift over time due to shifts in data distribution or environments
  - Stemming from differences in training sets to input data
- Regulation and verification of the AI-enabled systems must consider rapid development of the technology

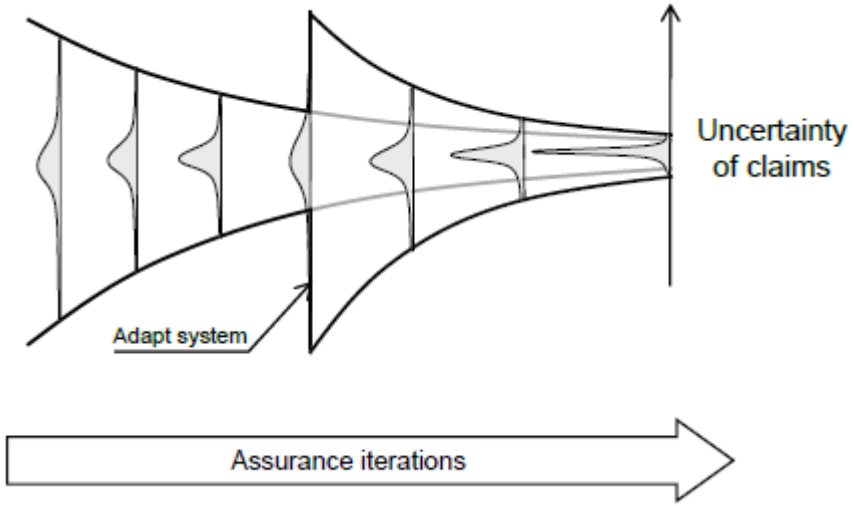


Illustration from the recommended practice DNV-RP-0671 “Assurance of AI-enabled systems”

Increased dependency on AI-enabled systems

- Aquaculture will increasingly depend on AI-enabled systems, to operate and optimize
- The industry is increasingly basing strategic decisions, animal husbandry strategies, and regulatory demands on output from AI-enabled systems
- The developers need to adapt to a reality where their services are increasingly pivotal for their customers; in operation, business development, regulation and compliance
- Fact-based assurance and continuous verification of data collection and methodology of insight-driven products will instill *and* maintain trust in the products

Table 8: Does your organization focus on any of the following aspects of the AI system?

Question asked only to those extremely, very and moderately knowledgeable

	Overall	Work on AI implementation	Leading
Reliability: Ability to perform required functions	56%	81%	84%
Verification and validation: Enabling the organization to obtain verification and validation	44%	64%	81%

Adapted from the DNV ViewPoint surveys “Leading the way on artificial intelligence” and “Starting the artificial intelligence journey” from November 2024

Thank you

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