Towards a cause-specific monitoring of mortality in Norwegian salmonid aquaculture

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Objective

To describe mortality of farmed salmonids using high-resolution data with the assigned causes of death.

Background

- > 50 million farmed salmon die annually in Norway (Fig. 1)
- This is approximately 15% of the salmon transferred to sea
- Mortality can be an indicator of fish health and welfare (Fig. 2)

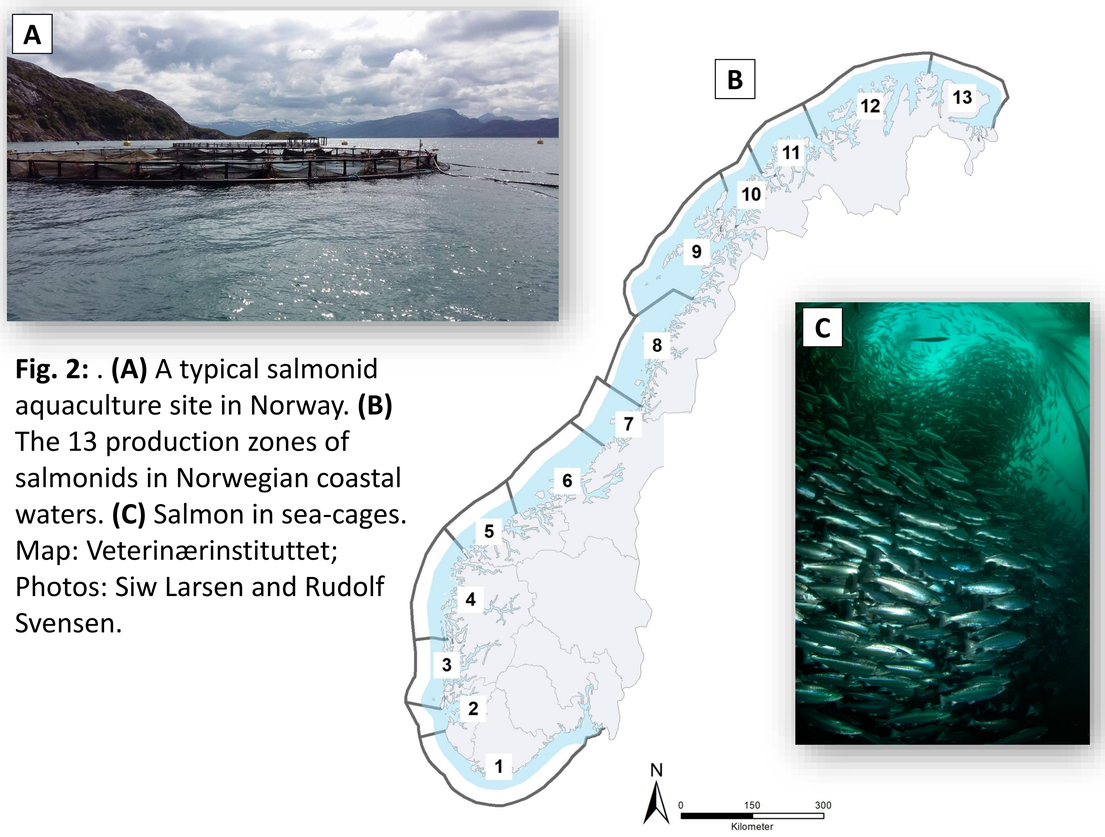

Fig. 2: . **(A)** A typical salmonid aquaculture site in Norway. **(B)** The 13 production zones of salmonids in Norwegian coastal waters. **(C)** Salmon in sea-cages. Map: Veterinærinstituttet; Photos: Siw Larsen and Rudolf Svensen.

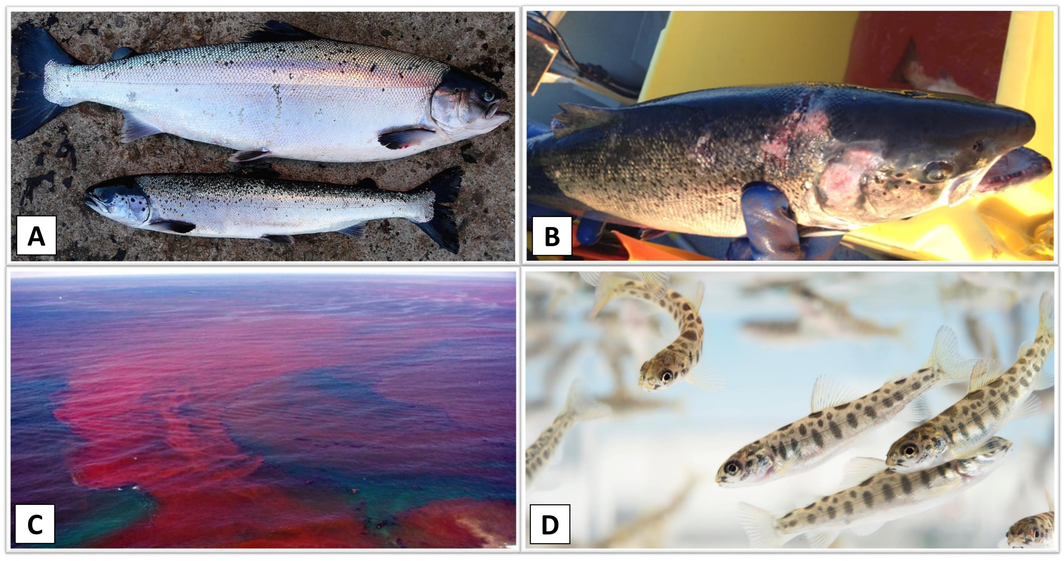

Fig. 2: Adverse events associated with increased mortality in farmed salmonids. **(A)** Salmon with reduced growth from a site infected by salmonid alphavirus. **(B)** Injuries (trauma) in salmon after mechanical delousing procedures. **(C)** Algal blooms in the sea. **(D)** Salmon at early-life stages can have physiological adaptation problems when transferred to sea. Photos: Trygve Poppe, Aqua kompetance, Kai Schumann (Zheng and Klemas, 2018) and Johan Wildhagen.

Results

- Study population: ≈ 20% of active farms in Norway
- Indications of ongoing improvements in data quality, e.g., completeness and consistency (Fig. 3)
- There were regional differences in the mortality causes (Fig. 3)
- Causes of mortality varied over the production cycle (Fig. 4)
- Daily records of mortality causes showed some biological plausibility (Fig. 4 & 5)

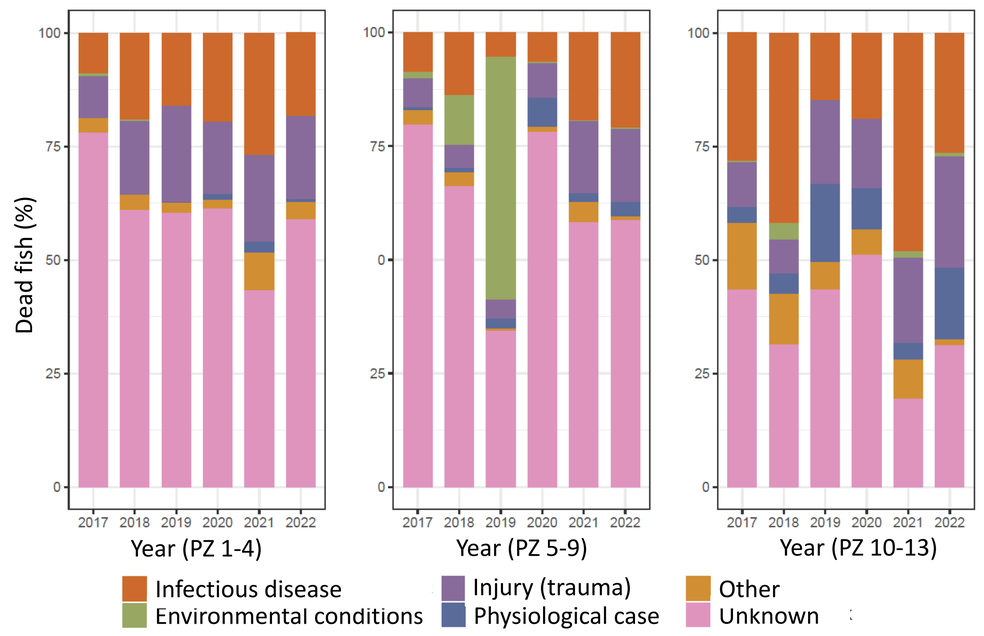

Fig. 3: Proportion of dead salmonids in each mortality category per production zone (PZ) between 2017 and 2022 (until the end of July).

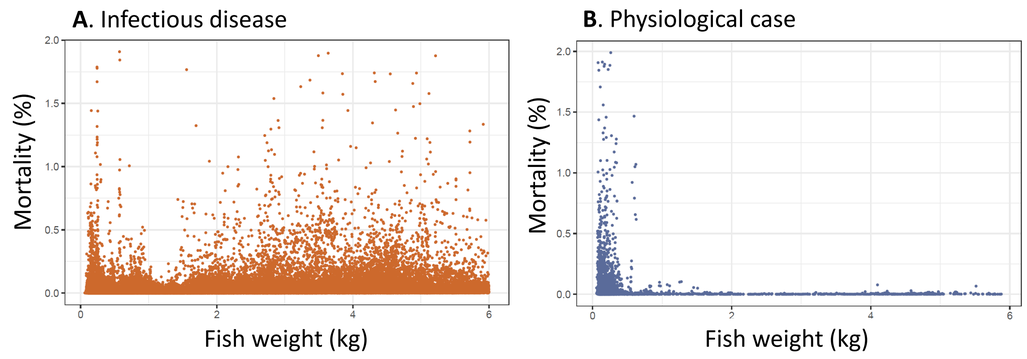

Fig. 4: Mortality categorization during the production cycle, based on fish weight. **(A)** Deaths due to infectious diseases are generally more evenly distributed, whereas **(B)** most of deaths due to physiological causes were registered in younger fish.

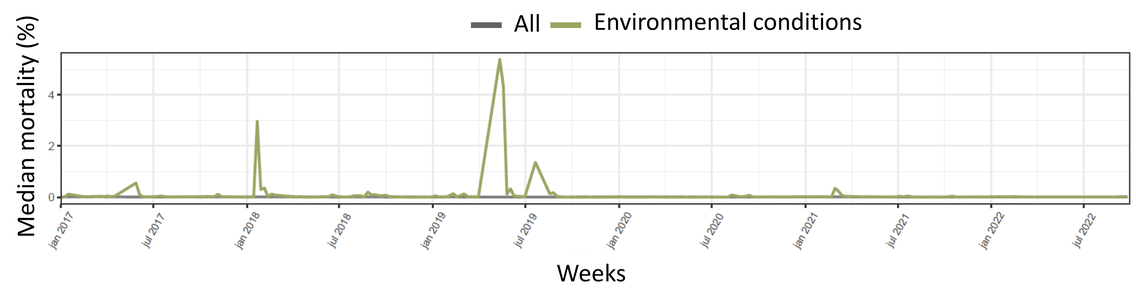

Fig. 5: Mortality time-series with a comparison between overall mortality (usually below 0.02% in a week) and mortality due to poor environmental conditions.

Perspectives

- Benchmarking mortality using daily time-series
- Use of the subcategories of deaths in mortality models
- To develop and improve early warning surveillance of infectious diseases and other threats that are based on mortality data (Fig. 6)
- To obtain data from other production phases, i.e. hatcheries

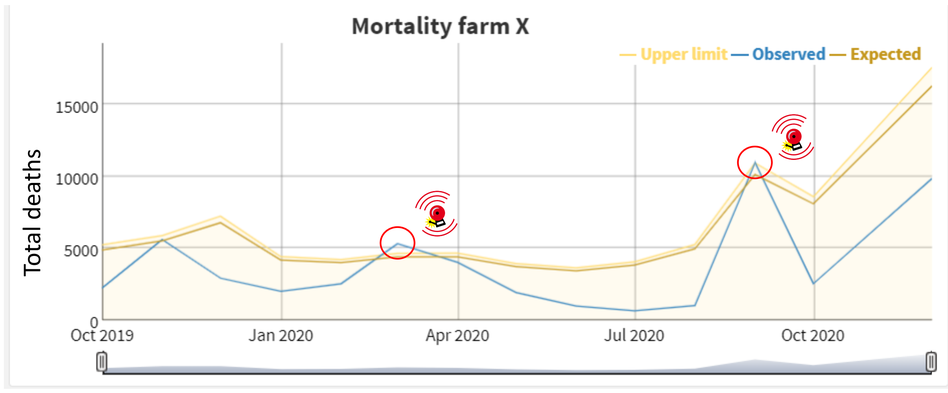

Fig. 6: Example of a dashboard prototype built for early warning signals of increased mortality in a salmon farm.

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