![Veterinærinstituttet — Norwegian Veterinary Institute]

Spatiotemporal mortality patterns in Norwegian salmonid aquaculture

Britt Bang Jensen[#a], Nils Toft[b] & Lars Qviller[a].   [a]Norwegian Veterinary Institute, [b]IQinAbox
[#]Presenting author

INTRODUCTION

In an ethical, sustainable production of animals, monitoring and minimizing mortality must be a top-priority, especially considering that mortality is an indicator of suboptimal welfare of animals. In 2018, the average mortality in Norwegian seafarms cultivating Atlantic salmon was 14,7%, and 16,6% in farms cultivating rainbow trout. In total, 49 million farmed salmonids were reported to have died during production (Hjeltnes et al., 2019). Meanwhile, large differences in mortality is observed between counties, and between farms within a county, thus indicating that there is a large potential for mitigating this mortality. We therefore set out to propose a logical, transparent way of calculating mortality. And to present the calculated differences between counties and years for a five-year production period.

RESULTS & DISCUSSION

In Norway, there is a stated political goal of quintupling the aquaculture production by 2050. In order to reach this goal, the producers are implementing new technologies, and changing their ways of producing. Measuring mortality and comparing to a baseline mortality can be used to evaluate the impact on fish welfare due to these changes.

The method for calculating mortality as presented here, is now being used by several public institutes, since it was presented in the "Report on the Health situation in Norwegian aquaculture 2018".

There are relatively large differences in mortality across the different counties and between the years. However, we know very little about the drivers for these differences. Understanding this is the first step towards managing mortality on a national scale.
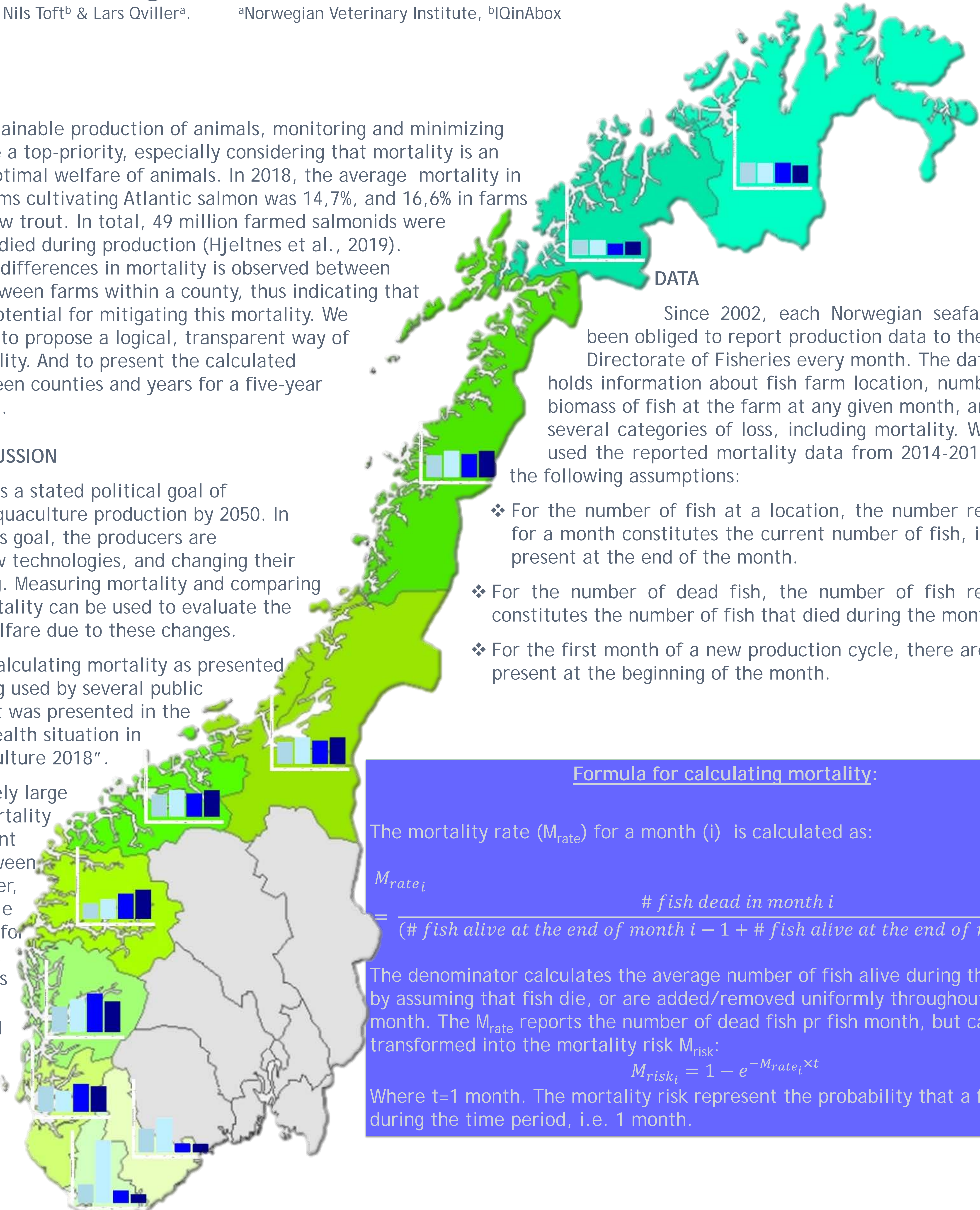
DATA

Since 2002, each Norwegian seafarm has been obliged to report production data to the Directorate of Fisheries every month. The data holds information about fish farm location, number and biomass of fish at the farm at any given month, and several categories of loss, including mortality. We have used the reported mortality data from 2014-2018, with the following assumptions:

❖ For the number of fish at a location, the number reported for a month constitutes the current number of fish, i.e. fish present at the end of the month.

❖ For the number of dead fish, the number of fish reported constitutes the number of fish that died during the month.

❖ For the first month of a new production cycle, there are 0 fish present at the beginning of the month.

Fig. 1. Map of Norway showing the salmonid producing counties and the average yearly mortality of salmonids for each county

Formula for calculating mortality:

The mortality rate (M_{rate}) for a month (i) is calculated as:

$$M_{rate_i} = \frac{\#\ fish\ dead\ in\ month\ i}{(\#\ fish\ alive\ at\ the\ end\ of\ month\ i-1 + \#\ fish\ alive\ at\ the\ end\ of\ month\ i)\ /2}$$

The denominator calculates the average number of fish alive during the month, by assuming that fish die, or are added/removed uniformly throughout the month. The M_{rate} reports the number of dead fish pr fish month, but can be transformed into the mortality risk M_{risk}:

$$M_{risk_i} = 1 - e^{-M_{rate_i} \times t}$$

Where t=1 month. The mortality risk represent the probability that a fish die during the time period, i.e. 1 month.

Fig. 2. Graph showing the monthly mortality risk during the entire time period

References
1. Hjeltnes B, Bang Jensen B, Bornø G, Haukaas A, Walde C S (eds.), Fish Health Report 2018, Published by the Norwegian Veterinary Institute 2019