Veterinærinstituttet
National Veterinary Institute

Cardiomyopathy syndrome (CMS) in farmed Atlantic salmon

- preliminary results of a case-control study

B. Fineid[1], M. Alarcon[1], B. Bang Jensen[1], R. Bjerke Larssen[2], RT. Kongtorp[3], E. Brun[1]

1 National Veterinary Institute, Norway
2 Norwegian School of Veterinary Science
3 Ministry of Fisheries and Coastal Affairs

Introduction

CMS is a severe chronic cardiac disease in farmed Atlantic salmon which was first discovered in 1985. In recent years between 60 and 90 farms have been affected annually (Figure 1). Fish are clinically affected during the late seawater phase; typically about 400 days after sea transfer (from 253 to 595 days) (1), but the disease has also been seen in younger fish. Mortality may be moderately elevated over a longer period of time or more acute mortality may be seen without prior signs of clinical disease. The disease is transmissible under experimental conditions, but no infectious agent has so far been characterized (2). Diagnosis is made by histopathology and CMS is characterized by inflammation in the atrium and ventricle (3). The study objective is to gain a better understanding of the epidemiology and risk factors for CMS.

Study Design

This is a case-control study with the site as unit. It was initiated in April 2009 and is expected to last for approximately one year. Cases are defined by clinical signs and histopathology and include all verified cases detected in the Norwegian salmon industry during the study period. It is based on samples submitted to the National Veterinary Institute's laboratories due to unresolved clinical findings. The controls are randomly selected from all active sea water sites with farmed Atlantic salmon (Figure 2). A questionnaire is used to collect data on potentional risk-factors and when possible, samples are collected for histopathology to ensure correct classification of the sites.

Results

So far, 66 sites have been diagnosed with CMS. Samples have been collected from 21 of them. From 17 sites only questionnaires will be obtained due to the fish being slaughtered before the site were recruited in the study. The remaining 28 sites are sites which do not want to participate, where sampling is not yet performed or new cases which have not yet been sampled. Samples for histopathology have been received from 32 control sites at this point in the study. So far questionnaires have been returned from 9 cases and 11 controls.

Discussion

As shown in Figure 2, the cases are distributed along most of the Norwegian coast, with strong accumulation in Mid-Norway. This clustering indicates the infectious nature of the disease. One of the challenges in this study is to have a clear distinction between cases and controls. Important differential diagnosis to CMS are heart and skeletal muscle inflammation (HSMI) and pancreas disease (PD). Atypical outbreaks or concurrent outbreaks with several diseases represents diagnostic challenges, and this is the case for many of the CMS sites (Figure 3). Other challenges are the non-responders when it comes to samples and questionnaires.

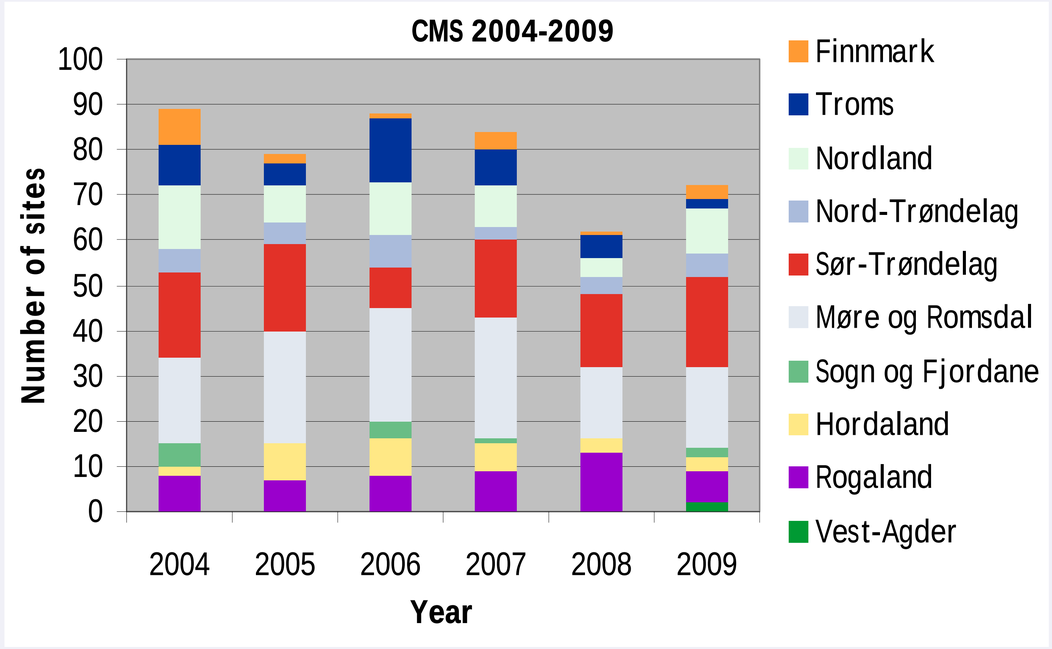

Figure 1. Number of affected farms in Norway from 2004-2009 and the geographical distribution. CMS occurs along most of the Norwegian coast with a hot-spot in Mid-Norway (Sør-Trøndelag and Møre og Romsdal counties)

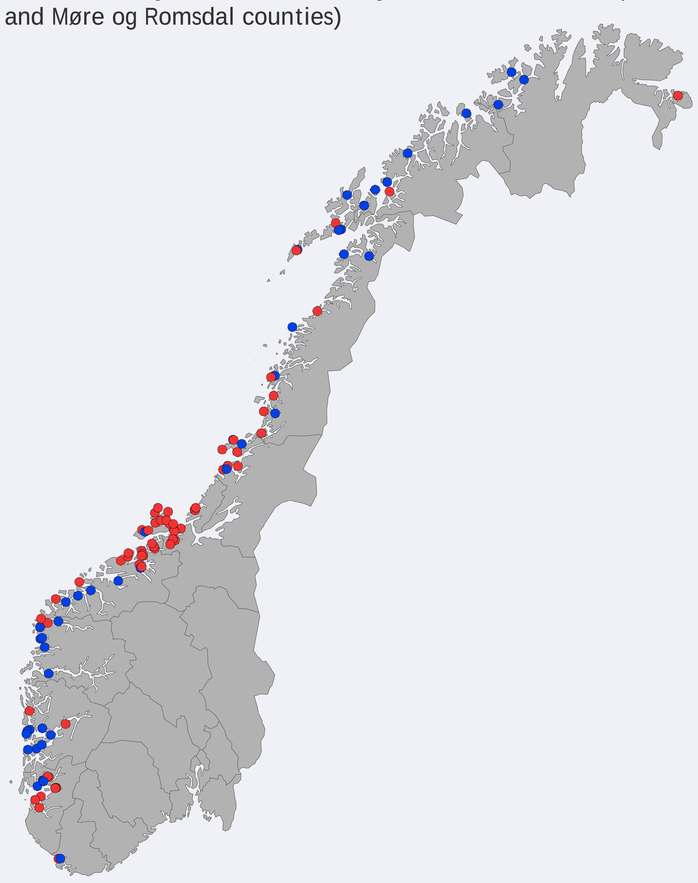

Figure 2. Geographical distribution of cases and controls. Red = cases, blue = controls.

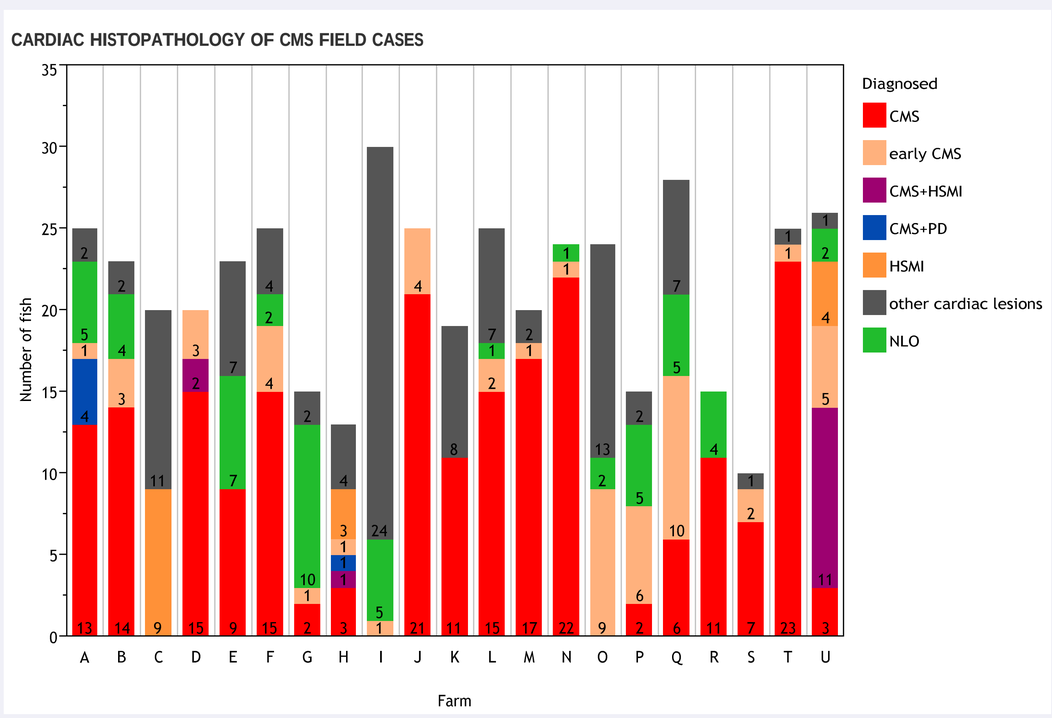

Figure 3. Distribution of CMS and other diseases in the cases. The group "other cardiac lesions" includes fish with undiagnosed heart lesions alone or together with CMS lesions. Hopefully we will have a more accurate diagnoses after more tests, e.g. histology of other organs and PCR for PD. NLO = no lesions observed

References

1. Skrudland A. Poppe TT., Jarp J, Brun E. (2002) Hjertesprekk hos norsk oppdrettslaks. En feltundersøkelse. *Veterinærinstituttet.* In Norwegian.
2. Fritsvold C., Kongtorp R.T., Taksdal T., Ørpetveit I., Heum M., poppe T.T. (2009) Experimental transmission of cardiomyopathy syndrome (CMS) in Atlantic salmon, *Salmo salar. Dis Aquat Org.* 87:225-234
3. Ferguson HW., Poppe T., Speare DJ. (1990) Cardiomyopathy in farmed Norwegian salmon. *Dis Aquat Org.* 8:225-231

Acknowledgements

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