

Epidemiology of parvicapsulosis in Norwegian farmed salmon (*Salmo salar*)

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Summary

In March 2002 a myxosporean parasite -*Parvicapsula pseudobranchicola*- Karlsbakk, Saether, Hostlund, Fjellsoy and Nylund, 2002 - was detected in the pseudobranchs of diseased fish in five seawater farms in Northern Norway. The mortality varied between 2-35% in affected farms. This was the first observation of the parasite, but it is suspected that *P. pseudobranchicola* may account for some of the annual mortality of unknown aetiology registered in salmon farming in Norway.

In this paper we present a descriptive analysis, based on a surveillance scheme investigating the association of occurrence of *P. pseudobranchicola* and characteristics of farm localities and affected fish groups in comparison with healthy control groups.

Preliminary results are presented.

Introduction

Myxosporeans in the genus *Parvicapsula* are potential pathogens of both wild and farmed fish. *Parvicapsula minibicornis* Kent, Whitaker and Dave, 1997 has caused high mortality in pre-spawning sockeye salmon *Oncorhynchus nerka* in the Fraser River watershed in British Columbia, Canada (see Karlsbakk et al. 2000). Seven other species of *Parvicapsula* have been described from the urinary system of a number of marine fish (see Sterud et al. 2003).

In March 2002, severe mortality was recorded in a fish farm in northern Norway. By the end of April 2002, 35% of 200,000 Atlantic salmon *Salmo salar* transferred to seawater in September 2001 had been lost. Myxosporeans, assigned to the genus *Parvicapsula*, were found in the pseudobranchs of diseased fish submitted to The National Veterinary Institute. Myxosporeans in the genus *Parvicapsula* have not previously been reported as pathogenic parasites in farmed Atlantic salmon.

No extrapiscine phase of *Parvicapsula* has yet been described, and of the large number of described Myxozoan species, the invertebrate host has been identified only in very few. The epidemiology of the disease and the life cycle of the parasite are not yet known.

The aim of the present studies is to describe the characteristics of affected farms and fish groups and the course of the disease on farm level.

Materials and Methods

All fish groups in Norway where *Parvicapsula pseudobranchicola* has been diagnosed in the period from the first observation in April 2002 until August 2003 is included in the material. The control groups were chosen from farms assigned to the same Fish Health Services as the study population, but from localities where no *Parvicapsula* has been diagnosed in samples investigated by the same laboratory

methods. Diagnostics has been made at The National Veterinary Institute by direct microscopy or histology.

The investigation was designed as a case-control study, based on a questionnaire, which was sent out to all Fish Health Services and fish farms in Norway that had reported parvicapsulosis in their area. The data were recorded in Excel at The National Veterinary Institute before the analysis.

The outcome variables were recorded on locality level, where the locality describes the geographical unit, consisting of several cages with fish groups put to sea at various times. Localities were identified with their names and designated an identification number.

Data regarding current, bottom substrate, depth, artificial light, salinity, temperature and location in the fjordsystem were collected. Fish groups were described with date of transfer to sea, origin and initial mortality. For diseased fish the date of diagnosis or occurrence of clinical symptoms, concurrent disease and fate of the fish was recorded. The percentage of mortality from one month before diagnosis to three months after diagnosis was registered. Slaughter results, when available, were also included.

The material is still under collection. Hence, the material presented here will be a selection of the final results to be presented at ISVEE10, Chile.

Results

Selected variables describing the physical characteristics of each locality was systematized. In addition to describe the normal conditions at localities in general, the data can pinpoint physical factors characteristics for *Parvicapsula* prone areas. The data contains information about concurrent diseases, which in practice has seemed to be strongly associated to *Parvicapsula*. Temperature data in relation to date of sea transfer and date of diagnosis are under preparation. Most cases of parvicapsulosis have been diagnosed in fish groups put to sea in the autumn, with a peak in the 2002-generation. The mortality one month before diagnosis to three months after diagnosis was significantly higher in fish with parvicapsulosis than in the control groups, indicating the losses due to *Parvicapsula* in Norwegian salmon production.

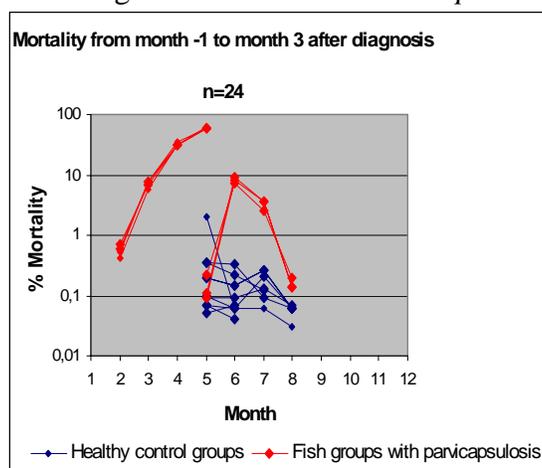


Fig. 1. Mortality during month (-1) – (+3) in relation to time for diagnosis of the disease.

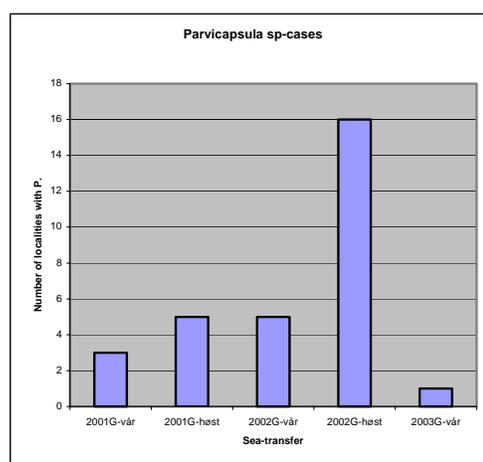


Fig.2. Number of diagnosed parvicapsulosis in fish groups put to sea at different time of the year.

Table
Physical characteristics of localities with parvicapsulosis (n=9) and control localities (n=1).

		Study population	Control
Locality			
Topography	Outer fjordsystem	6	
	Inner fjordsystem	6	1
Is the locality exposed to sea currents?	Yes, strong	5	1
	Moderately	1	
	No	3	
Bottom substrate	Sand	4	
	Clay	4	
	Mud		
	Rock	4	
	Gravel	3	
Dept	30	1	
	40	3	
	50	7	
	60	6	
	70	5	
Artificial light	In use during winter	2	
	Not used	8	
Salinity	<25‰		
	>25‰	9	1
Concurrent disease	IPN	4	
	HSMB	5	
	CMS		
	Wintersore	2	
	ILA	1	

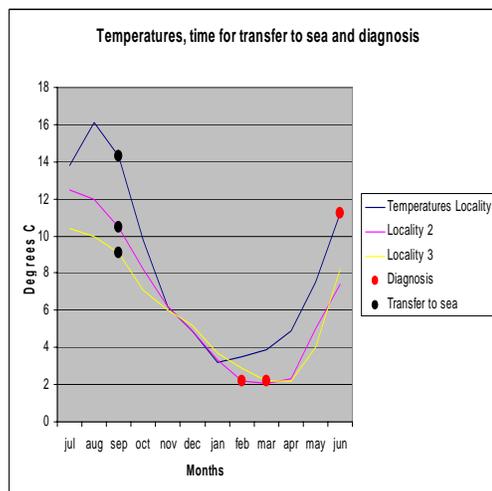


Fig. 3. Monthly temperatures in farm with parvicapsulosis. Time for seatransfer (black) and diagnosis (red) are indicated.

Discussion

Parvicapsulosis has puzzled fish farmers and researchers since the first diagnosis in March 2002. Mortalities are varying from locality to locality and even between fish groups put to sea at different times. Fish put to sea at spring or early autumn can be disease free, whereas fish put to sea a few days later get diseased. Initially it seemed as if the parasitic development in the fish took place during winter, since most cases are diagnosed in spring. However, recently *Parvicapsula* has been diagnosed in fish put to sea in late spring after only two months in the sea. Therefore many questions remain to be answered. Hopefully we are able to answer a few of these questions with the ongoing study.

Reference List

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- 2 Kent ML, Whitaker DJ, Dawe SC. *Parvicapsula minibicornis* n.sp. (Myxozoa, Myxosporidia) from the kidney of sockeye salmon (*Onchorhynchus nerka*) from British Columbia, Canada. Journal of Parasitology 1997; 83(6):1153-1156.
- 3 Sterud E, Simolin P, Kvellestad A. Infection by *Parvicapsula* sp. (Myxozoa) is associated with mortality in sea-caged Atlantic salmon *Salmo salar* in northern Norway. DAO 2003; 54:259-263.