Gyrodactylus On Salmonids In Norway

Genetic population structure of *Gyrodactylus thymalli* (Monogenea) in a large Norwegian river system

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SUMMARY

The extent of geographic genetic variation is the result of several processes such as mutation, gene flow, selection and drift. Processes that structure the populations of parasite species are often directly linked to the processes that influence the host. Here, we investigate the genetic population structure of the ectoparasite *Gyrodactylus thymalli* Žitňan, 1960 (Monogenea) collected from grayling (*Thymallus thymallus* L.) throughout the river Glomma, the largest watercourse in Norway. Parts of the mitochondrial dehydrogenase subunit 5 (NADH 5) and cytochrome oxidase I (COI) genes from 309 *G. thymalli* were analysed to study the genetic variation and investigated the geographical distribution of parasite haplotypes. Three main clusters of haplotypes dominated the three distinct geographic parts of the river system; one cluster dominated in the western main stem of the river, one in the eastern and one in the lower part. There was a positive correlation between pairwise genetic distance and hydrographic distance. The results indicate restricted gene flow between sub-populations of *G. thymalli*, most likely due to barriers that limit upstream migration of infected grayling. More than 80% of the populations had private haplotypes, also indicating long-time isolation of sub-populations. According to a molecular clock calibration, much of the haplotype diversity of *G. thymalli* in the river Glomma has developed after the last glaciation.

Key words: Population structure, gene flow, Salmonid fish, ectoparasite, networks, isolation by distance.

INTRODUCTION

The study of genetic diversity and gene flow can provide fundamental insights into the demographic and evolutionary history of populations (Wright, 1943; Slatkin, 1987). In order for a population to adapt to environmental change, genetic variation is required (Slatkin, 1987). Gene flow due to individuals dispersing among sub-populations may increase genetic variation. However, the opportunity for individuals to disperse depends on the geographical topography and presence of potential barriers to movement. A lack of gene flow may lead to loss of genetic diversity and increased genetic drift (Grenfell *et al.* 2004). In general, there are a large number of studies on genetic diversity in a wide range of study systems. However, studies on the genetic variation and geographical distribution of parasites on larger scales are still rare. Host specific monoxenous fish parasites are interesting for studies of genetic diversity at local and regional scales as their occurrence and genetic diversity depend on the distribution and migration of their hosts as well as transmission probabilities. In rivers and streams, these parasites can disperse downstream by passive drift of detached parasites or fish host migration, whereas upstream dispersal depends on host migration (Criscione and Blouin, 2004). Such upstream migration may be restricted by barriers (waterfalls, dams) and may over time lead to a reduced genetic variation upstream due to genetic drift and bottleneck events in small populations. Further, the dominating downstream gene flow can over time result in increased genetic diversity in downstream areas.

Fish ectoparasites of the genus *Gyrodactylus* have a short generation time, give birth and have no specialized transmission stages. In the recent years, several molecular studies has been done on the taxonomy, systematics, phylogeography and genetic variation of species of *Gyrodactylus* based on mitochondrial DNA sequences (see e.g. Hansen *et al.* 2003, 2007*a*, *b*), but the genetic variation within river systems has not been studied in detail. One of the species that has been studied in some detail is *Gyrodactylus thymalli* Žitňan, 1960 (Monogenea) and several phylogenetic lineages and haplotypes of this species have been found on its main host grayling *Thymallus thymallus* (L.) in European rivers (Hansen *et al.* 2007*a*, *b*; Lindqvist *et al.* 2007; Anttila *et al.* 2008; Kuusela *et al.* 2009). *Gyrodactylus thymalli* occurrs frequently on grayling in the Glomma river system, the largest watercourse in Norway (Mo *et al.* 1998; Hansen *et al.* 2003, 2006, 2007*a*, *b*). Hansen *et al.* (2003, 2006, 2007*a*, *b*) found

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The salmon parasite Gyrodactylus salaris is a serious threat to Norwegian wild salmon stocks. The Norwegian Food Safety Authority is responsible for parasite.Gyrodactylus salaris (Monogenea, Platyhelminthes) is a notifiable freshwater Due to the impact of G. salaris on Norwegian salmon, extreme.Gyrodactylus salaris Malmberg, has had a devastating impact on wild Norwegian stocks of Atlantic salmon Salmo salar L., and it is the.Gyrodactylus salaris is a directly transmitted ectoparasite that reproduces in situ on its fish host. Wild Norwegian (East Atlantic) salmon stocks.Gyrodactylus salaris, commonly known as salmon fluke, is a tiny monogenean ectoparasite which lives on the body surface of freshwater fish. This leech-like parasite has been implicated in the reduction of Atlantic salmon populations in the Norwegian.The surveillance and control programme for Gyrodactylus salaris in Atlantic salmon and rainbow trout in Norway Technical Report (PDF.NORWAY - A new outbreak of Infection with Gyrodactylus salaris has been In total, 12 cases were found in a wild juvenile Atlantic salmon population and Gyrodactylus salaris is a species of this genus found on fins and skin of Atlantic and on Norwegian salmon in three rivers and on rainbow trout in fish farms in.its introduction to Norway in the late s, G. salaris has caused the Gyrodactylus salaris on salmon parr in Norwegian rivers, status report.Norway has more than watercourses with Atlantic salmon and sup. The introduced parasite Gyrodactylus salaris, freshwater acidification, hydropower.Gyrodactylus salaris was probably introduced into the River Vefsna, a large salmon river in northern Norway, by stocking of Atlantic salmon.This chapter contains sections titled: Introduction. The parasite community of Atlantic salmon. G. salaris and the epidemiological triangle.Over the 6 years 85, Norwegian rivers have been examined for occurrence of Gyrodactylus salaris: it was found in 26 rivers and six salmon hatcheries.Natural History Museum. University of Oslo. Norway. External supervisor .. Gyrodactylus teuchis (Monogenea, Platyhelminthes) and its salmonids hosts.In Norway the monogenean Gyrodactylus salaris Malmberg, is held Norwegian Atlantic salmon stocks within the timescale of the.Working Group on Gyrodactylus salaris in the. North-East Commission area was held in Oslo, Norway, during October under the.Background: Gyrodactylus salaris is a freshwater monogenean ectoparasite Norway, with near extermination of the salmon population a few years after river.Resuming the cooperation on the salmon parasite. Gyrodactylus salaris in the North Calotte region. 26 th. th. October, Svanvik Norway. Abstracts.Gyrodactylus salaris Malmberg, is reported to be an in- troduced parasite into Norwegian salmon rivers causing gross mortality and threatening the salmon .Mitochondrial DNA variation of Gyrodactylus spp. (Monogenea, Gyrodactylidae) populations infecting Atlantic salmon, grayling and rainbow trout in Norway and.

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