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The surveillance programme for infectious salmon anaemia virus HPR0 (ISAV HPR0) in Norway 2021

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Content

Summary

The non-pathogenic variant of the infectious salmon anaemia virus, ISAV HPR0, was detected in eight of 78 hatcheries in conjunction with the surveillance programme for ISAV HPR0 in 2021. No hatcheries tested positive for the pathogenic variant ISAV HPRdel in the surveillance programme.

As the hatcheries were sampled only once in the calendar year and a limited number of tanks were sampled, this result is a likely underestimate of the true prevalence of ISAV HPR0 in Norwegian hatcheries.

Introduction

Infectious salmon anaemia (ISA) is a serious disease in salmon caused by ISA virus (ISAV), a virus within the *Orthomyxoviridae* family. The disease was first described in Atlantic salmon (*Salmo salar*) in Norway in 1984 and has since been reported in several countries (USA, UK, Canada, Faroe Islands and Chile). In Norway, the number of outbreaks peaked in 1990 with 80 cases. In the late 1980s and early 1990s several measures were implemented in order to combat and limit the spread of the disease. Since 1993, the annual number of outbreaks has varied between 1 and 25, and ISA is still a recurring challenge to the salmon farming industry in Norway (Sommerset *et al.*, 2022).

Infection with ISAV is an OIE listed infection, and ISAV HPRdel is notifiable within the EU including Norway. In Norway, there is a legal obligation to report suspicion of ISA to the Norwegian Food Safety Authority (NFSA), and immediate restrictions on fish movement will be adopted. Following a suspicion, the NFSA performs fish sampling at the suspected site and submits the samples to the national ISA reference laboratory, the Norwegian Veterinary Institute (NVI), for diagnostic investigation. If this investigation confirms an ISA diagnosis, the NFSA determines the official diagnosis for the site and makes decisions on the implementation of control measures such as the establishment of a containment area. ISA diagnoses are reported to the EU and the OIE by the NFSA.

There are two main types of ISAV. The pathogenic type, termed ISAV HPR-deleted (ISAV HPRdel), is associated with ISA outbreaks, while the non-pathogenic type, termed ISAV HPR0, causes subclinical infections only. ISAV HPR0 is now regarded as the origin of the virulent ISAV HPRdel through differential mutations in at least two virus genes. Positive PCR-tests for ISAV HPR0 have so far not been considered notifiable by the Norwegian regulations. While both types of ISAV are reportable to the OIE, it is generally not reported by Norway due to the absence of a notification requirement in the national legislation.

The surveillance programme for ISAV HPR0 in Norwegian hatcheries has been conducted since 2019.

Aim

The aim of the ISAV HPR0 surveillance programme is to map the occurrence of ISAV HPR0 in Norwegian Atlantic salmon and rainbow trout hatcheries. Due to the new EU Animal Health Law the Norwegian strategy for combating and limiting ISA is currently under review. An overview of the ISAV HPR0-situation in hatcheries is an important part of the knowledge base for the work on the new strategy.

Materials and methods

Hatchery selection was coordinated with the surveillance programme on *Gyrodactylus salaris*, with each hatchery being sampled every second year (50% of hatcheries sampled per year). Sampling was conducted by the NFSA.

A total of 90 fish were sampled per hatchery. In each hatchery, ten tanks were randomly selected, and gill samples were collected from nine fish per tank. Samples were pooled in pools of three, giving three samples per tank and 30 samples per hatchery. If the hatchery had less than ten tanks, the required number of samples were divided by the number of available tanks.

Samples were submitted to the Norwegian Veterinary Institute (NVI) for analysis. The samples on RNAlater™ were processed and analysed for ISAV by real-time RT-PCR with primers and probe as described by Snow *et al*. (2006). To differentiate ISAV HPR0 from ISAV HPRdel, ISAV positive samples were further investigated by RT-PCR and sequenced with primers recommended by the World Organisation for Animal Health (OIE, 2021) to determine the amino acids in the hypervariable region (HPR) of segment 6.

All results were made available to the NFSA through a shared database (EOS). In addition, the NVI compiles a yearly report on the data to the NFSA.

Results

In total, 78 hatcheries were sampled. The geographic locations of sampled hatcheries and ISAV HPR0 screening results are shown in Figure 1.

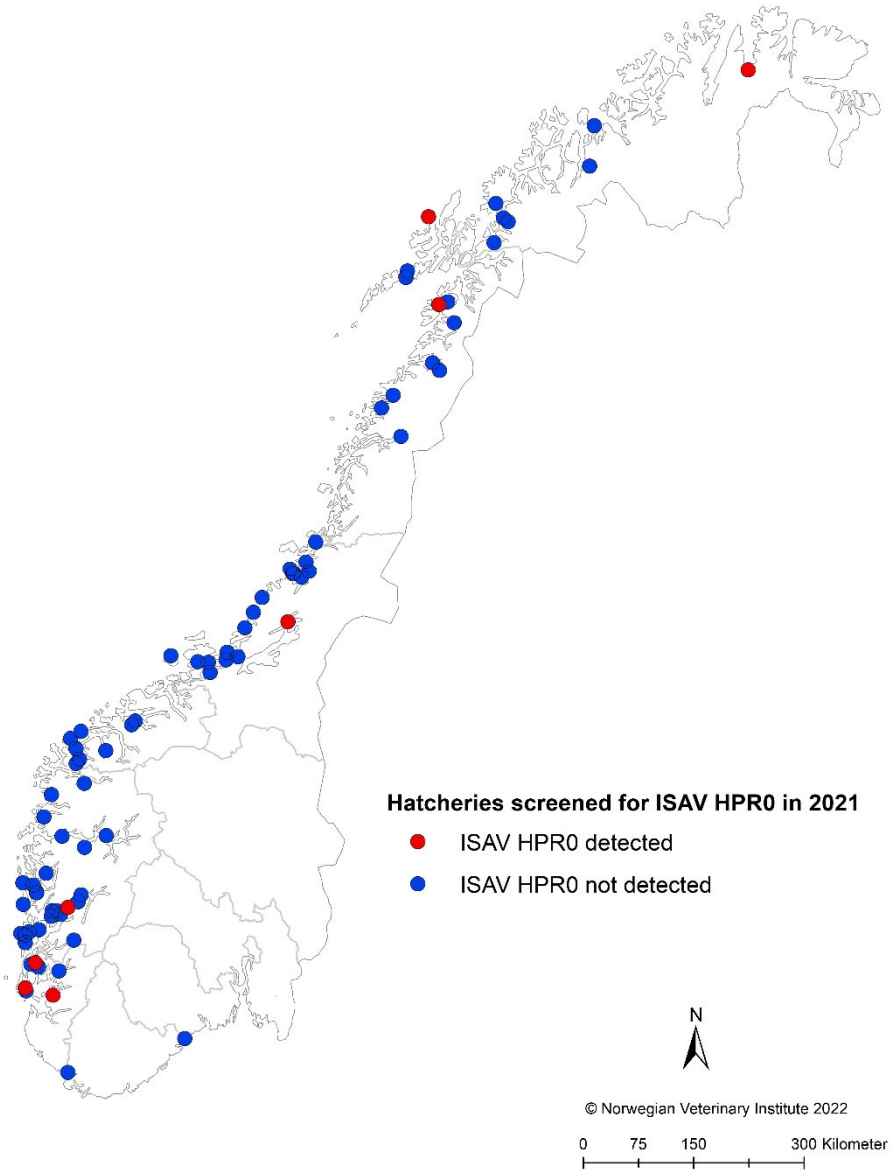

***Figure 1**: Geographic locations of sampled hatcheries and their ISAV HPR0 screening results*

The non-pathogenic variant of ISAV, ISAV HPR0, was detected in eight hatcheries while no hatcheries tested positive for the pathogenic variant (ISAV HPRdel) in the surveillance programme. All positive samples originated from Atlantic salmon.

An overview of the production technology of sampled hatcheries is shown in Table 1, while details of the positive hatcheries are shown in Table 2.

Table 1: *Summary of the hatchery technology used by the sampled hatcheries.*

Hatchery technology*	Number of sampled hatcheries	Number (%) positive hatcheries
GS only	49	2 (4)
GS and RAS	11	3 (27)
RAS only	17	3 (18)
Other (Cages in freshwater)	1	0 (0)

* GS = flow-through system, RAS = recirculation system.

Table 2: *Summary of data for ISAV HPR0-positive hatcheries and tanks.*

Hatchery ID	Hatchery			Positive tanks			
	Technology*	No. tanks sampled	No. positive samples	No. positive tanks	Technology*	Seawater addition	Average fish weight (g)
A[#]	GS and RAS	22	86	20	GS and RAS	Yes	19 - 223
B	RAS	5	3	2	RAS	Yes	3
C	RAS	10	4	2	RAS	No	20 - 41
D	RAS	10	7	4	RAS	Yes	59 - 89
E	GS and RAS	10	19	7	GS and RAS	Yes & No	10 - 72
F	GS and RAS	10	6	3	RAS	Yes	29 - 43
G	GS	9	2	2	GS	Yes	30 - 59
H	GS	10	12	5	GS	No	36 - 44

* GS = flow-through system, RAS = recirculation system.
[#] A total of 150 individual gill samples were collected and analysed for this hatchery, replacing the standard OK ISAV HPR0 material of 90 individual gill samples analysed as 30 pooled samples

Discussion

This report contains the results from the third year of the surveillance programme for ISAV HPR0 in Norwegian hatcheries. Approximately 10% of the hatcheries (eight out of 78) tested positive for ISAV HPR0. ISAV HPR0-positive tanks were found in both recirculation - and flow-through systems, and the majority of positive tanks were run with a degree of seawater addition at the time of sampling. The three hatcheries that had ISAV HPR0-positive tanks without seawater addition were contacted in order to obtain information on previous seawater exposure of the sampled fish groups. While ISAV HPR0-positive fish groups in one farm had been exposed to previous seawater buffering, the ISAV HPR0-positive fish groups in the remaining two hatcheries had never been exposed to any seawater.

The hatcheries were only sampled once in the calendar year, and a limited number of tanks were sampled per hatchery. As a result, it is likely that the results obtained in this surveillance programme is an underestimation of the true annual prevalence of ISAV HPR0 in Norwegian hatcheries. The apparent prevalence of ISAV HPR0 in 2021 (10%) was relatively similar to that reported in the previous two years of the surveillance programme (7% in 2019

and 14% in 2020). Eighty-four percent (62 out of 74) of hatcheries sampled in 2019 were sampled again in 2021. Two of these hatcheries tested positive for ISAV HPR0 in both samplings, while six hatcheries tested positive in one of the two samplings (two in 2019 and four in 2021). Several ISAV HPR0-positive hatcheries have in recent years delivered smolt to sea sites with ISA outbreaks where the ISAV HPRdel at the sea site was found to be identical or closely related to the ISAV HPR0 detected in the respective hatchery based on sequences for segment 5 and segment 6 (Sommerset *et al.*, 2022). This suggests that ISAV HPR0 screening should be an important component of risk management measures in Norwegian hatcheries. The absence of a national overview of ISAV HPR0 detections makes it difficult to study and understand the actual level of risk posed by ISAV HPR0 presence in hatcheries.

Acknowledgement

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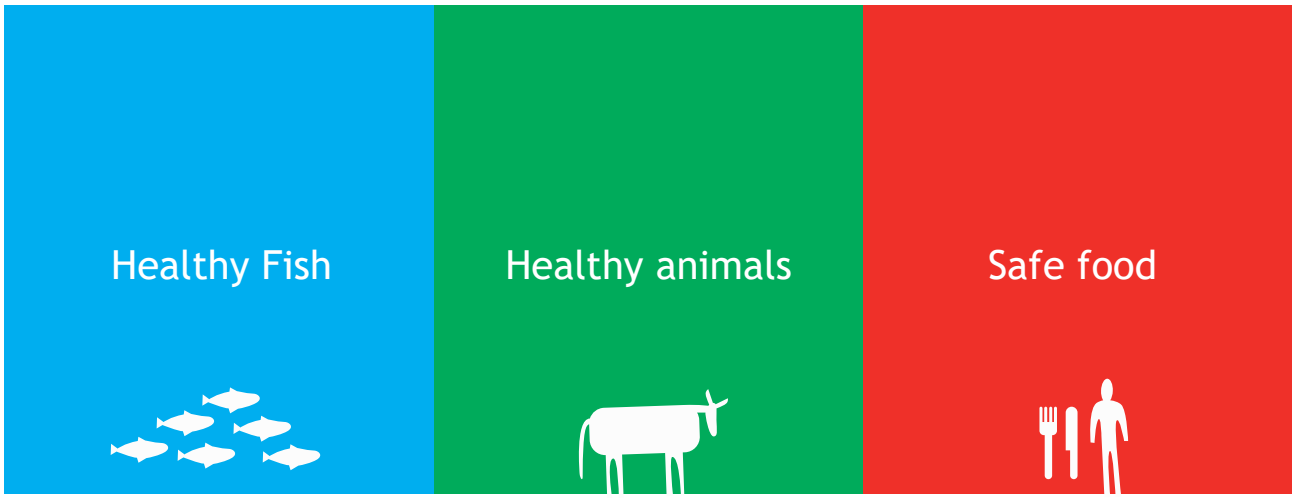

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