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The surveillance programme for infectious salmon anaemia virus HPR0 (ISAV HPR0) in Norway 2024

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Content

Sammendrag

Den ikke-patogene varianten av infeksiøs lakseanemi-virus, ILAV HPR0, ble påvist på sju av 82 lokaliteter i overvåkingsprogrammet for ILAV HPR0 i 2024.

Siden det kun ble tatt ut prøver på ett tidspunkt på hver av lokalitetene i løpet av kalenderåret og fra et begrenset antall kar, representerer trolig resultatet en underestimering av den faktiske prevalensen av ILAV HPR0 på norske settefiskanlegg.

Summary

The non-pathogenic variant of the infectious salmon anaemia virus, ISAV HPR0, was detected in seven out of 82 sites in the surveillance programme for ISAV HPR0 in 2024.

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

Introduction

Infectious salmon anaemia (ISA) is a serious disease in Atlantic salmon (*Salmo salar*) caused by ISA virus (ISAV), a virus within the *Orthomyxoviridae* family. The disease was first described in Atlantic salmon 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 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 (Moldal *et al*., 2025).

There are two main types of ISAV. The pathogenic type, termed ISAV HPR-deleted (ISAV HPRΔ), is associated with ISA outbreaks, while the non-pathogenic type, termed ISAV HPR0, causes subclinical infections only. ISAV HPR0 is regarded as the origin of ISAV HPRΔ through a deletion in segment 6 and a mutation or insertion in segment 5.

While both types of ISAV are notifiable to the World Organisation for Animal Health (WOAH), ISAV HPR0 is not reported by Norway due to the absence of a notification requirement in the national legislation. ISAV HPRΔ 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 Norwegian Veterinary Institute (NVI) as the national reference laboratory for fish diseases for diagnostic investigation. If an ISA diagnosis is confirmed, 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 WOAH by the NFSA.

Vaccines containing ISAV HPRΔ is increasingly used with approximately 196 million doses sold in 2024. Information about vaccination status is important when analysing samples from smolt for ISAV as the vaccine virus may be detected in different matrixes including gill tissue several weeks after vaccination.

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

Aim

The aim of the surveillance programme is to map the occurrence of ISAV HPR0 in hatcheries with Atlantic salmon (*Salmo salar*) and rainbow trout (*Oncorhynchus mykiss*) in Norway. Due to the new Animal Health Law in EU, 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 new strategy.

Materials and methods

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

In each site, ten tanks were randomly selected, and gill tissues were collected from nine fish per tank, accounting for a total of 90 fish sampled per site. All tanks at the site were numbered consecutively, department by department. The total number of tanks were then divided by ten, and this number was used to choose tanks. In some cases, individual assessments had to be made to ensure that all departments were represented. It is important that the selection of tanks follow a formal predetermined procedure to ensure random selection. Samples were taken from randomly selected, apparently healthy fish from each tank. Tissues from three fish in the same tank were pooled on RNAlater™, giving three samples per tank and 30 samples per site. If the site had less than ten tanks, all tanks were sampled, and the required number of samples were divided by the number of available tanks.

The samples were submitted to the Norwegian Veterinary Institute (NVI) for analysis for ISAV by real-time RT-PCR with primers and probe as described by Snow *et al*. (2006). To differentiate ISAV HPR0 from ISAV HPRΔ, ISAV positive samples were further investigated by RT-PCR and sequenced with primers recommended by the World Organisation for Animal Health (WOAH, 2022) to determine the amino acids in the hypervariable region (HPR) of segment 6. In addition, both segment 5 and segment 6 were sequenced for phylogenetic analyses if the Cq-values indicated sufficient viral load.

All results were made available to the NFSA through a shared database (EOS). If ISAV was detected, a separate report was sent to the NFSA.

Results

In total, 77 hatcheries with Atlantic salmon and rainbow trout were sampled. Sampling was performed at sixty-six hatcheries holding Atlantic salmon, ten hatcheries holding rainbow trout and one hatchery holding both species. In addition, two ongrowing sites with rainbow trout and three sites with brown trout for restocking in the Eastern Norway were sampled. The non-pathogenic variant of ISAV, ISAV HPR0, was detected in seven hatcheries holding Atlantic salmon. The geographic locations of sampled hatcheries and ongrowing sites as well as the ISAV screening results are shown in Figure 1.

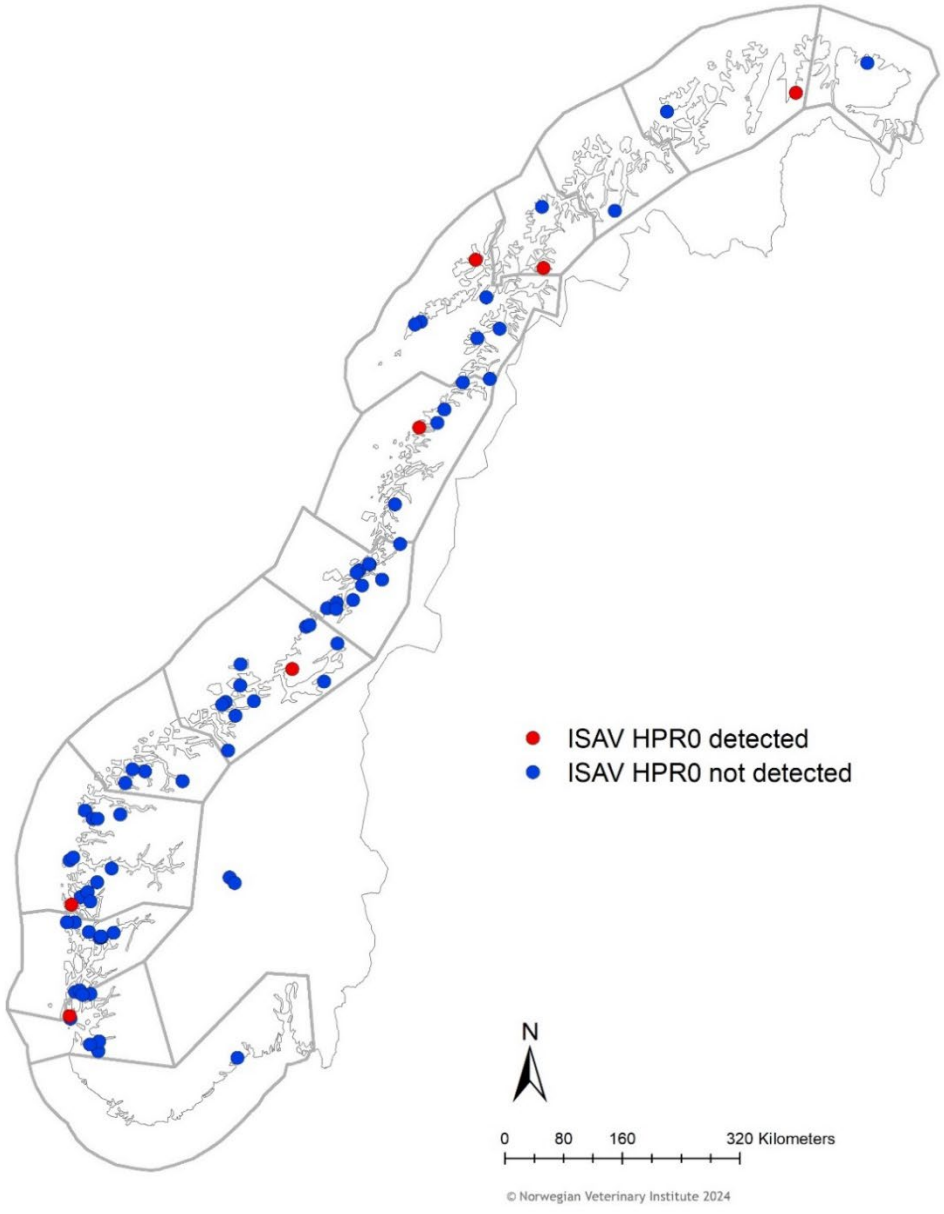

Figure 1. Geographic locations of sampled hatcheries and ongrowing sites as well as their ISAV HPR0 screening results.

An overview of the sites that were sampled in 2024 regarding water flow is shown in Table 1, while details of the ISAV HPR0-positive hatcheries are shown in Table 2.

Table 1. Summary of the water flow used by the sampled sites.

Site technology*	Number of sampled sites	Number (%) of HPR0-positive sites
GS only	59	3 (5,1 %)
RAS only	16	1 (6,3 %)
GS and RAS	7	3 (42,9 %)

* GS = flow-through system and 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	Seawater addition	Average fish weight (g)
A	GS	10	17	8	Yes	67
B	GS and RAS**	13	11	5	Yes	209
C	GS and RAS**	10	5	2	Yes	250
D	GS	10	3	3	Yes	2,5
E	GS and RAS**	9	4	1	Yes	96
F	GS	13	2	1	Yes	90
G	RAS	10	9	6	Yes	18

* GS = flow-through system, RAS = recirculation system
** Positive samples in RAS only

More flow-through facilities than recirculation facilities have been sampled in the surveillance programme. However, the proportion of ISAV HPR0-positive hatcheries is greater among the recirculation facilities and facilities with both flow-through and recirculation (Figure 2).

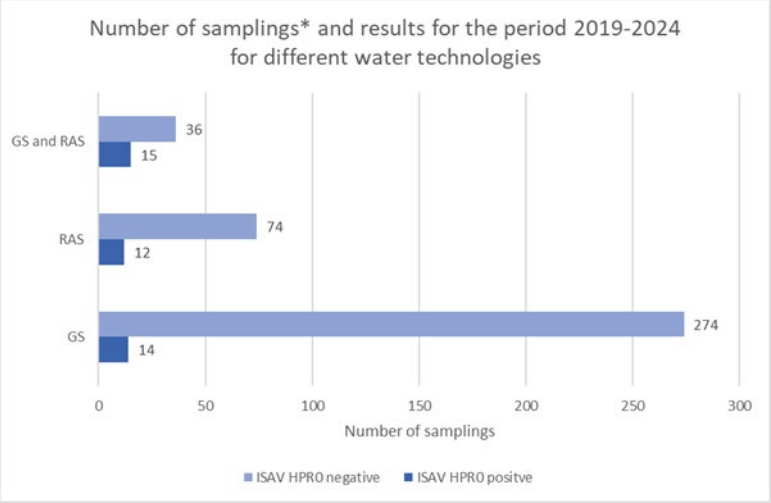

Figure 2. Summary of the water flow (GS = flow-through system and RAS = recirculation system) used by the sampled sites from 2019 – 2024. More GS facilities than RAS facilities have been sampled, but the proportion that have tested positive is greater in RAS and GS/RAS facilities. *Number of samplings: There could be several samplings at the same site, and the numbers represent the total number of samplings between 2019 and 2024 and not the total number of sites, which is less.

ISAV HPR0 has been detected in Atlantic salmon in 30 hatcheries since the surveillance programme was initiated in 2019 (Figure 3). Most hatcheries have been sampled several times, and ISAV HPR0 have been detected in samples from two samplings in eight hatcheries and three samplings in two hatcheries. Based on sequences for segment 5 and segment 6, the same variant of ISAV HPR0 has been detected in hatcheries when sequences from several time points have been obtained.

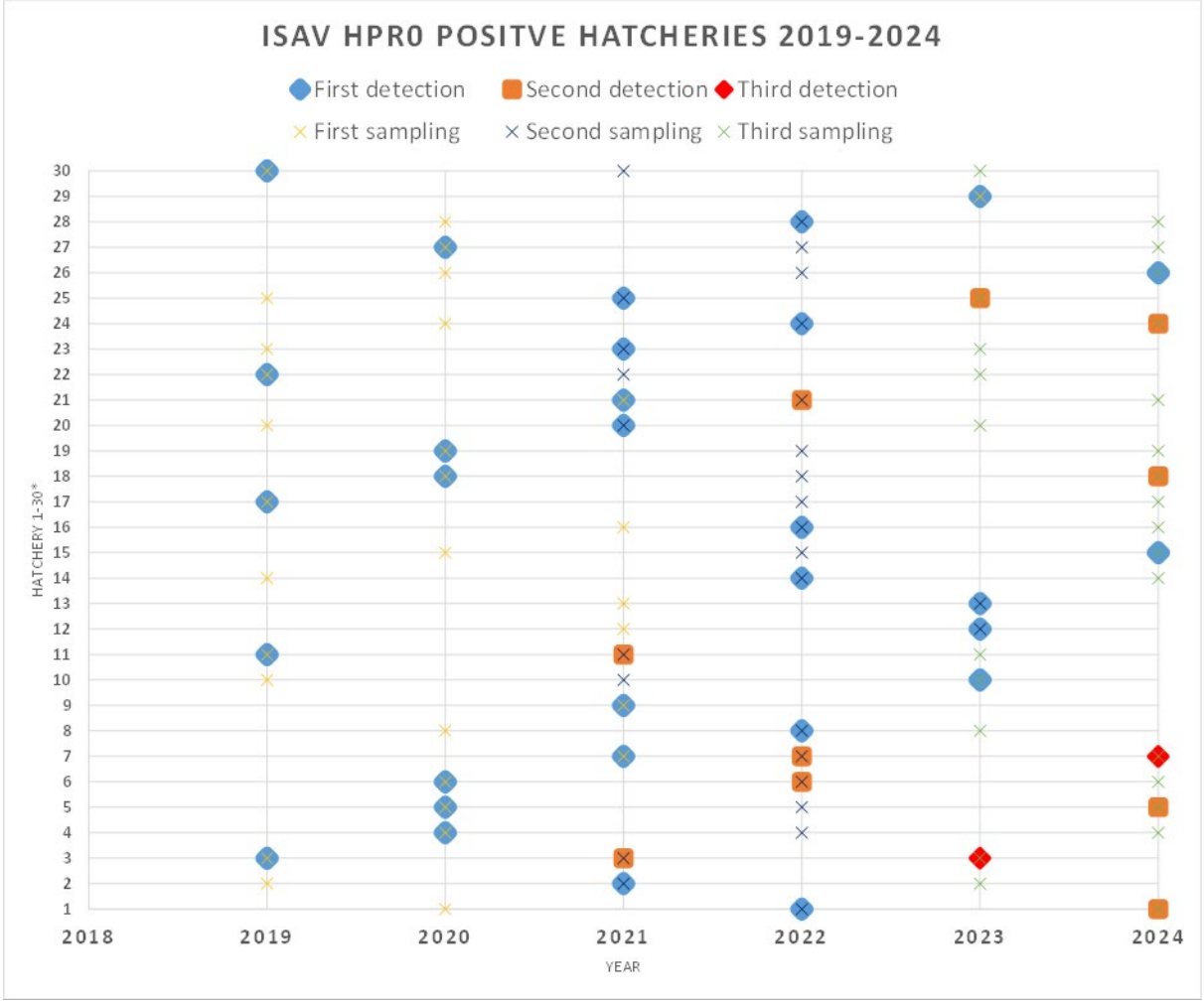

Figure 3. Sampling history and results for hatcheries where ISAV HPR0 has been detected in the frame of the surveillance programme. *The thirty ISAV HPR0 positive hatcheries were given a number between 1 and 30, where one number represent one hatchery.

Discussion

This report contains the results from the sixth and last year of the surveillance programme for ISAV HPR0 in Norwegian hatcheries. ISAV HPR0 was detected in 8.5 percent of the sites (seven out of 82). ISAV HPR0-positive tanks were found in both flow-through and recirculation systems, but all the positive tanks were run with seawater addition at the time of sampling. As in previous years, more flow-through facilities than recirculation facilities have been sampled (Table 1). However, the proportion of ISAV HPR0-positive hatcheries is greater among the recirculation facilities and facilities with both flow-through and recirculation.

The sites were only sampled once in the calendar year, and a limited number of tanks were sampled per hatchery. Consequently, it is likely that the results obtained in this surveillance programme is an underestimation of the true prevalence of ISAV HPR0 in Norwegian hatcheries. The apparent prevalence of ISAV HPR0 in 2024 (8.5 %) was relatively similar to that reported in the previous five years of the surveillance programme (7 % in 2019, 14 % in 2020, 10 % in 2021, 11.5 % in 2022 and 8 % in 2023).

Seventy of the sites sampled in 2024 were also sampled in 2022. All the seven hatcheries that tested positive for ISAV HPR0 in 2024 were also tested in 2022, and three of these hatcheries tested positive for ISAV HPR0 in both years. Nine hatcheries tested positive for ISAV HPR0 in 2022, and eight of these locations were retested in 2024. Since 2019, a total of eight hatcheries have tested positive for ISAV HPR0 twice, while two hatcheries have tested positive for ISAV HPR0 three times.

ISAV HPRΔ with sequence identical to the vaccine virus strain in HPR was detected in one hatchery in 2024. The fish were vaccinated during the last two weeks before sampling. The use of vaccines containing ISAV HPRΔ may give a positive PCR-reaction due to the vaccine virus and should be kept in mind especially when detecting ISAV HPRΔ in samples from hatcheries.

Several ISAV HPR0-positive hatcheries have in recent years delivered smolt to sea sites with ISA outbreaks shortly after sea transfer, and the ISAV HPRΔ 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. 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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