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# The surveillance programme for viral haemorrhagic septicaemia (VHS) and infectious haematopoietic necrosis (IHN) in Norway 2021

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# Content

# Summary

This surveillance programme has a risk-based approach. The core surveillance activity is the routine clinical inspections on marine sites with farmed salmonids and analyses of samples collected from diseased fish. In 2021, samples from pink salmon caught in several rivers as well as rainbow trout and brown trout from freshwater sites were also included. Viral haemorrhagic septicaemia virus and infectious haematopoietic necrosis virus were not detected in any of the samples tested in the 2021.

# Introduction

Viral haemorrhagic septicaemia (VHS) and infectious haematopoietic necrosis (IHN) are two important diseases in salmonid fish caused by rhabdovirus infections (1).

VHS has most frequently been recorded in farmed rainbow trout (*Oncorhynchus mykiss*), but may also cause losses in other wild and farmed fish species, both marine and freshwater (2, 3). Norway obtained disease free status for VHS and IHN in 1994 (4). VHS was diagnosed in farmed rainbow trout in Norway in 2007, and the disease free status for the established containment area was temporarily suspended (5, 6). Measures to eliminate the disease and prevent its spread were immediately taken by the Norwegian Food Safety Authority (NFSA). In 2011, the relevant fjord regained its free status.

Outbreaks of IHN have resulted in significant economic losses in farmed rainbow trout and salmon in North America and Europe, and the disease has also had an impact on wild populations of Pacific salmon (7). IHN-virus (IHNV) was detected for the first time in Finland in 2017 and in Estonia in 2018. In 2021, IHNV was detected at 11 sites in Denmark and subsequently at sites in Åland in Finland due to imports from Denmark. The virus has never been detected in Norway, but the recent detections in Denmark and Finland are worrying.

The Norwegian Veterinary Institute (NVI) coordinates the surveillance programme and publishes the overall results in annual reports available on VHS og IHN hos fisk (vetinst.no). All samples were analysed at the NVI. The NFSA was continuously updated on the results at site level through a digital data sharing portal (the EOS-portal).

# Aim

The aim of the programme is to document the absence of VHS-virus (VHSV) and IHN-virus (IHNV) in salmonids in Norway.

# Materials and methods

The surveillance programme has a risk-based approach (8), where the core surveillance activity is the routine clinical inspections on marine sites with farmed Atlantic salmon (*Salmo salar*) and rainbow trout (*Oncorhynchus mykiss*) carried out by the fish health personnel (FHP) and laboratory investigation of suspicious samples. The FHP are performing health controls based on the risk of infections, stress and increased mortality (9).

In addition, the Norwegian Food Safety Authority samples rainbow trout at marine sites to increase the number of samples from this species. In 2021, samples from rainbow trout in freshwater sites in Innlandet county were also included in the surveillance programme. Furthermore, samples from wild pink salmon (*Oncorhynchus gorbuscha*) invading Norwegian rivers during the summer for spawning were investigated as this species may carry and introduce IHN-virus (IHNV) and VHS-virus (VHSV) to farmed salmonids. Most samples from pink salmon were from rivers in the northernmost county of Norway (Troms og Finnmark), but some samples were taken from pink salmon caught in rivers in the Oslofjord area.

Due to the detection of IHNV in Denmark last year, it was decided to include samples from brown trout (*Salmo trutta*) from four sites from different parts of the country. Two of the sites are for stock enhancement, while one hatchery and one on-growing site for food production were included. The number of samples from rainbow trout from freshwater sites and pink salmon was also increased. Additionally, a small number of samples from lumpfish (*Cyclopterus lumpus*) used as cleaner fish for biological delousing at sites with farmed salmonids were examined. The number of samples that were analysed for IHNV and VHSV as well as the number of sites from where the samples originated are outlined for each species in Table 1. The geographical location of the marine sites are displayed in Figure 1.

***Table 1**. The number of samples that were analysed for IHNV and VHSV as well as the number of sites from where the samples originated.*

| Species | IHNV | VHSV | Sites |
|---|---|---|---|
| Atlantic salmon | 166 | 166 | 33 |
| Rainbow trout, marine sites | 183 | 182 | 19 |
| Rainbow trout, freshwater sites | 179 | 60 | 6 |
| Lumpfish | 6 | 6 | 2 |
| Pink salmon | 183 | 183 | |
| Brown trout | 120 | | 4 |
| | **837** | **597** | **64** |

Samples on RNAlater™ or transport medium submitted to the NVI were processed and analysed for VHSV and IHNV by real-time RT-PCR with VHSV primers and probe from Jonstrup *et al.* (2013) and IHNV primers and probe modified from Liu *et al.* (2008), respectively (10, 11). All samples from rainbow trout from freshwater sites, pink salmon and brown trout were further analysed for IHNV with an assay based on Cuenca *et al.* (2020) with the probe from Hoferer *et al.* (2019) as recommended in the recently updated manual from the European Union Reference Laboratory for Fish and Crustacean Diseases (12, 13, 14).

# Results and Discussion

VHSV and IHNV were not detected in any of the samples in the surveillance program in 2021.

The performance of the routine clinical inspections in surveillance for freedom from VHS was evaluated in 2016, using a stochastic simulation model (15). Model results indicate that the current surveillance system, based on routine inspections by the FHP, has a high capability for detecting VHS, and that there is a high probability of freedom from VHS in Norwegian marine farmed salmonids (PFree >95%). Sensitivity analysis identified the probabilities that samples actually are submitted and that submitted samples are tested, as the most influential input variables. The model provides a surveillance platform for similar exotic viral infectious diseases in marine salmonid farming in Norway, if they share similar risk factors, e.g. IHN.

# Acknowledgements

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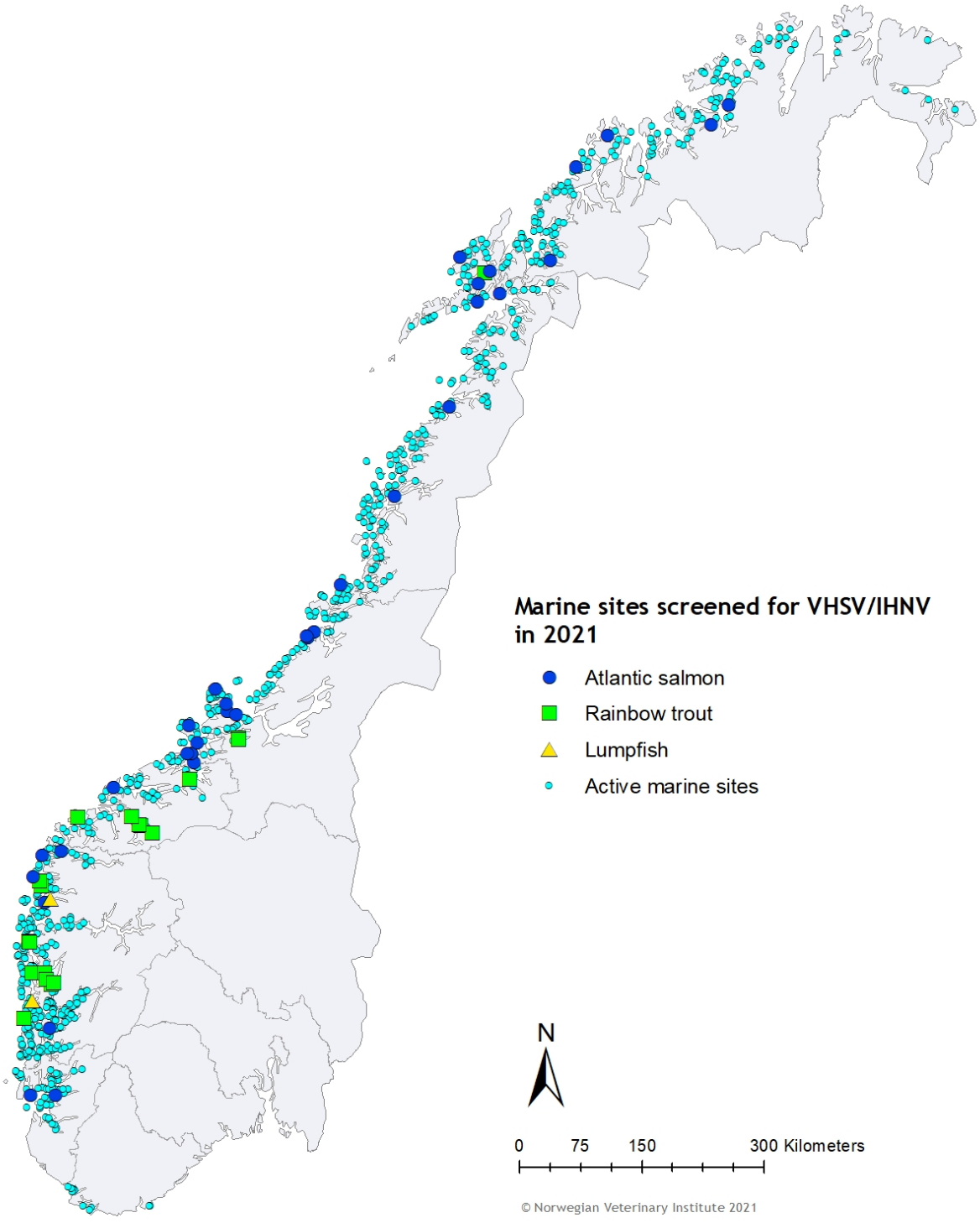
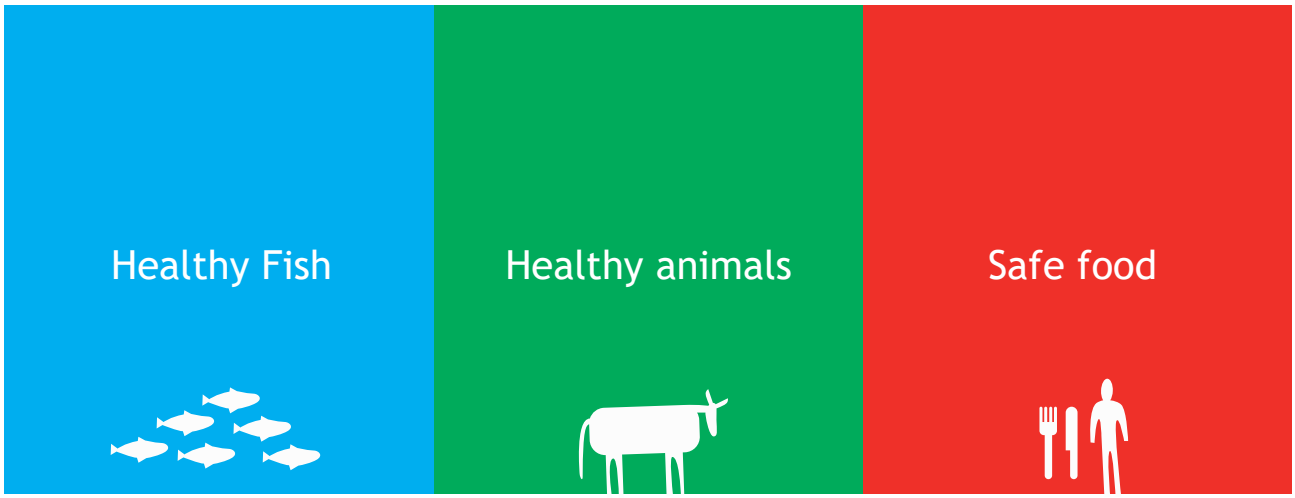



***Figure 1**: Marine sites screened for VHSV and IHNV in 2021. All marine sites with Atlantic salmon or rainbow trout that have been active for at least three months are also marked. Courtesy to Attila Tarpai.*

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