SURVEILLANCE OF INFECTIOUS DISEASES

IN ANIMALS AND HUMANS IN SWEDEN 2022

Chapter excerpt:
Wild fish surveillance programme

SVA NATIONAL VETERINARY INSTITUTE

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Cover: A cultivation of *Salmonella* at the Public Health Agency of Sweden.
Photo: Nicklas Thegerström/DN/TT. Cover design by Rodrigo Ferrada Stoehrel.

Reporting guidelines: Reporting guidelines were introduced in 2018 for those chapters related to purely animal pathogens. The guidelines build on experiences from several EU projects, and have been validated by a team of international experts in animal health surveillance. The aim is to develop these guidelines further in collaboration within the global surveillance community and they have therefore been made available in the form of a wiki on the collaborative platform GitHub (https://github.com/SVA-SE/AHSURED/wiki). Feel free to contribute!

Layout: The production of this report continues to be accomplished using a primarily open-source toolset. The method allows the source text to be edited independently of the template for the layout which can be modified and reused for future reports. Specifically, the chapter texts, tables and captions are authored in Microsoft Word and then converted to the LaTeX typesetting language using a custom package written in the R software for statistical computing. The package uses the pandoc document conversion software with a filter written in the lua language. Most figures and maps are produced using R and the LaTeX library pgfplots. Development for 2022 has focused on generalising the R package to accommodate conversion into formats other than LaTeX and PDF, with a focus on markdown files which can be published as HTML websites using the Quarto publishing system. The report generation R package and process was designed by Thomas Rosendal, Wiktor Gustafsson and Stefan Widgren.

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Wild fish surveillance programme

Figure 69: Noble crayfish (*Astacus astacus*) from the crayfish plague outbreak in river Skellefteälven 2022. From left to right: large adults (male and female with embryonated eggs) and a smaller male. Photo: Anna Aspán.

BACKGROUND

In 2020, a general surveillance programme for wild fish, crustacean and mollusc health was launched, organised by the National Veterinary Institute (SVA) by commission from the Swedish Agency for Marine and Water Management (SwAM). Previously, wild fish had only been investigated through short term projects or in cases of acute disease, except for eel, that had been monitored since 2018. Crayfish plague has been monitored for several years, and wild molluscs have been included in bonamiosis and marteiliosis projects for farmed molluscs. The surveillance programme aims to cover several ecological niches and important diseases for each of these three animal groups. To manage this, several programmes are currently under development, including both active and passive surveillance. The programmes and currently available results from 2022 are described below.

SPECIES-INDEPENDENT TOOLS

In addition to the specific fish, crustacean and mollusc programmes, other surveillance components are available that are used as complements to cover acute disease events and species not covered by the active surveillance programmes.

Reporting site

A reporting site (rapporterafisk.sva.se) was set up in 2016 to enable passive surveillance, mainly of returning salmonids. It has since been expanded but salmon is still the main species reported.

Emergency funding

The emergency funding is a pot of money within the surveillance programme, dedicated to urgent cases/non-planned samplings, and that allows the investigation of cases identified through passive surveillance (e.g., the reporting site, phone calls or email correspondence).

Invasive alien species

Upon specific request from SwAM, risk assessments are made regarding introduction of pathogens with invasive alien species that are identified in Sweden or are considered at high risk of being introduced. Invasive alien species like the American lobster (*Homarus americanus*), are also investigated for the presence of pathogens at SVA using emergency funding.

FISH

Anadromous fish

Salmonids and lampreys are anadromous (breed in freshwater and mature in salt/brackish water). The programme focuses on salmonid health because of ongoing health issues in the Baltic salmon (*S. salar*) population. The disease problems started in 2014, with fresh run salmon showing ventral skin haemorrhages followed by fungal infections. The cause of this is still unknown. In 2019, a similar disease started appearing in rivers emptying to the Atlantic Ocean (Sweden, Norway, British Islands). The syndrome has been named red skin disease. In addition, many rivers have problems with fungal infections in both salmon and trout (*S. trutta*) in the period around spawning (October-December). Summer samplings are performed in specific rivers to investigate the disease cause. Active surveillance is also done for autumn problems by monitoring spawning grounds and recording health problems in broodstock (restocking farm).

In 2022, a total of 104 salmons collected by traps, gill nets or in fish ladders were sampled in the summer. Both healthy looking and diseased individuals were sampled. Analysis of viral, histopathological samples, blood smears, thiamine and metabolomics have been performed. A summary of results from 2020–2022 will be done once all results are present. Spawning grounds were successfully monitored in some rivers but could not be performed due to high water flow in other rivers. In all, it is considered a valuable monitoring tool given that the environmental conditions are good. After three years of data collection, we can now start to follow the health trends for broodstock in restocking farms.

Catadromous fish

The European eel (*Anguilla anguilla*) is an endangered species and Sweden is working to restore the population. Glass eels are imported annually and quarantined before being released at different locations. Assisted migration for juveniles that have migrated naturally to Sweden is conducted at hydroelectric power dams in Southern Sweden. Health monitoring started in 2018 at some of these dams and in larger eels collected during the coastal fishing performed by the Swedish University of Agricultural Sciences (SLU). Ten to 30 eels per site are investigated for the presence of Infectious pancreatic necrosis virus (IPNV), Eel virus European X (EVEX) and eel herpes virus (AngHV-1). In addition, fish

>18 cm are checked for the eel swim bladder worm *Anguillicoloides crassus*. If skin haemorrhage, wounds or internal signs of infectious disease are present, bacterial culture is also performed.

In 2022, a total of 292 eels were sampled. Generally, they were in good condition. Of 166 eels examined for the presence of swim bladder worm, 57 were infected. In addition, one eel <18 cm was found to be infected with swim bladder worms during viral sampling. Eel herpes was the only virus detected and it was found in 46 of1015 organ pools, with each pool containing 2–3 eels.

Saltwater fish

Active surveillance is performed through sampling of cod (*Gadus morhua*), flounder (*Platichthys flesus*) and dab (*Limanda limanda*) in the Southern Baltic and Kattegat. Sampling is done during international trawl surveys performed by SLU. In the Baltic, 100 cods and 100 flounders and dabs were collected in the first quarter of the year, and in Kattegat 100 cods and a total of 100 flounders and dabs were collected in the third quarter of the year. External signs of disease were noted according to an internationally used schedule. Internal signs of disease were also noted. Histopathology was performed on liver and gonads. Sampling for virus or bacterial culture was done if deemed necessary. In cod, livers from 50 fish >35 cm per sampling were digested and the number of cod worms (*Contracaecum* sp.) were counted. The results are currently being evaluated.

Freshwater fish

For freshwater fish, no specific programme has been established. Instead, annual projects that focus on 'hot topics' are selected. In 2021–2022, a project on pike sarcoma has been running. A total of 50 pikes were to be sampled for pathology, histopathology and microbiology to identify the suspected associated retrovirus. After two years, a total of 42 pikes have been sampled. Of these 4 were healthy and used as references and 38 had lymphosarcoma or wounds/scars that were potentially healing sarcoma ulcers. Histopathology identified tumours with varying grades of invasiveness, with moderate differences in mitosis frequency, cell morphology and concurrent inflammation. Tumours were also analysed by PCR to identify the responsible retro virus and to look at activity level (mitosis frequency). A specific virus has not been identified due to lack of matching sequences, but PCR to look at activity level was successful and confirms a variability between the tumours. In addition, one pike with blue spots (suspected herpes virus infection) was caught during sampling. The pike was sampled and the presence of Esocid herpesvirus 1 was shown. This is the first identification of this benign virus in Sweden.

In addition to pike investigations, a project to investigate the presence of BKD in wild salmonids in lakes Vättern and Siljan was performed. Vättern has previously had cage farms whereas Siljan currently has one cage farm. A total of 199 fishes (Arctic char, brown trout, grayling, whitefish and vendace were sampled. Two Arctic chars from Vättern and one grayling from Siljan were positive for BKD. This indicates a low prevalence within the wild salmonid populations in both lakes. In Siljan, a recent outbreak of BKD in the cage farm with delayed slaughter might mean that the prevalence in wild fish is actually higher than detected, because the disease has a slow onset, and it can take years to see the effects in the wild fish population.

CRUSTACEANS

Saltwater crustaceans

Saltwater crustaceans are monitored by passive surveillance. For example, SLU fishes for Norwegian lobster (*Nephrops norvegicus*) and if any disease signs are detected, animals are sent for analysis. The university also reports if the invasive alien species American lobster is caught on the west coast.

Freshwater crustaceans

Freshwater crayfish has been monitored for crayfish plague for many years. This surveillance is passive, with investigations upon suspicion of disease. White spot syndrome virus and porcelain disease, caused by the parasite *Thelohania contijeani*, two other lethal diseases, are investigated at the same time as crayfish plague by a combined PCR. Results for 2022 are included in the chapter "Infectious diseases in fish, crustaceans and molluscs" (page 139).

In recent years, the use of eDNA for detection of crayfish plague and the presence of noble crayfish (*Astacus astacus*) and the invasive alien species signal crayfish (*Pacifastacus leniusculus*) under Swedish conditions has been evaluated. Work to enhance the eDNA extraction step is being done, otherwise the methodology works well.

MOLLUSCS

Saltwater molluscs

Saltwater molluscs are included in the surveillance from 2021. A total of 150 blue mussels and 150 European/flat oysters (*Ostrea edulis*), from five sites each are investigated for the presence of bonamiosis, marteiliosis, perkinsosis and mikrocytosis. Results are presented in the chapter "Infectious diseases in fish, crustaceans and molluscs" (page 139).

Freshwater molluscs

The river pearl mussel (*Margaritifera margaritifera*) is an endangered species, and in some Swedish rivers there have been sharp population declines in the last years. Research to identify the cause is ongoing. Because of the endangered state of the species, annual samplings of a number of individuals per population is not an alternative. A monitoring programme will be developed as soon as there is more knowledge about the cause.