SURVEILLANCE OF INFECTIOUS DISEASES IN ANIMALS AND HUMANS IN SWEDEN 2020

Chapter excerpt -

Wild fish surveillance programme

SVA NATIONAL VETERINARY INSTITUTE

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Cover: Juvenile mink in hand. Photo: Elina Kähkönen

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, produced by authors, 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 using pandoc and R to the LaTeX typesetting language. Most figures and maps are produced using the R software for statistical computing and the LaTeX library pgfplots. Development for 2020 has further improved the importing of content from Excel files to automatically build figures in the pgfplots LaTeX library. The tool is available as an R-package on GitHub (https://github.com/SVA-SE/mill/). The report generation R-package and process was designed by Thomas Rosendal, Wiktor Gustafsson and Stefan Widgren. In 2020, final typsetting was done primarily by Wiktor Gustafsson with contributions from the report authors.

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Wild fish surveillance programme

BACKGROUND

In 2020, a general surveillance programme for wild fish, crustacean and mollusc health was launched, organized by the National Veterinary Institute by commission from the Swedish Marine and Water Agency. Previously, wild fish had only been investigated through short term projects or in cases of acute disease, except for eel which had been monitored since 2018. Crayfish plague has been monitored for several years, and wild molluscs have been included in bonamiosis and marteilosis projects for farmed molluscs. The surveillance programme started in 2020 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 summary results from 2020 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 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 the Swedish Marine and Water Agency, 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 the National Veterinary Institute 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 2020, a total of 148 salmon were sampled in the summer. Analysis of histopathological samples, thiamine, thyroid status and whole metabolism are ongoing. 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. The health trends for broodstock will be evaluated after a few years of data collection.

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. Ten to 20 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 >10 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 2020, a total of 155 eels were sampled. Generally, they were in good condition. Of 120 eels examined for the presence of swim bladder worm, 49 were infected. Eel herpes was the only virus detected and it was found in 11 of 49 organ pools, with each pool containing 2–3 eels. All eels in herpesvirus positive pools were >33 cm.

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 the Swedish University of Agricultural Sciences. In the Baltic, 100 cod and 100 flounder were collected in the first quarter of the year, and in Kattegat 100 cod and a total of 1000 flounder 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 2020, renibacteriosis (BKD), caused by *Renibacterium salmoninarum*, in wild fish was investigated. Until 30 June 2021, Sweden has additional guarantees for BKD. On-growing of salmonids is usually performed in open net pens, and without stamping out of infected fish, the disease could easily spread to the surroundings and become established in wild salmonids. The disease is present or has recently been present in farms in four different rivers (see chapter "Infectious diseases in fish crustaceans and molluscs" on page 128). In the decision-making process to determine if Sweden should apply for national measures according to the new animal health law (Article 226, (EU) 2016/429) or not, a study was performed to investigate the status of wild salmonids (Arctic char (*Salvelinus alpinus*), Brown trout (*Salmo trutta*), Whitefish (*Coregonus* sp.) and grayling (*Thymallus thymallus*)) in these four rivers. The county boards selected nine sampling points upstream and downstream from affected farms as well as a reference sampling point outside the river system. The reference point was situated in a lake or river where anthropogenic movement of fish had not occurred. With 10 sampling points representing each river, there were a total of 40 sampling points, with 30 salmonids collected at each sampling point, generating 1200 fish for analysis. In addition, water was collected at each sampling point to test for *Renibacterium salmoninarum* eDNA using real-time PCR. Detection of *Renibacterium salmoninarum* in fish was done by an antigenic ELISA, with confirmation through real-time PCR.

A total of 1059 fish could be sampled in 38 sampling points and all four designated species were represented. Of the 1059 fish, 52 (4.9%) were positive for *Renibacterium salmoninarum* by ELISA. Of these, 50 came from one river. Whitefish was the main species infected (n=43), whereas only 6 graylings, 2 trout and one Arctic char were positive. Active infection could only be confirmed in one fish by real-time PCR. Water samples were positive for *Renibacterium salmoninarum* eDNA at only two sampling points and this was not associated with the presence of *Renibacterium salmoninarum* infected fish from the same sampling point.

It is apparent that there is a chain of *Renibacterium salmoninarum* transfer between farmed and wild fish. Within a farm, high fish density can cause high infection pressure and the subsequent spread of pathogens from net pens to surrounding wild fish. If the pathogen becomes established in the wild fish, there is a high risk of reinfection of the site after sanitation and restocking.

The river where 50/52 *Renibacterium salmoninarum* positive fish were collected is small with shallow lakes and slow water flow in comparison to the other three rivers. We believe that the water properties of this smaller river allow for a higher infection pressure to build up around a farm. Little is known about the virulence of *Renibacterium salmoninarum* to whitefish and grayling. It is apparent that whitefish are readily infected, but the lack of active infection suggests high survival rates. This could be problematic as they could represent a reservoir for the disease for Arctic char that can suffer high mortalities. The lack of eDNA positive water samples could possibly be attributed to the lack of active infection in the wild fish, but it may also be that bacteria adhere to particles in the water and sink. Thus, it might be necessary to use equipment that allows for water sampling at the river bottom. Interestingly, both *Renibacterium salmoninarum* positive sampling points were situated a few km downstream from fish farms, one of which tested positive for *Renibacterium salmoninarum* a few months later. The other farm tested negative. However, this site had been recently sanitised due to BKD so it is probable that wild fish adjacent to the farm harbour the infection.

CRUSTACEANS

Saltwater crustaceans

Saltwater crustaceans are monitored by passive surveillance. For example, the Swedish University for Agricultural Sciences 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*, are investigated if crayfish plague is ruled out as the cause of mortality. Results for 2020 are included in the chapter "Infectious diseases in fish, crustaceans and molluscs" (page 128).

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. In 2021, a pilot will be run to begin active surveillance of crayfish plague and crayfish species using eDNA analysis.

MOLLUSCS

Saltwater molluscs

Saltwater molluscs will be included in the surveillance from 2021. Samplings in 2020 were included in a project funded by the European sea and fisheries fund, and results are presented in the chapter "Infectious diseases in fish, crustaceans and molluscs"(page 128).

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.