Introduction

Aquaculture is one of the fastest growing animal production branches worldwide. Due to the decreasing availability of wild fish species and the increasing customers demand for a large variety of food, not only production quantities but also the diversity of species available in aquaculture is constantly growing. In Switzerland, fish consumption increased by more than 60% over the last 25 years. However, over 95% of the fish consumed in Switzerland originate from foreign countries. To increase the availability and variety of locally grown fish species on the market, several new projects were established over the last couple of years.

To reduce water consumption for maintenance of the fish in culture, recirculating aquaculture systems (RAS) are getting more and more popular. However, experience with these new systems as well as the newly introduced species is often limited. Consequently, losses due to mortality can be high. Our project aims to identify critical time points and risk factors as well as relevant pathogens in a selection of new species produced in RAS and to establish appropriate diagnostic methods. Our findings will be used to create guidelines and production manuals in order to optimize production procedures. This is not only important for economic reasons but also with regard to animal welfare. As possibilities for therapeutic treatments are limited in RAS, prophylactic measures to prevent health problems are extremely important.

Project and study aims

The project is based on a cooperation between a warm water RAS facility in the Swiss Alps (Tropenhaus Frutigen, further called THF) as business partner and the University of Bern as research partner. The fish health management is covered by veterinarians specialised in fish medicine (fishdoc GmbH). The THF was founded in the beginning of 2000. The water source for the facility is a warm spring, which was discovered during construction work of a transalpine tunnel. The concept covers a tropical garden with exotic fruits and a fish farm. This fish farm originally produced mainly caviar and sturgeon meat (Acipenser baerii, Acipenser gueldenstaedtii). However, starting a few years ago, European perch (Perca fluviatilis) and pike perch (Sander lucioperca) are cultivated as well. As knowledge of optimal maintenance conditions of these species in RAS is limited until now, a project was initiated to (1) identify critical time points during the production cycle, (2) identify possible risk factors for induction of increased mortality in different age classes, (3) establish diagnostic methods and criteria to recognize infectious diseases as early as possible and to (4) establish a prophylaxis and treatment concept for new fish species in recirculation systems.

Interest in these species for aquaculture is increasing in and outside of Switzerland. Therefore, the knowledge gained during this project can be beneficial for other aquaculture projects in the future as well.

Description of the problem

At the moment, mortality is relatively high in all three species investigated, especially during the first steps of production. In sturgeon, mortality can raise up to 30% in the first year, followed by losses up to 10% until sexual maturity. In perch and pike perch, mortality can raise up to 25% during the whole production cycle. Therefore, mortality exceeds by far the average of other farm animals where losses up to 5% are tolerated.

In sturgeon, European perch and pike perch, methods to diagnose many of the infectious diseases are not well established until now. This is often the reason why diagnostics in these species is time consuming.
Therefore, the period between first recognition of a clinical problem, diagnosis and treatment often takes too long and cannot prevent increased mortality. Suboptimal husbandry conditions will additionally increase the probability of stress-related outbreaks of infectious diseases.

**Methods**

Production-relevant data are stored in a management program which is established since 2012 in the THF. These data help to identify critical points relating to mortality during the production cycle. Samples of 80 perch, 30 pike perch and 10 sturgeons according to different age classes were taken at the beginning of the project for an initial health assessment. On each individual fish a macroscopic, bacteriological, virological and histological examination was performed. For histology, samples of liver, spleen, kidney, muscle, skin and intestine were taken.

**Preliminary Results**

There is an annual increase of mortality in perch and pike perch during the summer months June till September. Mortality peaks due to transport around day four after arrival of new fish at the quarantine. In pike perch, pathogens and treatments lead to episodes with fast increase of mortality and high numbers of dead animals. The histological examination showed severe changes in muscle and liver with extensive muscle necrosis in European perch as well as in pike perch. Depending on the weight classes up to 78% perch and up to 100% pike perch were affected. About 71% of the examined perch and 70% of pike perch showed multifocal moderate hepatic inflammation with granuloma formation, necrosis and hemorrhage.

**Outlook**

Results of this project will give the basis to increase the production efficiency and fish welfare in Swiss aquaculture specialized on new fish species cultivated in RAS. Due to the close interaction between the fish farm and the university, husbandry related stress factors will be identified and reduced. Moreover, the establishment of new diagnostic methods will optimize and speed up disease diagnostics for these new species. With these measures, mortality should be reduced by at least 10% in all included fish species in the project. The project started in February 2017 and is planned to last for three years.

**Funding**

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