NetClean 24/7

Tetherless robot for biofouling prevention and inspection in salmon farming

Biofouling is a challenge for salmon farming worldwide, particularly in Norway since its presence decreases the effectiveness of cleaner fish employed to control the salmon lice. Other impacts of biofouling accumulation include decreased oxygen levels within cages, net deformation, and increased stress on mooring systems. One of the main measures for counteracting biofouling today is in -situ high-pressure net cleaning.

UNDERLYING IDEA

The underlying idea of NetClean 24/7 is to develop an autonomous and tetherless robot for prevention of biofouling and inspection of net integrity. The permanently installed robot will be small, energy efficient, have its own docking station, and conduct continuous net cleaning and inspection operations in fish farms (Figure 1).

Biofouling management in Norwegian salmon farming currently relies heavily on regular net cleaning with high-pressure washers, a frequently conducted, labour intense operation. The NetClean 24/7 project will develop novel technology to build an advanced self-actuated robot permanently installed in each cage, introducing a new management strategy that does not impact fish health and will make salmon farming more sustainable. Being motivated and inspired by currently available compact and cost-efficient technological solutions in the fields of robotic lawn-mowers and cleaners for pools, ship hulls, floors and windows, the project aims to develop a tetherless, standalone-self-actuated solution able to prevent biofouling (i.e. the unwanted growth of organisms such as algae and hydroids) on fish nets through autonomous cleaning and inspection operations. Dedicated cleaning tools will be developed to guarantee high cleaning efficiency at low energy cost. Simultaneously, the robot will conduct monitoring operations. An integrated sensor package consisting of cameras and environmental sensors will be used to inspect the condition and integrity of the fish net area and obtain relevant data for the assessment of environmental conditions. The accompanying cage-integrated docking station will clean the robot during charging, and will transfer the collected data to the control room where it can be used in decision making.

The innovation will be built on new knowledge generated within automation and biofouling management and will enable the farming industry to improve farming control and productivity while at the same time contributing on reducing costs and risks related to cleaning operations. The novel technology and biofouling management strategy are expected to have positive effects on fish health and welfare in commercial fish farming. This new technology for autonomous cleaning and inspection in fish

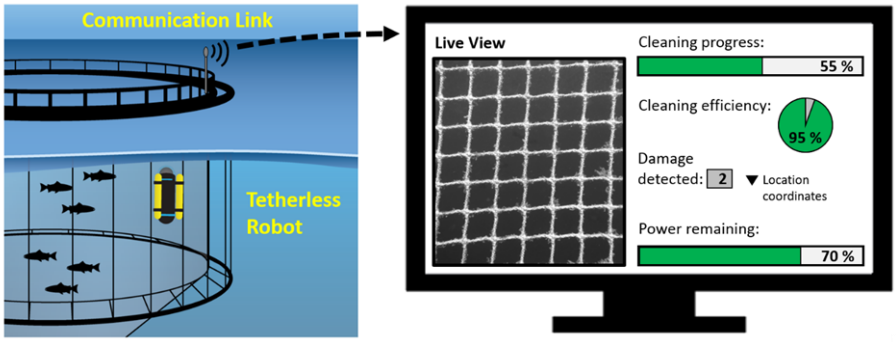

Fig. 1: Permanently installed, autonomous and tetherless robot for simultaneous daily cleaning and inspection operations

cages is a very important development on the way towards operation of remote farm sites.

RESEARCH AREAS

The following research areas are addressed in the project:

- Autonomous inspection and cleaning: Development of autonomous cleaning and methods for inspection and monitoring of cleaning efficiency.
- Sensor package system for data capturing: Automate the extraction of characterizing information obtained from the sensor package, by developing appropriate algorithms and methods to analyse and quantify variables and conditions related to A) net, B) biofouling and C) environment.
- Underwater docking station: Subsea docking systems for automatic launching and recovery of the robot, as well as inductive battery charging and transmission of the large data quantities obtained must be developed.
- Permanent resident cleaning robot: Create a real world applicable permanent resident tetherless cleaning robot.

Project Owner, Remora Robotics AS has already developed a first version of cleaning robot with tether named Remora (Fig. 2). Hence, research will be focused on the adap-tation of the Remora cleaning robot to incorporate the outputs from 1), 2) and 3) in order to develop an advanced, full autonomous and tetherless cleaning robot permanently installed in a cage that is capable of provid-ing inspection and biofouling prevention as well as con-tinuous monitoring of environmental conditions (i.e. temperature, O2, etc.) in fish cages.

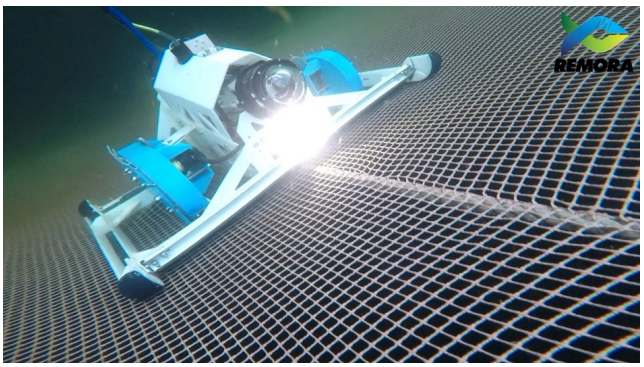

Fig. 2: Remora net cleaning robot developed by Remora Robotics AS.

POTENTIAL FOR VALUE CREATION

There are currently no similar commercial products available on the market, giving the partners in the project the opportunity to be first providers of a new and ground-breaking technology and associated services. The realization of the outlined innovation comprises a very high potential for value creation for the involved partners, allowing them to offer new pioneering and revolutionary technology. With a total of 1044 fish farming facilities in Norway in 2017, each with 4-16 cages, the current Norwegian market offers large opportunities. Since biofouling is a worldwide problem that is not restricted to salmon farming, further opportunities can be expected on the international market.

PROJECT PARTNERS

The consortium behind the NetClean 24/7 project is built around:

- An innovative developer of cleaning robot, Remora Robotics AS as project owner.
- One of the world's largest salmon farming companies, Nordlaks Oppdrett AS.
- Developer of robust and reliable instrument solutions for oceanographic and other environmental measurements, Xylem Aanderaa AS.
- Two research partners (SINTEF Ocean AS and NTNU).

This project is funded by The Research Council of Norway.

The Research Council of Norway

SINTEF

CONTACT:

Nina Blöcher
+47 920 84 858
Nina.Bloecher@sintef.no