Efficient and innovative fish production via best available technology (RAS2020) (39328)
This project includes a full scale test and development of a conceptual recirculating aquaculture system (RAS) for king fish production. The innovative aspect of this modular RAS2020 concept regards the design—a one unit circular module designed to have a 1200 MT/Y capacity.

The aim of this project is to build and develop a RAS unit with small footprint, low cost and reduced construction time. The RAS2020 unit includes state of the art treatment units (Hydrotech drumfilters, Krüeger biofilters—nitrification and denitrification) and is built with flexible interconnected rearing sections. When the RAS2020 is built and stocked with kingfish, an extended sampling and monitoring program will be performed in order to assess system performance in particular N, P and organic matter removal.

This project is coordinated by Sashimi Royal.

The project is funded by the Danish Environmental Protection Agency.

National Institute of Aquatic Resources
Section for Aquaculture
Sashimi Royal
Aqua-Partners Aps
Dansk Akvakultur
Period: 01/02/2016 → 31/12/2018
Number of participants: 7
Research area: Aquaculture
Project participant:
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Pedersen, Per Bovbjerg (Intern)
Jokumsen, Alfred (Intern)
Møller, Brian (Intern)
Sproegel, Ulla (Intern)
Frandsen, Dorthe (Intern)
Nielsen, Sara Møller (Intern)

Environmental neutral aquaculture water treatment (MIVANAK) (39295)
Despite a transition from flow-through systems to more advanced open water reuse aquaculture systems (e.g. model trout farms), the need for water treatment still exists. In brackish and saltwater reuse systems, blooms of toxic microalgae in an example of a recently new challenge.

The purpose of this project is to further develop current aquaculture water treatment practice and reduce the total amount of disinfectants used.

The project includes 3 different work packages, investigating
- ecological consequences of continuous application of peroxyacetid acid.
- toxicological effects of easy degradable disinfectants.
- alternative biological methods to control / avoid blooms of toxic heterotrophic dinoflaggelates.

Trials will include mesocosmos experiments where disinfectants are added continuously or by daily pulses over a prolonged period of time where phyto- and zoo-plankton abundance and compositions will be investigated. Other trials will be made in batch experiments with pure algae cultures, as will prolonged continuous peroxyacid application experiments be made.

This project is coordinated by DTU Aqua.

The project is funded by the Environmental Protection Agency's Programme for Pesticide Research.

National Institute of Aquatic Resources
Section for Aquaculture
Period: 01/08/2015 → 31/12/2017
Number of participants: 9
Research areas: Aquaculture & Marine Populations and Ecosystem Dynamics
Project participant:
Pedersen, Per Bovbjerg (Intern)
Koski, Marja (Intern)
Sproegel, Ulla (Intern)
Frandsen, Dorthe (Intern)
Møller, Brian (Intern)
Larsen, Ole Madvig (Intern)
Jensen, Rasmus Frydenlund (Intern)
Project Manager, organisational:
Pedersen, Lars-Flemming (Intern)
Phd Student:
Rojas-Tirado, Paula Andrea (Intern)

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Water treatment technology for microbial stabilization in landbased aquaculture systems (MicStaTech) (39277)
MicStaTech is a transnational research project (COFASP) between Norwegian, German and Danish research groups. The paradigm of this project is that a stable, elevated microbial abundance in the water phase of land based aquaculture systems can be beneficial for fish health and economically profitable. A common challenge in land based systems, and shown across species, is the loss of fish due to unfavourable conditions and disease outbreaks that may be linked to opportunistic bacteria. A popular approach to prevent this is to attempt to reduce the load of bacteria in the systems by the use of UV, ozone or chemical disinfection. This is however not possible or sufficient in the majority of systems, because disinfection has a non-lasting effect on the numbers and a destabilising effect on the composition of bacteria. In most systems, the water exchange rates and organic loading applied for biological reasons allow for microbial regrowth in the rearing tanks. Hence, alternative approaches to reduce the chances of disease outbreaks are needed. This project pursues the concept of establishing and maintaining stable microbial systems.

Water treatment technology for promoting K-selection, which is a selective pressure disfavouring the r-selected opportunists, has shown very promising results for several marine species in small scale experiments, but the up-scaling and optimization for flow through systems (FTS) and recirculating aquaculture systems (RAS) remains. The paradigm favouring a stable and elevated bacterial abundance is foreseen to reduce fish mortality and also reduce water treatment costs. This project will investigate fish health and microbial carrying capacity in experiments performed at three locations – NTNU, DTU Aqua and University of Applied Sciences, Saarlandes, Germany.

This project is coordinated by Norwegian University of Science and Technology, Norway.

The project is funded by EU, COFASP, ERA-NET.

National Institute of Aquatic Resources
Section for Aquaculture
Norwegian University of Science and Technology
Hochschule für Technik und Wirtschaft des Saarlandes University of Applied Sciences
Period: 01/03/2015 → 31/12/2017
Number of participants: 7
Research area: Aquaculture
Project participant:
Towards stable water quality in RAS by use of a new rapid microbial test (Biostable water) (39154)

Water quality control is central for successful management of recirculating aquaculture systems. Most common and important chemical parameters (i.e. pH, TAN, nitrite, alkalinity) are measurable, whereas microbial water quality (abundance and activity) is more complicated to measure. Microbial water quality measurements are important for several reasons: it can be used to ensure safe and stable conditions (baseline), to identify sudden changes (deviations from baseline) and potentially contribute to improve system performance by identifying suboptimal treatment component or practices.

The aim of this project is to test a rapid microbial methods developed by Mycometer; a test that quantifies the microbial activity in different types of water samples within 30 minutes from sampling to measurement. The Bactiquant® method is expected to provide new insight of microbial succession within RAS and will be used to monitor microbial water quality in commercial recirculating aquaculture systems.

The project includes controlled batch experiments where disinfection efficiency and regrowth potentials can be estimated. The new knowledge can be applied in RAS management, and the project also includes method verification under commercial RAS conditions. The equipment has been introduced and implemented on a large model trout 3 farm with mixed effect and valuable experiences. The method is also being introduced to a huge smolt RAS facility build by Billund Aqua; here daily monitoring as well as intensive campaigns including diurnal measurements will be performed.

The project is coordinated by DTU Aqua.

The project is funded by the Danish Ministry of Food, Agriculture and Fisheries through the Green Development and Demonstration Program (GUDP).

National Institute of Aquatic Resources

Section for Aquaculture

Mycometer A/S

Billund Aquaculture Service Aps
Period: 01/02/2014 → 01/07/2016
Number of participants: 9
Research area: Aquaculture
Project participant:
Rojas-Tirado, Paula Andrea (Intern)
Pedersen, Per Bovbjerg (Intern)
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Møller, Brian (Intern)
Nielsen, Sara Møller (Intern)
Frandsen, Dorthe (Intern)
Larsen, Ole Madvig (Intern)
Jensen, Rasmus Frydenlund (Intern)

Project Coordinator:
Pedersen, Lars-Flemming (Intern)

Sustainable technologies to control microalgae in land based saltwater recirculating systems (39032)

Land based salt water recirculating systems is a potential alternative to fish farming in net pens. This purpose of this project was to test different solutions on how to control unwanted microalgal growth thereby addressing a potential challenges associated with land based farming.

A high degree of water reuse and the associated nutrient accumulation may favour growth of microorganisms and thereby
deteriorate the biological water quality.

The project included:
- Test of improved mechanical filtration (application of pilot scale protein skimmers on small to medium sized RAS, and application of full scale 4 meter vacuum airlift; an innovative treatment technique tested in full scale RAS)
- Test of chemical water treatment routines using easy degradable disinfectants (Peracetic acid, chloramine-T, hydrogen peroxide) to control and inhibit toxic microalgae,
- Test of electrochemical oxidation disinfection technology to assess the efficacy (radical formation and algicidal effects) of boron doped diamond electrodes.

Numerous batch and pilot scale experiments were made at the section for Aquaculture, Hirtshals. In addition, intensive, diurnal sampling/monitoring and analysis on location was performed on a commercial pike perch RAS facilities facing toxic algae problems.

The project is coordinated by DTU Aqua.

The project was funded by the National Environmental Protection Agency through Programme for Development and Demonstration of Bio-technologies (MUDP).

National Institute of Aquatic Resources
Section for Aquaculture
University of Copenhagen
AquaPri Innovation
Billund Aquaculture Service Aps
Electrocell
Environmental Protection Agency
Period: 01/01/2013 → 30/11/2013
Number of participants: 8
Research areas: Aquaculture & Marine Populations and Ecosystem Dynamics
Project participant:
Koski, Marja (Intern)
Pedersen, Per Bovbjerg (Intern)
Sproegel, Ulla (Intern)
Frandsen, Dorthe (Intern)
Møller, Brian (Intern)
Jensen, Rasmus Frydenlund (Intern)
Project Coordinator:
Pedersen, Lars-Flemming (Intern)

Enzymes in fish feed: Optimization of protein digestibility in fish production (38396)
The demand for aquaculture products is increasing globally and is expected to keep increasing in proportion with the growth in the global human population. A limiting factor for the expansion of the aquaculture industry is the dependency of fish meal, which is the primary protein source in feed for carnivorous fish (trout, salmon, turbot, cod etc.). Increasing world market prices on quality fish meal is reflected in the price of fish feed, and has intensified the international competition for finding ways to optimise the use of alternative plant-based proteins in fish feed.

Enzymes are catalysts that increase the speed of the processes in which they are involved. A high degree of specificity makes enzymes an excellent tool for increasing specific reactions, e.g. the degradation of complex feed ingredients to digestible nutrients. The addition of enzymes to fish feed has the potential of improving the nutritional value of the feed, reducing production costs and loss of valuable nutrients to the environment. Enzymes are already widely used in feed for broilers and pigs, while only phytases have been approved for commercial fish production.

The objective of this project was to promote the use of industrial enzymes in fish feed as a means to improve the utilization by the fish of existing and/or alternative protein sources. The project consisted of four work packages: 1) Identification of relevant enzymes and feed ingredients; 2) Feed production; 3) Test of feed quality in a digestion model; 4) Data analyses, reporting and preparing publications. Low-grade soybean cake, sunflower cake and rapeseed cake were chosen as alternative plant-based protein sources in three diets. The effects of three exogenous enzymes in liquid form (Ronozyme®VP (β-glucanase, pectinase), Ronozyme®WX (xylanase) and an experimental protease) on nutrient digestibility was examined. The study showed that Ronozyme®VP and the experimental protease were able to
significantly improve the nutrient digestibility primarily in the soybean cake diet at doses of 150-300 mg kg⁻¹. No clear effect of RONOZYME® WX on nutrient digestibility was observed with any of the ingredients tested. The overall conclusion of the project was that Ronozyme® VP and the experimental protease have potential to increase the nutritional and energetic value of proteinaceous plant-based feed ingredients in fish feed.

The project was coordinated by DTU Aqua.

National Institute of Aquatic Resources
Section for Aquaculture
BioMar A/S
Novozymes A/S
DSM Nutritional Products

Period: 01/01/2008 → 31/12/2010
Number of participants: 6
Research area: Aquaculture
Project participant:
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