GHENT UNIVERSITY

Course Specifications

Valid in the academic year 2025-2026

Recirculating Aquaculture Systems RAS (I002859)

Course size *(nominal values; actual values may depend on programme)*

Credits 7.5 **Study time 200 h**

Course offerings in academic year 2025-2026

A (semester 2) English Gent

Lecturers in academic year 2025-2026

Navada, Sharada	TRONDH01	lecturer-in-charge
Bakke, Ingrid	TRONDH01	co-lecturer

Offered in the following programmes in 2025-2026	crdts	offering
International Master of Science in Health Management in Aquaculture	7.5	A

Teaching languages

English

Keywords

Freshwater and seawater RAS, RAS ecosystem, microbial community, technology and biology, species and stages of fish, waste management, risk assessment

Position of the course

Recirculation aquaculture systems (RAS) significantly reduces water demand, increases water quality control, allows for rapid growth at year-round stable temperatures, facilitates utilization of waste, facilitates a good bacterial environment, and provides a basis for more controlled and predictable production both in freshwater and seawater. The course will provide a broad introduction to RAS and how water treatment can help to create a stable and optimal water environment in the system. Design, dimensioning, start-up, operation, waste management, resource utilization, risk assessment and action plans will be addressed. The subject will hold an interdisciplinary profile, where the technological function and the importance of biological, chemical and physical factors are seen in connection to each other. The course will cover both RAS in freshwater and seawater, for the production of smolt, postmolt, marine fry and marine ongrowing, as well as other relevant species for production in RAS in Norway. The course will also provide insight into how the needs of selected technology and treatment methods change according to the species and life stage.

Contents

Microorganisms in aquaculture systems are omnipresent and function as friends and foes. Traditionally the focus has been on pathogenic organisms, but e.g. the development of recirculating aquaculture systems (RAS) clearly illustrates that bacteria can be used to secure a good chemical water quality. Recently it is well documented that the establishment of mutualistic interactions between host and microbes are essential for viability and welfare of the host. The course will have focus on how microorganisms can be used to secure high chemical and microbial water quality and how biosecurity and mutualistic host-microbe interactions can be promoted. For detoxification and treatment of waste, both traditional and new methods will be covered. An overarching focus of the course is sustainable waste handling and fish welfare. In the mandatory group assignment, the students will get an in-depth knowledge to one aspect of microbial management and to communicate this to fellow students.

Initial competences

Basic knowledge of aquatic biology, aquaculture and water treatment technology is

an advantage. Limited admission to classes.

Final competences

Have good knowledge about the beneficial and problematic compounds produced by microorganisms that are relevant for aquaculture. Understand the microbial processes that are most relevant for aquaculture. Have good knowledge about the different types of microbes that are most relevant for aquaculture (e.g. bacteria, archaea, fungi, algae, and viruses) and their most relevant effects on water quality and fish health. Have good knowledge in the various possibilities for how nitrogen can be detoxified and removed through microbial and physiochemical processes. Have good knowledge in different technologies and operation strategies for using microbes for water treatment (e.g. nitrification and denitrification bioreactors). Have good knowledge in how phosphorus and organic matter/sludge can be removed and handled. Understand how microorganisms affect the health of the reared organism, and how microbial management can be used to increase the probability of mutualistic host-microbe interactions. Have knowledge about methods for biosecurity and disinfection, and how they affect the microorganisms and the cultivated organisms. Understand mechanisms for microbial problems other than pathogens (e.g. H2S and off-flavour) and how they can be prevented and treated.
Get practical experience in reviewing the scientific literature on a defined topic, and to be able to communicate the outcome from this review in written form and orally.

Conditions for credit contract

This course unit cannot be taken via a credit contract

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Group work, Seminar, Excursion, Lecture, Independent work

Extra information on the teaching methods

The course consists of lectures (40 hours), project assignment (40 hours), exercises (10 hours), excursion (10 hours), and self-study (100 hours). Total workload is estimated to 200 hours.
Compulsory assignments: Term paper and oral presentation

Study material

None

References

"Recycling of water in hatchery production - Background Booklet for courses in recycling technology for hatchery production" 2nd edition 2017 by Fjellheim, A.J., Hess-Erga, O.-K., Attramadal, K.J.K., Vadstein, O., NIVA, NTNU, SINTEF, Marine Harvest and Scottish Sea Farms, 28 pp. ISBN: 978-82-577-6842-3.
A selection of scientific publications will be provided at the start of the course.

Course content-related study coaching

PhD students acts as course advisers in practical phase, support from 2-3 permanently employed, guiding upon request, student advice on agreement.

Assessment moments

continuous assessment

Examination methods in case of periodic assessment during the first examination period

Examination methods in case of periodic assessment during the second examination period

Examination methods in case of permanent assessment

Oral assessment, Presentation, Written assessment, Assignment

Possibilities of retake in case of permanent assessment

not applicable

Extra information on the examination methods

Term paper and oral presentation
In case of postponed exam (continuation exam) written exam may be changed to

oral exam. The project assignment is apporved by each group presenting their assignment and discussing it with fellow students and the teacher.

Calculation of the examination mark