Deliverable 17.1
Analysis of access provided by NTNU Sealab: types and users

Version 3

WP 17
Deliverable 17.1
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Executive Summary

NTNU SeaLab is a research facility for marine and freshwater biology, biotechnology and aquaculture science, established in 2006. The facility has participated in the TNA programme of AQUAEXCEL 3.0 by offering access to its research facilities. In total NTNU expected to host three projects over the duration of AE3.0. As of May 2025, two projects have applied for and been granted access to SeaLab in the framework of AE3.0. Both projects were carried out successfully between January and July 2024. Both projects were supported by NTNU SeaLab staff, who provided guidance on experimental protocols and training. The support ensured that the experiments were carried out successfully. Hosting the TNA visitors was also a benefit for NTNU SeaLab, as they served to strengthen collaboration between the host and visiting researchers.

The people involved in providing TNA are as follows:

Technical support and training:
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2. Overview of TNA users projects realized in TNA NTNU

2.1.1. Installations

NTNU SeaLab provides a multidisciplinary platform for aquaculture and marine science research and education. It offers services in the field of aquaculture biology and technology, fisheries, processing of marine resources, marine engineering, coastal community development and marine ecotoxicology. NTNUs special aquaculture competence is related to several biological aspects of fish, zooplankton, and micro-/macro-algae, open ocean cage systems, environmental impacts of aquaculture, land-based recycling systems (RAS), and hatchery technology and logistics. NTNU SeaLab offers nine flexible climate-controlled wet labs, as well as two larger climate-controlled wet labs for experiments with fish, all with access to freshwater and seawater, and a suite of analytical labs.
Facilities include:

- CODTECH larviculture laboratory: An automated system consisting of 16 rearing tanks (100/200L) with optional self-cleaning. It is especially designed for controlled experiments with marine fish larvae and planktonic organisms, with associated infrastructure for production of live feed organisms (Rotifers, Artemia and copepods) and microalgae.
- Laboratory for trophic interactions: NTNU Sealab can offer access to facilities for performing experiments with model species of copepods (Calanus finmarchicus and Acartia tonsa) under controlled environmental conditions for observing the effects of temperature, carbon dioxide and chemical stressors - either individually or in combination.
- Experimental Recirculation System (RAS): The Mini-RAS system consists of six independent recirculation systems each holding three tanks, for research and development of RAS systems and biofilters using fresh, brackish or seawater.
- Analytical laboratories (biochemistry and histology).

Figure 1: Two scientists from Sparos maintaining the tank environment for juvenile cod in the frame of the project CodL5EXCEL carried out at NTNU SeaLab.

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1.1.1. User projects

Min. quantity of access units to be provided according ther DoA: 9
Total number of access units (sum of access units in the table): 6

Installation number	Installation code	Project title	Project acronym	Description about the experiment	Coordinator	Affiliation of user	Date of access	Already used installation (Yes/No)	Nature of the access unit*	Number of used access units during the project	(Potential) paper	How many people was trained by this procedure ?
1	NTNU - SeaLab	Isolation and characterization of antibacterial compounds in microalgae cultures	ALGABAC	Cultivating two microalgae species to isolate and characterize their Antibacterial compounds. Testing against four fish pathogenic bacteria.	Pavlos Makridis	University of Patras, Greece	22.01.2024 – 22.04.2024	No	access.month	3	Not yet published	1
1	NTNU - SeaLab	Optimal dietary phosphorus and Calcium levels for cod larvae	CodL5EXCEL	hatching and start feeding cod larvae with experimental feed containing different concentrations of phosphorous and ratios of phosphorous to calcium	Francisco Marta	Sparos, Portugal	20.05.2024 – 20.07.2024	No	access.month	3	Not yet published	2

* *Access units describe how accesses are calculated, typically 1 day x 1 pot, 1 season x 1 microplot, etc …*

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2. TNA projects

2.1.1. TNA projects description

NTNU has hosted two TNA projects in AE3.0. The first, Isolation and characterization of antibacterial compounds in microalgae cultures (ALGABAC), was carried out by a PhD candidate from the University of Patras in January to April 2024. In this study, antibacterial compounds produced by two halotolerant microalgae species, Tetraselmis red var. pappas, and Asteromonas gracilis, were isolated and characterized. The microalgae species were cultivated on a large scale up to several hundred litres to obtain enough harvested biomass for microbiological analysis against four fish pathogenic bacteria: Aeromonas veronii, Vibrio anguillarum, Vibrio alginolyticus, and Vibrio harveyi.
Antibacterial response was shown for both algal species. To identify the bioactive compounds responsible for these antibacterial reactions, the chemical identification of the antibacterial compounds present in the microalgae cultures will be performed using mass spectrometry and NMR platforms.
SeaLab staff provided training on cultivation of microalgae to one person, the PhD candidate responsible for the project. In addition, support was provided by staff at NTNU's Department of Chemistry.
The results of this project will be published as part of the candidate's PhD thesis and will be shared with the AE3.0 community as soon as possible.

The second project, Optimal dietary phosphorus and Calcium levels for cod larvae (CodL5EXCEL), was carried out by staff at the company Sparos from May to July 2024. The objective of the project was to study the effect of different dietary levels of phosphorus (P) and Calcium (Ca): Phosphorus ratio (Ca:P) on cod larvae performance and skeletal development. Fish were initially fed with enriched rotifers and using green-water technique. At day 15 unenriched Artemia was introduced, and co-feeding of Artemia and microdiets occurred from 15-29 days after hatching.
Fish were fed the experimental diets over 35 days, according to a predefined feeding plan. Feeding levels were assessed daily based on visual inspection of all tanks and feeders and adjusted for the following day whenever necessary. The total ration and leftovers were recorded at the tank level on a daily basis.
There were two staff from Sparos involved in the experiment, who were supported by NTNU staff. They were provided with training by a professor, PhD candidate and a MSc student who had recently carried out a cod feeding trial. They were also provided with the support of a laboratory assistant who was hired on a short-term contract to support the experiment.
The results of the study are being prepared for publication and will be shared with the AE3.0 community as soon as they are published.

A third project has applied for TNA to NTNU SeaLab, but due to delay in the scientific review it was not possible to carry out the project.

2.1.2. Selection of One exemplary project

The project Optimal dietary phosphorus and Calcium levels for cod larvae (CodL5EXCEL), mentioned above, was a success story for the project owner Sparos and NTNU SeaLab as host facility. The trial was carried out according to plan with no technical problems.
The trial included five different treatments, including a control, each with three replicates (15 tanks in total in the trial). Each 200L tank was stocked with 30ml eggs /tank (approximately 15680 larvae/tank). Fish in al tanks were initially fed enriched rotifers and using green water.

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At day 15 post-hatch Artemia were introduced to the diet, and co-feeding of Artemia and microdiets occurred from day 15-29. The experimental diets were fed for 35 days.
Fish were sampled at 3, 15, 30, 40 and 50 days after hatching. The following zootechnical parameters were measured:

- Wet weight
- Relative growth rate
- Length
- Survival
- Feed intake
- Feed conversion ratio
- Skeletal deformities

Early indications from the analysis suggests some differences in the weight and length of fish in response to different microdiets, but no difference in survival. There was no statistically significant difference between the diets when it came to incidence of skeletal deformities, but one of treatments did result in a higher number of deformities in each individual fish.

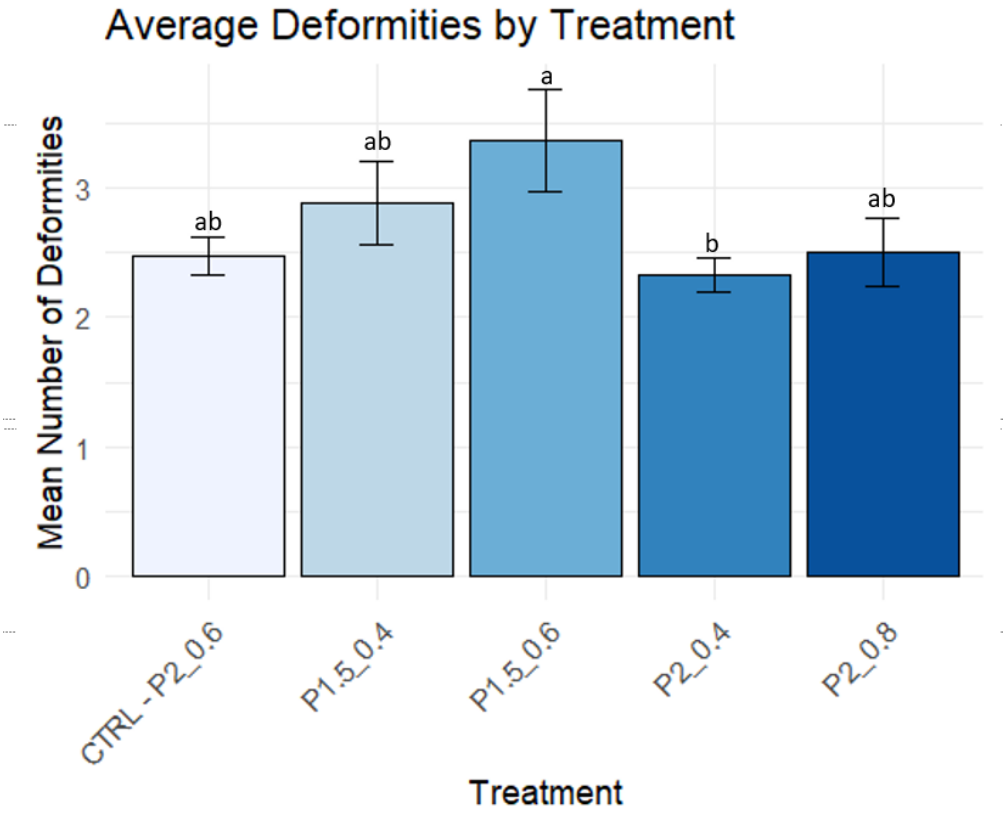

Figure 2: Average number of deformities per fish in Atlantic cod reared until 50DAH

3. Reflection on results of the TNA programme

Participation in the TNA programme has been a positive experience for staff at NTNU SeaLab. The projects we have hosted to date have been scientifically interesting and were both carried out successfully. We and the project members are expecting publications from the experiments to yield significant contributions to the respective fields. Unfortunately, neither of the projects

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have published their findings yet, but the publications will be shared with the AE3.0 community and beyond when they are available.
Planning is an essential part of hosting these kinds of projects. While several attempts were made to determine what the project members needed SeaLab staff to prepare in advance of the visits, one crucial consumable for one of the projects was forgotten about, which resulted in a last-minute scramble to sort out. While this shows that SeaLab staff are flexible and willing to go the extra mile to support research, it should not have been necessary, and even more care must be taken in the planning phase in future.
The administrative procedure after an application is submitted has been rather frustrating. Scientific review has taken too long, resulting in uncertainty and delays. There is a limit to how much time and effort can be put in to preparing for an experiment if we do not know if it will be funded. This is something that should be improved in future programmes.
Overall the AE3.0 TNA programme is still well organised and provides added value both to the hosting institution and visitors. NTNU SeaLab is keen to participate in such schemes in the future.

4. References

Androutsopoulou, C (2024) Summary of TNA project. AQUAEXCEL 3.0 internal newsletter. Available on: https://sites.inra.fr/site/AQUAEXCEL3.0/Communication%20tools/Forms/AllItems.aspx?RootFolder=%2Fsite%2FAQUAEXCEL3%2E0%2FCommunication%20tools%2FNewsletter

Makridis, P (2023) PID: 26822 – Isolation and characterization of antibacterial compounds in microalgae cultures. Available on Aria: https://apply.aquaexcel.eu/adm/proposal/view/26822

Marta, F (2024) PID: 29747 – Optimal dietary phosphorus and Calcium levels for cod larvae. Available on Aria: https://apply.aquaexcel.eu/adm/proposal/view/29747

Marta, F (2024) Impact of Phosphorus and Calcium dietary levels, and Calcium: Phosphorus ratio, on cod larvae performance and skeletal development. Trial report, not yet published.

Description of NTNU SeaLab is modified from the AQUASERV TA handbook. Available on: https://www.aquaserv-ri.eu/ta-handbook

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