# Deliverable D9.1
# Analysis of access provided by IMR Matre

*Verion 1*

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| WP 9 |
| Deliverable 9.1 |
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# Executive Summary

**Objectives** of the IMR Matre facility is mainly to perform studies to support the authorities with scientific supported advice and where possible to help interested scientific and industrial partners with experimental studies. IMR Matre CELL has tanks with automatic feeding, photoperiod, salinity (0-35 ppt), temperature (1-20°C all year round), $O_2$ and $CO_2$ control and is used in studies on fish welfare, nutrition, growth and reproduction, genomic studies, CRISPR knockouts, studies with isogenic lines and several studies involving salmon lice infections.

**Main Results:** As planned the facility have hosted two accesses. The first 'ASTAOIL' is a traditional feeding study, but the second 'SPARR' required a considerable rebuilding of the facility with a preference system taking advantage of the highly flexible research infrastructure in terms of manipulated water supply. This preference system is now in store and has made a great addition to the research facility.

**Authors/Teams involved:** The 'ASTAOIL' project was led by Monica Betancor from Stirling and 'SPARR' was led by María Alborja Valado together with reserarchers from University of Stirling and University of Vigo.

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## Contents



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# 1. Overview of TNA users projects realized in IMR Matre

### 1.1.1. Installations

Description of the infrastructure IMR Matre CELL has tanks with automatic feeding, photoperiod, salinity (0-35 ppt), temperature (1-20°C all year round), $O_2$ and $CO_2$ control. It is excellent for studies on fish welfare, growth, reproduction, and flesh quality, involving experimental parameters like diet, ration and photoperiod, in salinities ranging from full freshwater to full salinity seawater and fish sizes from first feeding fry up to 2 kg. The tanks have waste feed collectors, can be equipped with video cameras and can be followed and controlled over the web. The facility comprises 80 tanks with 100 cm diameter. The experimental parameters can be regulated to follow daily or seasonal cycles. IMR Matre CELL has access to several fish species, but the most important is cultured, wild and isogenic populations of Atlantic salmon, developed in AQUAEXCEL and AQUAEXCEL$^{2020}$. The facility is also equipped for infection studies with salmon lice. The facilities have been used for several salmonids, cod, herring, sea bream, sea urchins, and several crustaceans.

### 1.1.2. User projects

**Min. quantity of access units to be provided according the DoA:284**
**Total number of access units (sum of access units in the table): 212**

| Installation number | Installation code | Project title | Project acronym | Description about the experiment | Coordinator | 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 | IMR-CELL | The effect of circadian rhythms of temperature preference on the behaviour of parr Atlantic salmon (Salmon salar). Implications in fish welfare and the monoaminergic systems. | SPARR | Investigate the daily circadian rhythms of thermal preferences of salmon during the juvenile pre-smolt stages, how they affect the monoaminergic systems and what is the general impact on the welfare of fish. This project will also provide information that can be used for fish genetic selection regarding tolerance to higher. For this purpose, the fish will be given | María Alborja Valado | Yes | tank.week | 148 | Yes | 0 |

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| | | | | the opportunity to select from a wide range of water temperatures typically found in their natural environments (8, 10.5, 13, 15.5 and 18 °C) over a 24-hour cycle. | | | | | | |
| 1 | IMR-CELL | Boosting trout fillet quality | ASTAOIL | The aim of this study was to assess a novel oil, derived from a genetically modified *Camelina sativa*, containing both n-3 LC-PUFA and astaxanthin, as a new raw ingredient for feeds given to juvenile rainbow trout over a period of 10 weeks. The deposition and dynamics of both astaxanthin and n-3 LC-PUFA were assessed in the flesh of rainbow trout. Additionally, athleticism and stress tolerance were tested in a swim tunnel experiment in response to the dietary treatment. Markers of the antioxidant metabolism were measured to identify possible interactions between the exhaustive exercise stress and the dietary treatment. | Monica Betancor | Yes | tank.week | 64 | Wischhusen P, Madaro A, Hvas M, Broughton R, Han L, Quiroz KF, Chaiyasut K, Gupta A, Olsen RE, Fontagné-Dicharry S, Napier JA, Betancor M. 2025. Growth performance, swimming capacity, and fillet quality in rainbow trout fed a transgene-derived omega-3 and carotenoid-enriched oil. Aquaculture 604, 742453. | |
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AQUA EXCEL 3.0
AQUAculture infrastructures for EXCELlence in European fish research 3.0

** 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

As planned the facility have hosted two accesses. The first 'ASTAOIL' is a traditional feeding study where a new oil from transgenic *Camelina sativa* was evaluated for its potential to serve as a primary source for eicosapentaenoic acid (EPA), docosahexaenoic acid (DHA) and astaxanthin in feed for rainbow trout (*Oncorhynchus mykiss*). The transgene-derived oil supported normal growth and increased fillet EPA and DHA levels above standard. A comparable swimming capacity and stress response suggests that the inclusion of the transgenic camelina oil did not impair fish welfare. Several partners interacted in this study which is published in Aquaculture. https://doi.org/10.1016/j.aquaculture.2025.742453

The second study 'SPARR' required a considerable rebuilding of the facility with a preference system taking advantage of the highly flexible research infrastructure in terms of manipulated water supply. The study is described in more detail in 2.1.2. and has already been used to study preferences of several species. This preference system is now in store and has made a great addition to the research facility.

### 2.1.2. Selection of One exemplary project

In the 'SPARR' project we investigated the circadian rhythms of temperature preference in juvenile Atlantic salmon using a novel preference chamber system. Additionally, genetic markers of clock genes were analysed. The preference system was designed and installed at the Matre Research Station, Norway, taking advantage of the great research infrastructure in terms of manipulated water supply. Researchers from University of Stirling and University of Vigo visited for two months to perform experiments along with local personal in the autumn of 2024. We are presently in the process of analysing data and are confident that we will write and publish a scientific article based on this experiment within the next year. Additionally, the new preference chamber system this project allowed us to make have subsequently been using in several other behavioural studies on various salmonid species of different life-stages, thus adding new valuable methodology to the Matre Research station.
Although the existence of thermal preferences in Atlantic salmon (*Salmo salar*) and their physiological implications is well-known, the thermoregulatory behaviour of this species during daily cycles, specifically, how these preferences are influenced by circadian rhythms, remains unexplored. Therefore, the primary objective of this project is to assess the daily circadian rhythms of thermal preference, both centrally and peripherally, and study the physiological mechanisms underlying this thermal preference in juvenile salmon. For this purpose, the fish will be given the opportunity to select from a wide range of water temperatures typically found in their natural environments (8-18 ºC) over a 24-hour cycle. The aim of this study is to gain insights into how the temperature preferences of Atlantic salmon change throughout the day, enhancing our understanding of the species' thermal biology. This knowledge will enable us to optimize their natural habitats for conservation purposes, as well as to improve the welfare of the species in captivity by enhancing their rearing conditions.
We expect to find a circadian rhythm of temperature preference for Atlantic salmon. Therefore, we expect to be able to characterize the rhythmic profile of clock genes. We also expect to detect an impact of the increased complex environment (thermal gradient) on parameters related to behaviour and cognition. In addition, the knowledge generated in this work will be potentially useful to establish lines of research related to the impact of temperature on salmonids and will allow the selection of Atlantic salmon lines resilient to the effects of climate change, improving productivity and animal welfare concurrently.

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## 3. Reflection on results of the TNA programme

## 4. References

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## Document Information

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