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AQUAEXCEL3.0 builds on the previous AQUAEXCEL (FP7) and AQUAEXCEL2020 (H2020) projects and aims to further ensure research is aligned with industry needs, to boost the EU aquaculture sector by expanding the Transnational Access programme, and to develop new tools to keep pace with rapid scientific development, adding value to existing tools and resources to benefit all users.

Welcome from the Coordinator

We have now completed the third year of the project. The **TNA programme** has more and more success and remains a unique opportunity to access for free our world-class aquaculture facilities. It may sound too good to be true, but yes, it is open to any research, from academia to industry, under the same conditions! Do not think it will be here forever, if you have a project, **apply now** to be able to complete it in 2024 or 2025! We have seen very nice results from TNA displayed at Aquaculture Europe 2023 in Vienna.

We are also very proud to see that our **Technician Transnational Mobility programme** has been a great success. This is reserved for AQUAEXCEL 3.0 members but highlights the importance we give to our technical staff, which are a key element in the excellence of our experimental facilities. With the TTM program, AQUAEXCEL3.0 technicians have the

outcomes.

There are also several plans underway to ensure that the AQUAEXCEL network will continue to feed EU aquaculture research. I will tell you more about this in the next newsletter. For now, I call upon all researchers with an interest in aquaculture, and invite them to come and work with us through the TNA programme. This programme gives you the unique chance to carry out aquaculture research at one of our partner facilities for free, and to do what you cannot do because you don't have the installations, knowledge, or species you would like to work with!

-Dr. Marc Vandeputte, AQUAEXCEL3.0 Coordinator, French National Institute for Agriculture, Food and Environment (INRAE)

News and highlights

AQUAEXCEL3.0 Industry Brokerage Event 2023

The AQUAEXCEL3.0 project recently hosted another successful industry brokerage event, this time in the enchanting city of Vienna. At the Innovation Forum of Aquaculture Europe 2023, on September 20th, we showcased the latest innovative outputs from our project to a diverse audience encompassing both the aquaculture industry and academia. Themed "Innovation in Nutrition," the event was a collaborative effort between EATiP and ERINN Innovation. Its primary aim was to establish a dynamic forum that fostered meaningful engagement and exchange between researchers and industry beneficiaries potentially interested in leveraging the research results generated by our project. Read the full article here

AQUAEXCEL3.0 infrastructure PhD student Ricardo Domingo Breton wins prestigious Student Award at Aquaculture Europe 2023

Huge congratulations to Ricardo Domingo Breton, PhD student from IATS-CSIC (Spain), who won the Student Spotlight Award at Aquaculture Europe 2023 for best-submitted abstract to the event! Ricardo's abstract and associated presentation were related to results obtained from a Transnational Access (TNA) project, focusing on the use of intestinal microbiota as a marker of thermal stress in gilthead sea bream (*Sparus aurata*). The findings open the door to using microbiota, specifically the Brevinema genus, as a reliable marker of thermal stress. This could prove invaluable in evaluating the efficacy of future strategies aimed at alleviating the impacts of thermal stress in gilthead sea bream —an especially pertinent consideration in the broader context of a climate crisis. For more info on his study, check the **link**

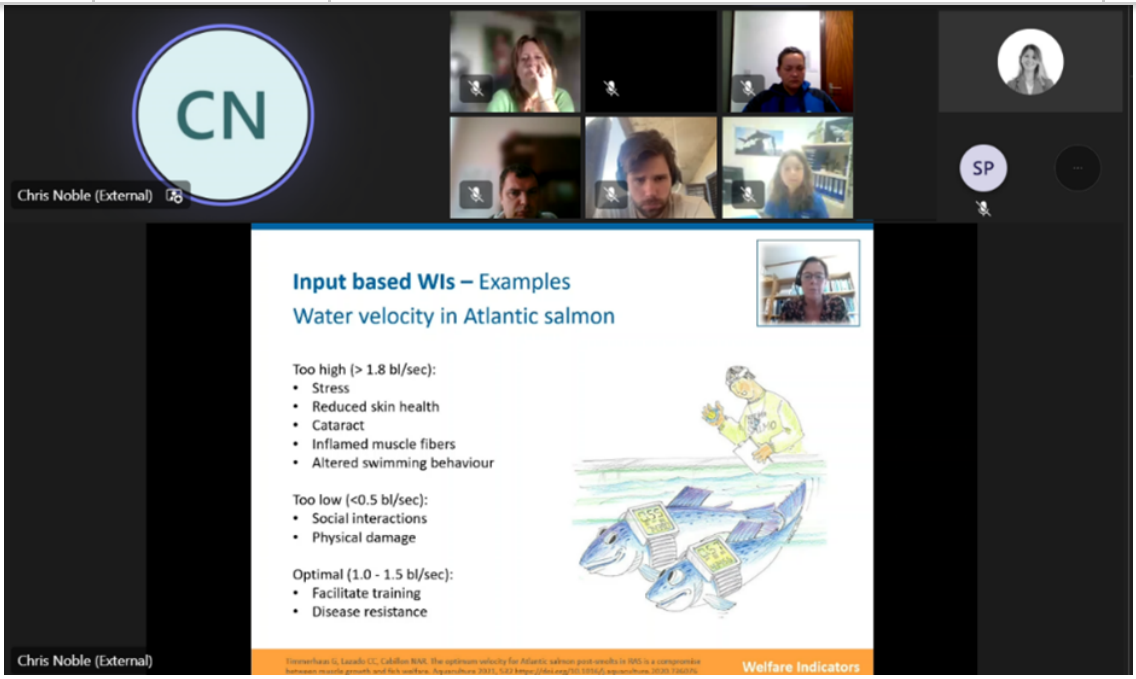
AQUAEXCEL3.0 at Aquaculture Europe 2023 in Vienna

The yearly Aquaculture Europe events are great opportunities to showcase all that AQUAEXCEL3.0 has to offer. The events aim to cover the full scope and diversity of European aquaculture, feature an international trade exhibition, industry forum, student sessions and activities, satellite workshops and updates on EU research and are attended by a wide and diverse range of audiences. Apart from the

represented at the latest Aquaculture Europe Event, taking place in Vienna in September 2023. Partners ERINN and EATiP showcased the project and the opportunities it offers to the aquaculture sector at their booths in the tradeshow part of the event. Pamela Prentice showcased WP6-related results on the **effects of structural enrichment on behavior and welfare in juvenile Atlantic salmon**, through the addition of artificial plants to Recirculating Aquaculture System (RAS) tanks, through a poster. CSIC exhibited their research related to AQUAEXCEL3.0: **"Gilthead sea bream skin microbiota shapes proactive and reactive behaviour in fish under high stocking densities".** INRAE presented their research "**Dietary selenium and vitamin B6 in the glutathione metabolism of rainbow trout exposed to periodic hyperoxia**" and displayed an e-poster on the **successful replacement of Artemia by cryopreserved barnacle nauplii in European seabass larval rearing.** JU and UoS also showcased their work: **"Bold-shy personalities in aquaculture: the link between boldness, stress tolerance and immunity in european perch (*Perca fluvialitis*)"** and **"'Exploring European seabass (*Dicentrarchus labrax*) eicosanoids metabolism when fed diets with incrreasing inclusion of free-catches ingredients after stress response"** through e-posters.

AQUAEXCEL3.0 TNA knowledge output presented at Aqua Nor 2023

The AQUAEXCEL3.0 TransNational Access (TNA) program has had yet another success: one of its participants, Kiranpreet Kaur, Director R&D, Fish Health & Nutrition of Aker BioMarine in Norway presented her TNA research findings at one of the world's largest aquaculture industry events: Aqua Nor 2023 in Trondheim (Norway). Kiran did her research on "**The effect of krill meal inclusion on the growth of juvenile gilthead seabream**". Her results demonstrate that krill meal inclusion leads to better utilisation of nutrients in feed, and hence could significantly reduce the amount of feed needed to achieve the desired growth or biomass. For more information, click the following **link**



First live training course on Welfare Indicators was a huge success!

A record number of approximately 200 people attended the live version of the **1st AQUAEXCEL3.0 online training course: Welfare Indicators**. The training course focuses on welfare indicators for different fish species used in aquaculture research, and participants learned about the latest technologies around developing welfare indicators. The course has been developed through a collaborative effort between many different AQUAEXCEL3.0 partners, and is led by our partners at NOFIMA (Norway). The live training course has been recorded and is now available as a continuous online training course, accessible after registration through the project website.

AQUAEXCEL3.0 will organise 3 more online training courses on different topics, building upon the project's newest results and previous success. **All training courses will be provided for free, as online, distance learning courses to support long-term sustainability, and they will make use of a blend of delivery technologies, also including practical exercises.** The next training course, organised by NTNU (Norway) focuses on '**Using modelling as a tool for experimental design**', and is expected to launch in **February 2024** . For more information on the next training courses, check our website and keep an eye on our social media.

Technician Transnational Mobility program – Unique exchange program for aquaculture technicians

The **AQUAEXCEL3.0 Technician Transnational Mobility (TTM) program** is now at its midway point and has shown to be a success for the participating technicians. AQUAEXCEL3.0 considers that motivated and skillful technicians are key to successful research, and thus invests in the development of cross-cutting and specific skills through the TTM program. This program aims to promote capacity building and the sharing of innovative experiments and best practices on how to improve the provision of research services at an aquaculture research institute, achieved through a bottom-up approach. The TTM program is dedicated specifically to RI technicians, between the AQUAEXCEL3.0 partner institutes, to foster a culture of cooperation between RIs and learn best practices from each other.

Midway through the TTM, 13 visits have taken place, and participants so far have been highly enthusiastic and positive about their experiences. They generally describe the process as an enriching professional experience that has built both their personal and their institute's capacity. We believe the program has also laid the groundwork for future successful collaborations between the participating institutes.
Check out the latest TTM experiences on our website!

AQUAEXCEL3.0 research on insects presented at INSECTA 2023

Edible insects have emerged as a possible alternative to ease the issues with growing demands for food and feed in all sectors, including aquaculture. One of our TNA projects, **FEEDBSFL**, focused on studying one of the most promising insect species for these purposes, the black soldier fly (BSF) larvae. BSL are powerful converters of organic waste into a fry fertilizing substrate if the cycle is managed properly. Results have been presented at **INSECTA2023** which took place in Magdeburg, Germany on September 13-14, 2023.

Environmental enrichment's effect on behaviour and welfare of juvenile Atlantic Salmon

Part of AQUAEXCEL3.0's work is on improving fish welfare using **environmental enrichment (EE)**. EE has been demonstrated to increase cognitive stimulation in response to increased environmental complexity, promoting natural behaviours and improving positive emotional states. Recent advances, in relation to the effects of structural enrichment on behaviour and welfare in juvenile Atlantic salmon, through the addition of artificial plants to Recirculating Aquaculture System (RAS) tanks, have been presented at the latest ISAE conference that took place in Tallinn, Estonia from 1-5 August 2023.

Transnational Access (TNA) Facilities - highlighting research opportunities for shellfish and algae

Do you work in public or private Aquaculture Research (including for SMEs) and want to gain open, inclusive, streamlined and free access to the best Aquaculture Research Infrastructures in Europe?

Different from the previous AQUAEXCEL projects, AQUAEXCEL3.0 is also offering unique access to shellfish

of research in the field of aquaculture to address the key priorities of the European Research Area. A major feature of AQUAEXCEL3.0 is its TNA program, which gives external researchers the opportunity to access 40 unique research infrastructures all around Europe. The available facilities cover the entire range of production systems, environments, scales, species and fields of expertise.

- **IFREMER PMMB** (Bouin, France): offers 2,000 m2 infrastructure located on the Bourgneuf bay, providing independent units for research on shellfish, from the larval level to the adult size
- **SINTEF NSTC** (Trondheim, Norway): NSTC is a knowledge platform for technology development within industrial cultivation, harvesting, processing and application of seaweed in Norway
- **DTU Aqua** Infrastructure (Nykøbing Mors, Denmark): offers 3,800 m2 of buildings and lands, as well as off-coast long-line culture units dedicated to low trophic aquaculture including shellfish, crustacean, microalgae and macroalgae production.

For more information on all our 40 facilities and the TNA program, visit our **website**

Fish'n'co: Saccharina latissima

Algae are not just green and slimy, they can be brown and crispy, and be used to make all kinds of tasty food!

Over the last years, seaweeds are gaining popularity as a dietary source. Consumers are attracted to the intriguing flavours and new culinary experiences by incorporating seaweed into dishes. Consuming seaweed may also be seen by many consumers as an ethical option because it is well-documented that seaweed production can lower global greenhouse gas emission levels.

which is a brown algae that grows between 2m to 4m in length, and is found in intertidal pools and occasionally in shallow subtidal waters. These algae can be found in several areas around the world. In Europe, *Saccharina latissima* can be found in the northern waters of Spain, southern coasts of Norway, Iceland , and it is common on most shores of Ireland and the United Kingdom. Sugar kelp is slowly being introduced into the European food industry, and can be eaten raw, cooked, dried, or fermented. It has a sweet and mild flavour, and a crunchy texture.

Do you feel inspired? Here are some of the uses of sugar kelp:

- As a **snack**: sugar kelp can be roasted with oil and salt to make a crispy and nutritious snack
- As a **salad**: it can be cut into thin strips and mixed with other vegetables, fruits, nuts or seed to make a tasteful salad
- As **pasta**: it can be boiled and used as a substitute for noodles
- As a **wrap**: it can be used to wrap around rice, fish, meat, cheese or vegetables to make a delicious and healthy wrap
- And, you can bake **cake** from sugar kelp, see recipe in the next section!

Image: seaweed.ie

Satisfy your Tastebuds: Carrot, Nori and Sugar Kelp cake

Have you ever thought of baking a carrot cake with sugar kelp and nori algae? Here is a lovely recipe by Irish seaweed chef Prannie Rhatigan that gives an adventurous and nutritious twist to your traditional carrot cake.

Wine tip from Marc (AQUAEXCEL3.0 coordinator):

Find the full recipe here

Image Source: RTE

Publications

- Karine Pinel, Cecile Heraud, Guillaume Morin, Karine Dias, Annaelle Marce, Linda Beauclair, Stephanie Fontagne-Dicharry, Karthik Masagounder, Martina Klunemann, Ivan Seiliez and Florian Beaumatin. Are the Main Methionine Sources Equivalent? A Focus on DL-Methionine and DL-Methionine Hydroxy Analog Reveals Differences on Rainbow Trout Hepatic Cell Lines Functions. International Journal of molecular sciences, Vol 23(6), 2935.
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- Paul G. Holhorea, Fernando Naya-Catala, Alvaro Belenfuer, Josep A. Calduch-Giner, Jaume Perez-Sanchez. Understanding how high stocking densities and concurrent limited oxygen availability drive social cohesion and adaptive features in regulatory growth, antioxidant defense and lipid metabolism in farmed gilthead sea bream (Sparus aurata). Frontiers in Physiology, Vol 14, 10.3389
- Jovanka Lukić, Gergő Gyalog, Zoltán Horváth, Anita Annamária Szűcs, Tijana Ristović, Amarela Terzić-Vidojević, Zsuzsanna J. Sándor, and Uroš Ljubobratović. Evaluation of Post-Larval Diets for Indoor Weaned Largemouth Bass (Micropterus salmoides). Animals, Vol 13, 3179

  Aya Saad, Biao Su, Finn Olav Bjørnson. A Web-Based Platform for Efficient and Robust Simulation of Aquaculture Systems using Integrated Intelligent Agents. Procedia Computer Science
- Rigolin Nayak, Roman Franěk, Radek Šindelka, Martin Pšenička. Enhancement of zebrafish sperm production via a large body-sized surrogate with germ cell transplantation. Communications Biology, Vol 6, 10.1038
- Tatyana Gebauer, Radek Gebauer, Petr Cisar, Deepali Rahi Roy, Mahyar Zare, Marieke Verleih, Vlastimil Stejskal, Alexander Rebl. Are bold-shy personalities of European perch (Perca fluviatilis) linked to stress tolerance and immunity? A scope of harnessing fish behaviour in aquaculture. Fish Shellfish Immunology, 143, 109190
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- Xie, Xuan, Roman Franěk, Martin Pšenička, Fan Chen, and Vojtech Kašpar. Optimization of in Vitro Culture Conditions of Common Carp Germ Cells for Purpose of Surrogate Production. Frontiers in Veterinary, Frontiers in Veterinary Science, 9, 2022, 1036495.

For a full list of publications from the AQUAEXCEL projects click HERE.