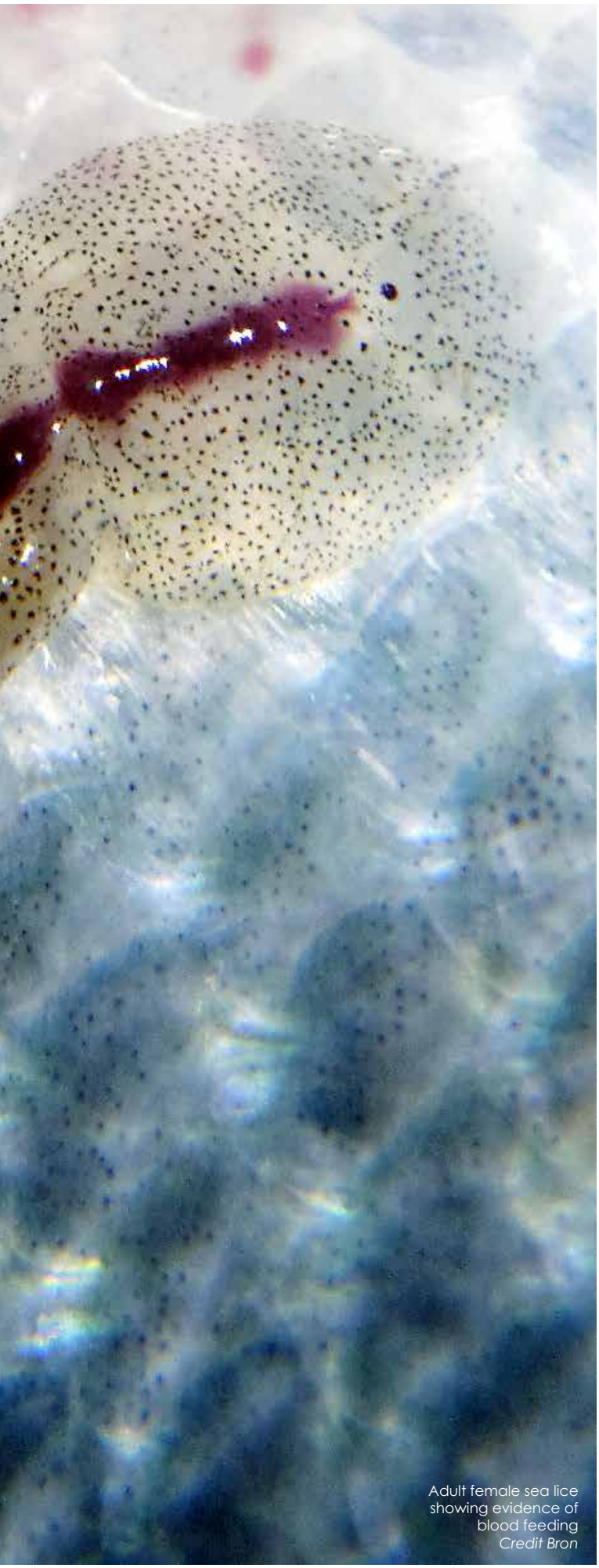
Parasite control in European farmed finfish

ParaFishControl aims to develop advanced tools and research strategies for parasite control in European farmed finfish



Adult female sea lice showing evidence of blood feeding
Credit Bron

ParaFishControl (Advanced Tools and Research Strategies for Parasite Control in European farmed fish) is a €8.1 million European Union Horizon 2020-funded research project that aims to increase the sustainability and competitiveness of the European aquaculture industry by improving our understanding of fish-parasite interactions and developing innovative solutions and tools to prevent, control and mitigate harmful parasites which affect the main finfish species farmed in Europe (Atlantic salmon, rainbow trout, common carp, turbot, European sea bass, and gilthead sea bream). ParaFishControl addresses the most harmful parasitic species affecting either one or more of these six fish hosts.

Aquaculture is the fastest growing animal food production sector worldwide, currently providing half of all aquatic animals for human consumption. If responsibly developed and practiced, aquaculture can generate lasting benefits for global food security and economic growth.

However, the aquaculture industry faces a number of challenges to its progress including the significant issue of disease outbreaks. Financial losses due to disease outbreaks are estimated at 20% of total production value, and parasites and related infections are increasingly responsible for such diseases.

Economic losses inflicted by parasites accrue from direct mortalities, morbidity, poor growth performance, low reproduction efficacy, increased susceptibility to other diseases, high cost of treatments and decreased value or marketability of fish products. Exact data on the economic impact of parasites in aquaculture is scarce but it is estimated that the highest economic cost for parasite control in European aquaculture amasses from sea lice infecting Atlantic salmon, the main farmed fish species in Europe.

European nations and associates spend €170 million annually to control sea lice, with annual global losses estimated to exceed €300 million. Parasites can also affect the end users of aquaculture products and therefore their monitoring and eradication are essential for ensuring the safety of European consumers.

While bacterial and viral diseases of cultured finfish have been extensively studied and have witnessed substantial advances in their control, parasitic diseases have received less attention so far. Currently, there are no commercial vaccines for fish parasites and the available diagnostic tools do not cover the main parasitic diseases or are not harmonised.

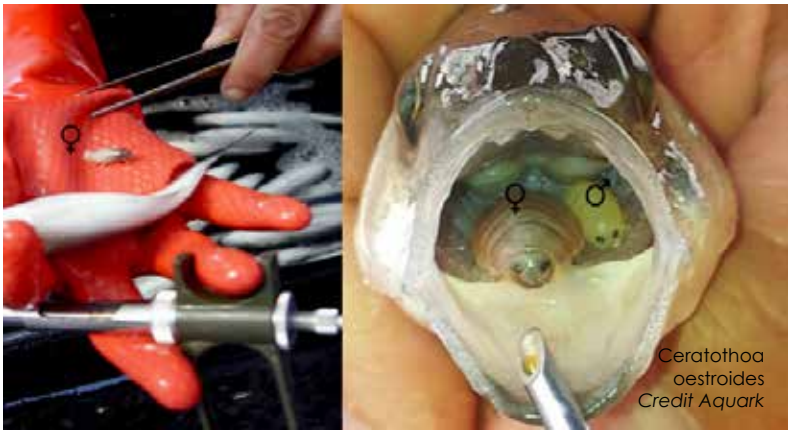
In addition, the number of licensed veterinary medicines targeting parasites remains low and many of those employed can have major environmental impacts and show reduced efficacy due to parasite drug resistance. Furthermore, some aquaculture parasites have attracted public attention due to the transfer of parasites between farmed and wild fish populations or because of the environmental impact of treatments used. Such issues negatively affect the public image and performance of European finfish aquaculture.

These challenges are currently being tackled by the ParaFishControl partnership, integrating world-leading, complementary, cross-cutting expertise drawn from academia and industry across Europe.

ParaFishControl seeks to advance the field by contributing to both fundamental scientific knowledge in relation to key fish parasites, and also developing applied technological

Adult female sea lice feeding on Atlantic salmon. *Credit Conway & Bron*

Adult female sea louse with salmon blood in gut. *Credit Bron*



Ceratothoa oestroides *Credit Aquark*

and industrial solutions to increase the sustainability and competitiveness of the European aquaculture industry. In addition, at the consumer and societal level, the partnership will work towards reinforcing the confidence of fish processors, traders and consumers in farmed fish products.

ParaFishControl is a ground-breaking project aiming to deliver innovative solutions at all levels. Responding to the identified significant need for the availability of effective, rapid, quantitative and validated tests for endemic and emerging parasitic infections of fish, the partnership is currently working on developing reliable, cost-efficient detection and diagnostic tools.

The commercial offer of fish parasitology services from animal diagnostics professionals is quite limited and this role is currently filled by academic laboratories, more focused on particular diseases, and whose level of proficiency and use of diagnostic tools is variable. Several parasites lack methods beyond microscopic and histological observation, leaving substantial room for innovation.

Based on current and newly developed knowledge and tools the project will generate improved and novel sensitive, reliable and cost-effective point-of-care diagnostic tests for parasitic infections.

The project will also focus on the harmonisation and validation of current procedures for the confirmatory diagnosis of parasitic infections at the laboratory level. The partnership expects that availability of diagnostic tests for parasitic diseases harmonised across the European Union and globally will facilitate the growth of national industries and international trade.

The adoption of these procedures will allow a more proficient, accurate and homogeneous diagnosis of parasites at laboratory level, reducing the uncertainty and facilitating accurate monitoring of parasites in fish production, fish trade, and

epidemiological or environmental studies. The existence of reference methods will facilitate their adoption by veterinary health laboratories and providers, who currently cannot provide these services due to deficient know-how and absence of validated methods and reagents.

In addition, simple to use point-of-care diagnostic tests for some diseases generated in the project can be marketed for quick parasite assessment, taking diagnosis out of centralised laboratories and allowing very rapid on site management decisions and appropriate actions to be made.

Concerning preventative practices, a major issue is that currently there is no commercial vaccine for any fish parasite. ParaFishControl tackles this challenge by aiming to develop several different candidate vaccines focusing on those parasite infections for which natural immunity seems to prevent re-infection.

The research behind this is very innovative and only affordable with the collaboration and concerted action of all partners in a big collaborative research project such as this, where research and industry are working directly together. Measures that will be developed are vaccination and improvement of fish immune status through use of in-feed immune-stimulants and other additives that will target host immunity.

Other measures, such as innovative water treatments and use of biological controls will target parasites prior to infection. Coupled with a range of management tools, these measures will be incorporated into effective new integrated pest management strategies (IPMS) for European aquaculture.

In relation to curative practices, the use of available anti-parasitic drugs in aquaculture is currently limited by issues such as drug availability, developed parasite resistance, toxicity of chemicals and persistence of chemical residues.

Moreover, many drugs previously widely used in fish farming are now prohibited as environmentally undesirable. There are no licensed anti-parasitic compounds for Mediterranean fish species and common carp and official Minimum Residue Levels currently available are extrapolated mainly from salmonids. Thus, there is a strong need for development of new effective drugs for parasite treatments.

ParaFishControl is working on improving existing treatments and developing novel treatments for both ecto- and endo-parasites. The partnership's approach includes extensive screening of antiparasitic products already available in the pharmaceutical industry for other veterinarian and human uses, as well as searching for prebiotics, probiotics and bioactive compounds from bacteria, plants and other natural sources.

ParaFishControl is also expected to generate new feed formulations against parasitic diseases and will increase the knowledge on the basis for fish immunity improvement that could be used for other future formulations.

Since most of the pathogens causing diseases in fish farms are also found in wild fish, reciprocal movements of pathogens between aquaculture populations and wild fish represent a two-sided risk. Farmed fish may pick up infections from wild fish, but can also act as pathogen-amplifiers that disseminate pathogens into the wild. ParaFishControl will implement sensitive and strain-specific diagnostic assays to determine to what extent such transfers of fish parasites take place.

This will enable the development of European policies protecting the health of wild aquatic animal populations, while allowing responsible use of the aquatic environment for aquaculture purposes.

Although it is generally assumed that farmed fish products have a very low or zero prevalence of zoonotic helminths, which are parasitic worms that have the potential to transfer to humans, this assumption has not been demonstrated scientifically for the majority of European fish farmed species.

As recommended by the European Food Safety Authority (EFSA), ParaFishControl will monitor marine and freshwater fish farms to provide data on presence or absence of zoonotic helminths and effects of different farming practices on their diffusion. An innovative Food Safety Programme with protocols and good practice guidelines will be established to avoid and decrease even more zoonotic risks in farmed fish.

ParaFishControl will directly address the needs of fish producers, veterinary practitioners and other aquaculture professionals by producing booklets and guidelines and organising international training courses on the IPMS on farms. A ParaFishControl Industry Forum (IF) will be set up in spring 2016 to facilitate engagement between the consortium and industrial companies and fish farmer associations to ensure essential Knowledge Exchange.

ParaFishControl will improve control of the major parasites of European aquaculture by assisting fish farmers to improve survival, decrease feed conversion ratios, reduce economic impact of the diseases and increase the industry's long term sustainability.

The focus will be on development of effective practical industry solutions that improve fish health and welfare, reduce environmental impact and ensure a safe final product for the consumer.

Some of the parasitic species that are studied in this project have impacts beyond the European borders, not only because their respective hosts are also farmed worldwide, such as Atlantic salmon, rainbow trout or common carp, but also because they have low host specificity and can infect several fish species, including major game fish in international waters. The results from ParaFishControl will therefore have a major positive impact on the global aquaculture industry.

www.parafishcontrol.eu

ParaFishControl consortium

The ParaFishControl consortium comprises 29 partners from academic, research and industry, based in 13 European countries, who are considered leaders in their respective domains of expertise.

The ParaFishControl project will run from 2015 to 2020, with a total budget of €8.1 million, of which €7.8 million is funded by the European Union. The project is coordinated by the Agencia Estatal Consejo Superior de Investigaciones Cientificas (CSIC), Spain.

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CSIC is the largest public research institution in Spain and the third largest in Europe. Its main objective is to develop and promote research that will help bring about scientific and technological progress. CSIC covers all fields of knowledge from basic to applied research.

AquaTT (Ireland) is the project dissemination partner.