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IFREMER EXPERIMENTAL PALAVAS PLATFORM

the largest French infrastructure dedicated to marine fish and micro-algae.

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Among the many assets that France possesses in the area of marine fish-farming are the major scientific skills and infrastructure which enable to stand at the forefront of innovation in Europe. Here we take a close look at the Palavas-les-Flots experimental platform, the largest infrastructure dedicated to research in this field in France, and the 3rd largest in Europe. A total of 6000 m² of experimental infrastructures are used by researchers from a host of institutes, working together on research projects dedicated to fresh water and marine fish, the development of the aquaculture sector and, more generally, marine biodiversity and its uses.

RESEARCH THE LEVER FOR FISH-FARMING DEVELOPMENT

Fish-farming, and aquaculture in general, is an economic activity with strong development potential and which is supported by complex research, both in terms of farming techniques and its ecosystem and socio-economic dimensions. Areas with major scientific potential have emerged one by one, combining the improvement in farming systems and farmed animals while ensuring consumer safety, animal well-being and environmental protection. All of these issues are common to all types of fish-farming, whether in sea or fresh water, temperate or tropical.

INNOVATION VIA MULTI-INSTITUTION AND MULTI-DISCIPLINARY COOPERATION

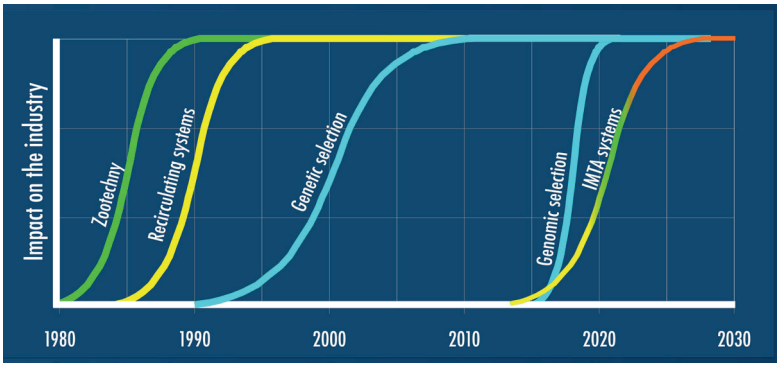
Nearly 20 years ago, national and European research institutes adopted the strategy of working together to provide overall responses to these issues more quickly. For the 4 major institutions involved in French fish-farming research and which are based in the Occitanie region of southern France, INRA, IRD, CIRAD and IFREMER, this strategy is based on two major principles:

☑ The sharing of material and human resources at the Palavas platform

☑ And a multi-disciplinary approach which combines genetics, genomics, physiology, behavioural science, ecology, animal science, systems engineering and development science:

- IFREMER-INRA partnership since 2004 for scientific questions relative to sea water and temperate fresh water farming,
- IFREMER-CIRAD partnership since 2010 for fresh water and tropical sea water farming,
- IRD-CIRAD partnership since 2015 for tropical fresh water farming.

These cooperation projects have enabled innovations to be brought to the market to improve yields and reduce the environmental impact of production units. These skills have been recognised beyond our borders and have been adopted by other European countries with highly developed fish-farming activities, such as Greece or Turkey in the marine fish-farming sector.



The areas of innovation supported by research at the Ifremer Palavas platform

THE EXPERIMENTAL STATION, A HIGH-TECH TOOL FOR SCIENTISTS

Between the sea and a lagoon, 6 000 m² are dedicated mainly to research into marine and tropical fresh water fish and micro-algae. This platform was upgraded by the Ifremer in 2015 with the support of the region, Europe and the CIRAD in the context of the CPER(1) «MeDITERA» project.

☑ **4 000 m² of covered infrastructure** divided into 5 halls hosting nearly 200 tanks (0.5 – 11 m³), 300 aquariums (8 – 200 L) and a stock of bass broodfish composed of different experimental lines (600 live fish and 30 000 frozen sperm samples), enabling research into all fish development stages (larvae, juveniles, adults).

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(1) Contrat de Plan Etat-Région

☑ **2 000 m² outdoor platform** enabling experimentation on open environment micro-algae culture for the bio-remediation of farming effluent or CO2 storage and the feeding of fish in 90 20 m² pools and 2 160 m² pilot pools, all with specific columns for circulation, CO2 dissolving, closed loop O2 degassing and micro-algae harvesting.

© Ifremer

☑ **A room dedicated to tilapias** and other species of interest for continental fish-farming in developing countries.

© Ifremer

The second most-produced fish species group after carp,
tilapias are forecast to climb onto the top step of the podium in the years to come.
Their production is due to double by 2030.

As male tilapias grow faster than females, farmers favour breeding them more. But the hormone treatments used to obtain male single-sex populations are not very sustainable. The Cirad is working on alternatives such as environmental factors.
The new 100 m² room is adapted to the specific requirements of tilapia farming and is equipped with thermo-regulated and recirculated circuit aquariums and containers. It enables research to be carried out in advance of the R&D work carried out in the field in developing countries, helps train partners and guarantees continuity between these different forms of research.

At the platform level, this new experimental project enables research projects common to Mediterranean (and DOM-TOM) and tropical continental marine fish-farming to be carried out, in areas as varies as thermal and extreme salt regimes, growth, feed efficiency or adaptation to plant-based food. In particular, the Cirad is carrying out work to assess the possibility of replacing soya cake with micro-algae to reduce the environmental impact of fish-farming.

Staff from 4 institutes

Around thirty members of staff from 4 institutes are working in permanent collaboration (around twenty IFREMER, 3 INRA, 3 CIRAD). The IFREMER employees are attached to the institute's Biological and Environmental Resources departments, within the «Animal and Farming Systems Adaptation and Adaptability» (L-3AS) laboratory, integrated into the MARBEC Mixed research unit (IRD, IFREMER, CNRS, UM) and «Aquaculture Experimentation plateform».

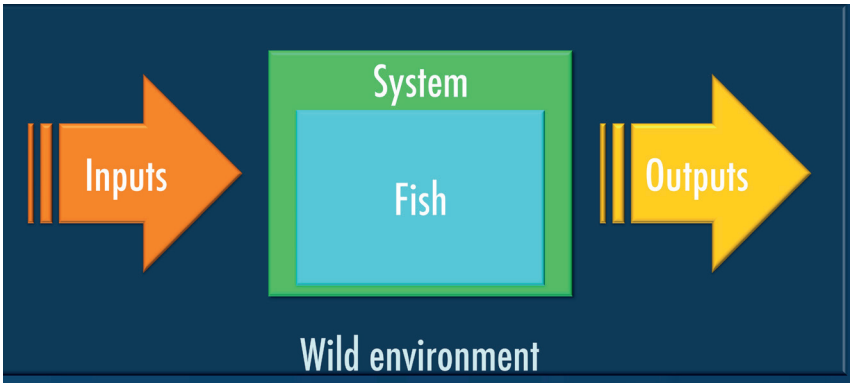
THE ACTIVITIES OF THE ANIMAL AND FARMING SYSTEMS ADAPTATION AND ADAPTABILITY» (L-3AS) LABORATORY

The research laboratory's objective is to contribute to the acquisition of knowledge on animal - farming system - environment interactions within a sustainable fish-farming development approach. The overall scientific investigations carried out by the laboratory are intended to understand the adaptation and adaptability processes for animals and farming systems and provides support to fish-farming sectors (temperate and tropical).

☑ For the animals, studies are carried out into their adaptation mechanisms (physiological and/or behavioural) and their variability (genetic and genomic architecture): adaptation to global farming conditions (domestication), plant-based foodstuffs, fasting (feed efficiency) and illness (infection resistance genetics).

☑ For the systems, studies are carried out into the flexibility and resilience of production systems: identification of adaptability levers (sustainability and development determining factors), evaluation of purification and production capacities for integrated multi-trophic systems and standardisation of technical farming reference bases (from genetic variability management to product packaging).

List of L-3AS fish-farming research projects



The aquaculture system (here named Aqua-ecosystem) as it is considered, breaks down into 4 elements that structure the laboratory's research axes: (1) the farmed fish (2) its breeding system, (3) the inputs required for its development, and (4) the outputs it produces. The objectives of this research will be to improve the farmed animals and their breeding system in parallel in order to help minimise the inputs and outputs of the production system.

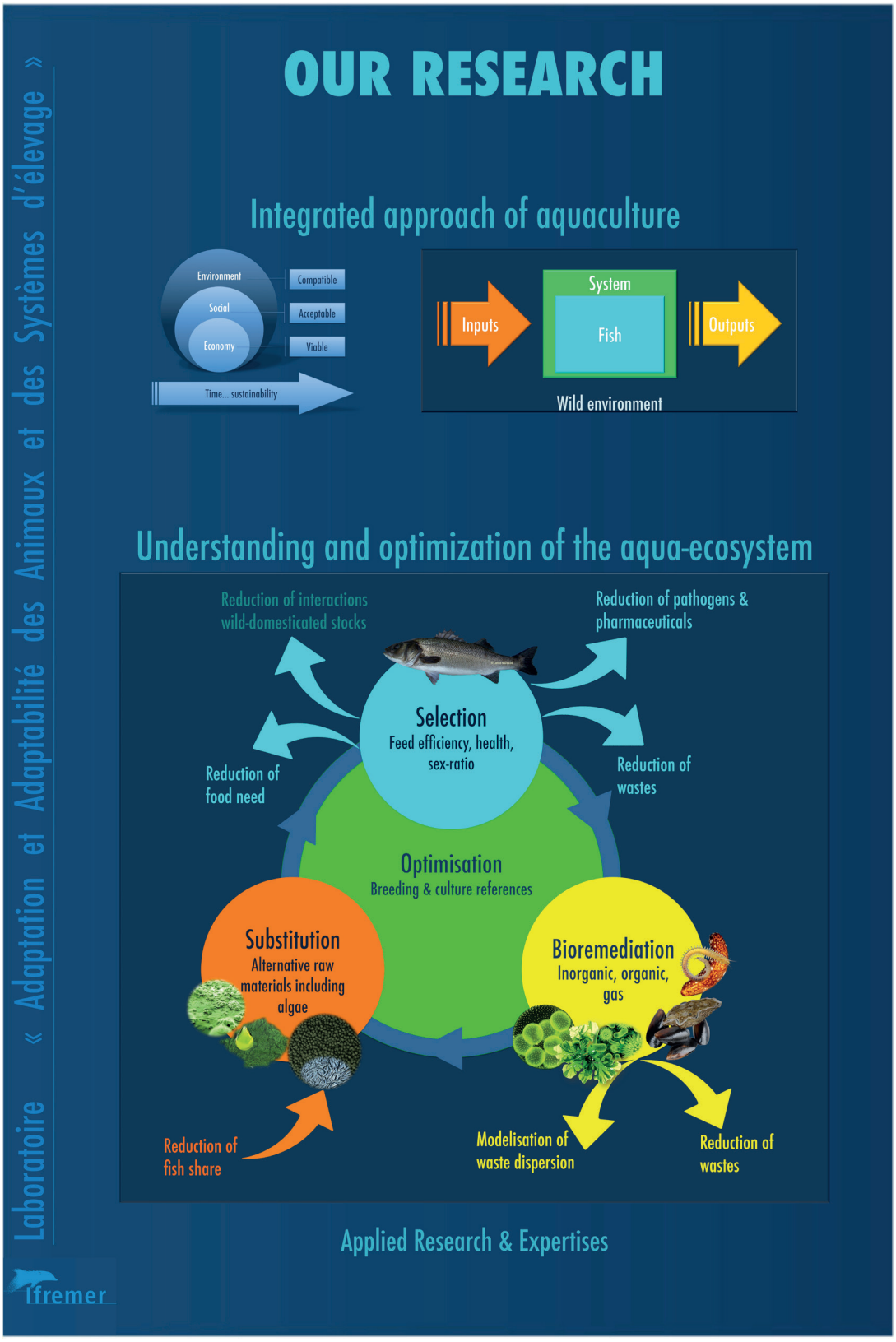
In this context, the laboratory team works on no fewer than 23 different projects:

1) 10 projects are dedicated to the study of the adaptation mechanisms (physiological and / or behavioural) and their variability (genetic and genomic architecture), focusing on 3 main traits, i.e., feed efficiency, disease resistance and sex determinism; 6 are supported by the European Commission - EC (FISHBOOST, EMBRIC, PERFORMFISH, AQUAEXCEL2020, SUSHIFISH, AQUAIMPACT), 2 are supported by the European Maritime and Fisheries Fund - EMFF (GENESEA, BIOGERM, 3S), and 1 by national funding (CRÉCHE2018).

2) 4 projects focus on breeding system - behaviour or health interaction; 1 is funded by the EU (WINFISH) and 3 are supported by regional funding (AQUASANA, APTOCORT, SKEL'ESTRO).

3) 2 projects aim to decrease the ingredients of fish origin in fish feed; 1 supported by the EU (MARINEALGAE4AQUA), the 2nd by national funding "Fonds Unique Interministériel - FUI" (NINAQUA).

4) 3 projects are dedicated to fish waste bioremediation using Integrated Multi-Trophic Aquaculture (IMTA-EFFECT - EC, EPURVAL2 - FEAMP) or algae (VASCO2 - national funding ADEME), and 4 projects target the characterisation of fish waste impact on environment (AQUASPACE - EU, MEDAID - EU, CAPAMAYOTTE and QUALISANT - regional funding).


OUR RESEARCH
Integrated approach of aquaculture
Environment
Social
Economy
Compatible
Acceptable
Viable
Time... sustainability
Inputs
System
Fish
Outputs
Wild environment
Understanding and optimization of the aqua-ecosystem
Reduction of interactions wild-domesticated stocks
Reduction of pathogens & pharmaceuticals
Selection
Feed efficiency, health, sex-ratio
Reduction of food need
Reduction of wastes
Optimisation
Breeding & culture references
Substitution
Alternative raw materials including algae
Bioremediation
Inorganic, organic, gas
Reduction of fish share
Modelisation of waste dispersion
Reduction of wastes
Applied Research & Expertises
Laboratoire « Adaptation et Adaptabilité des Animaux et des Systèmes d'élevage »
Ifremer

THE EXPERIMENTAL PLATFORM'S PARTNERS

INRA

As the leading for agricultural research institute in Europe, and the World number two, INRA, the French National Institute for Agricultural research works towards solutions for society's major challenges, food, nutrition, agriculture and the environment, in the wider context of food systems bioeconomy.

INRA has 7900 permanent staff, in 184 research units and 45 experimental units.

Aquaculture research at INRA is historically focused on freshwater species (especially trout), but work on marine species is conducted in close cooperation with Ifremer. Aquaculture research at INRA involves 165 permanent staff, eight research units and six experimental units, four of which are open to foreign partners in the European aquaculture infrastructures network AQUAEXCEL2020, coordinated by INRA.

INRA research teams are dedicated to the sustainable development of a resource-efficient, low impact sustainable aquaculture. This is achieved through improved knowledge of the biology of farmed fish species and of farming systems. The research spectrum is wery wide, from genetics to multi-criteria evaluation of farming systems, through physiology, pathology, immunology, nutrition and evaluation of environmental impacts.

www.inra.fr

IRD - France

A key stakeholder in research for development. The French National Research Institute for Sustainable Development (IRD), an internationally recognised multidisciplinary organisation working primarily in partnership with Mediterranean and inter-tropical countries, is a French public establishment under the joint authority of the French Ministry of Higher Education and Research and the Ministry of Foreign Affairs and International Development.

Via its network and presence in fifty or so countries, it takes an original approach to research, expertise, training and knowledge-sharing, to the benefit of countries and regions that make science and innovation key drivers in their development.

http://en.ird.fr/

CIRAD

As a public industrial and commercial establishment, the Centre de coopération internationale en recherche agronomique pour le développement (International agronomy research cooperation centre for development - Cirad) is monitored bu both the Ministry of Higher Education and Research and the Ministry of Foreign Affairs. In partnership with all developing countries, the Cirad produces and passes on new skills to help their agricultural development and contribute to the debate on the major challenges to agronomy worldwide.

A finalised research body, the Cirad establishes its programme from development requirements, from the field to the laboratory, on local and planet-wide levels.

Its activities cover life sciences, social sciences and engineering sciences applied to agriculture, food and rural territories.

The Cirad is committed to working as closely as possible to people and the Earth on complex and developing challenges: food security, natural resource management, inequalities and the fight against poverty.

www.cirad.fr
twitter.com/cirad

IFREMER

Created in 1984, the Ifremer is a public commercial and industrial establishment (EPIC) under the supervision of the Ministry of National Education, Higher Education and Research and Innovation and Ecological and Solidarity Transition. The Ifremer is France's reference institute for knowledge of the marine environment and its resources. At a national, European and international level, it is the driving force behind concerted programming initiatives for research infrastructure, such as the French Oceanographic Fleet which it now supports.

The Ifremer helps create knowledge and skills in relation to the marine environment to provide a response through research, technological development and innovation to the current and future challenges facing society, in particular in relation to the reasoned use of marine resources and ecosystem preservation.

By guiding its actions towards areas where it provides top-level scientific added value and by mobilising scientific communities and socio-economic actors, the Ifremer's ambition is also to provide effective support for the deployment of the French government's maritime policies and to be a key actor in «blue growth».

For the next decade, in keeping with sustainable development objectives for our oceans, the Ifremer is placing understanding and forecasting changes in the oceans in 2100 at the heart of its projects.

MANAGE A FISH FARM WITH THE AQUAKULTOR SIMULATION GAME DESIGNED BY SCIENTISTS

AquaKultor is the first fish-farming simulation game in the world, developed for Android (Google Play) and IOS (App Store) platforms by The One Man Army Game Studio from an original idea by François Allal (Ifremer) and Mathieu Besson (INRA).
The overall objective is to run and manage every dimension of a fish farm. So, you will have to manage your breeding operations, your infrastructure, your employees and your environment. Taking part in innovative projects will enable you to acquire new skills to improve your farming system (innovative cages, environmental support capacity, etc.) and also improve the genetics of your breeding species (parentage assignment, genome selection and so on). You will be able to set up your own selection programme in your hatchery to improve growth, feed efficiency or resistance to illness for your line, one of the keys to the success and sustainability of your production.

This game is not intended to be completely realistic, but is inspired by the animal science and genetic knowledge acquired on bass in actual scientific projects developed at the Palavas Ifremer platform, and also during the thesis produced by Mathieu Besson (INRA) on modelling the economic and environmental benefits of genetic progress.

Discover some of the programmes that are being developed at the Palavas station through interviews with researchers and technicians: https://wwz.ifremer.fr/webtv/Entretiens/Palavas

CONTACTS

IFREMER : Arthur de Pas - 06 49 32 13 83 - presse@ifremer.fr
CIRAD : Sophie Della Mussia - 07 88 46 82 85 - presse@cirad.fr
INRA : 01 42 75 91 86 - presse@inra.fr
IRD : 04 91 99 94 87 - presse@ird.fr

VISIT OUR EXPERIMENTAL PLATFORM ON 25TH AUGUST

COME AND MEET US AT STAND 94 AT THE AQUA SHOW