

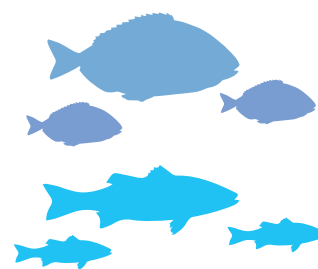


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WORK PACKAGE 1 – SELECTIVE BREEDING FOR ROBUST FISH

The Challenge

Although selective breeding has shown positive results for certain farmed fish species, the Mediterranean Marine Fish Farming (MMFF) industry has not yet benefited significantly from the use of genetics in the selective breeding of European sea bass and gilthead sea bream at the broader geographic scale.



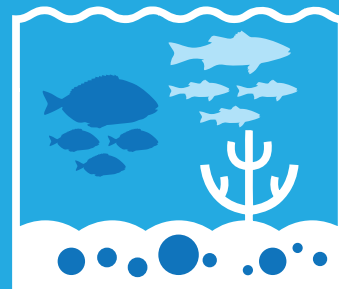
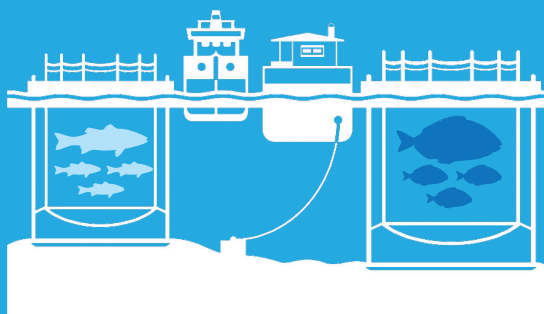
PerformFISH Proposed Solution

To overcome this challenge, **PerformFISH** will employ an SNP-array, a novel and powerful molecular tool which will assess the genetic background of disease resistance in both species. Moreover, new phenotyping methods will be developed for a series of industry-relevant traits, such as feed efficiency, disease resistance, and fish shape. The genomic variation for these traits can then be evaluated, allowing for disease-resistant, healthy fish to be produced.

PerformFISH gathers the major Mediterranean aquaculture companies that currently perform selective breeding for traits such as growth, disease resistance, and quality indicators, as well as the RD&I groups to design, validate and implement cost-effective tools for genetic selection.

Main Results to Date

In **PerformFISH**, samples of both gilthead sea bream and European sea bass were genetically analysed. The samples were representative of the species natural distribution in the wild (from the Atlantic Ocean to the Eastern Mediterranean), and the operating regions of the project's major industrial partners.

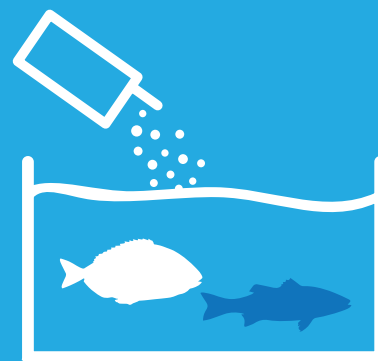


This genetic dataset is the largest ever generated for these species at population level and will enable greater characterisation of their genetic variation. The dataset is currently being analysed through bioinformatic pipelines in order to develop a catalogue of some millions of Single Nucleotide Polymorphisms (SNPs), from which the most polymorphic and representative will be chosen to be integrated into the first common genomic tool (the SNP-array). This is expected to be very affordable due to its broad access into the market. This work towards the shared design and application of the SNP-array (chip) tool has been partially carried out in collaboration with partners of the MedAID project.

PerformFISH conducted the first ever pilot challenge of gilthead sea bream juveniles' resistance to viral nervous necrosis (VNN) in order to overcome the difficulties of infecting small larvae, monitoring mortality, and collecting biological samples suitable for DNA analysis. Mortalities were significant at much younger stages (10-15 days post hatch (dph) juveniles) but not in stages older than 40-45 days dph.

In gilthead seabream, the first experiment using fish reared in individual aquaria was carried out to develop a protocol and estimate heritability of individual feed efficiency and its genetic correlation with growth. High-quality phenotypes for several hundred fish are now available, and their assignment to groups is underway.

Additionally, the study of the genetic architecture of skeletal deformities in gilthead sea bream has greatly advanced, with breeders being selected to establish future cross breeding according to their Estimated Breeding Value (EBV) for growth and presence-absence of deformity traits.

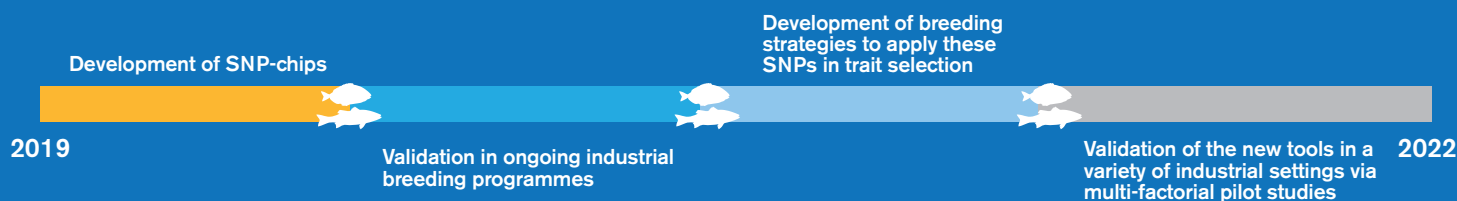


Lastly, challenge experiments were successfully executed in European sea bass to study parasite disease resistance to *Diplectanum*, *Lernanthropus* and *Vibrio*. Heritability estimates are currently being calculated.

Going Forward 2019-2022

Recent studies indicate that SNP-arrays (or chips) are a cost-effective means of genotyping in the field of fish breeding. A single toolbox incorporating these chips for marker-assisted selection in both European sea bass and gilthead sea bream will be established using the latest technologies and methodologies, permitting high coverage and representation of their genetic variation. Moreover, these results will be validated in ongoing industrial breeding programmes.

Breeding strategies will be developed to apply these SNPs in trait selection, which will permit genetic improvement without the need for further experiments on disease challenge, feed conversion efficiency, and other areas. These tools will be validated in a variety of industrial settings via multi-factorial pilot studies to ensure consideration of the existing aquaculture stocks and the diversity of aquaculture environments in the Mediterranean.



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