VIVALDI partners

Rade de Brest Study sites with specific monitoring

Cupped oysters - Mussels - Clams - Flat oysters - Cockles - Scallops

VIVALDI
Preventing and mitigating farmed bivalve diseases

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Preventing and mitigating farmed bivalve diseases

KEY RESULTS AFTER 4 YEARS OF RESEARCH

VIVALDI
Preventing and mitigating farmed bivalve diseases

This project has received funding from the European Union's Horizon 2020 Research and innovation programme under grant agreement N° 678589

CONTEXT

European shellfish farming enjoys a prominent position on a global scale. The European production of shellfish relies mostly on mussels, oysters and clams. Approximately 8,500 companies employ more than 42,000 people.

However, over the recent years, a growing number of mortality cases, associated to pathogen organisms, have been observed.

The European **VIVALDI** project aimed to improve **the sustainability and competitiveness of the European shellfish industry** by developing tools and approaches to prevent and mitigate the impact of bivalve diseases.

VIVALDI IN **NUMBERS**

4 YEARS
01/03/2016 - 29/02/2020

21 partners

6 SPECIES of shellfish studied

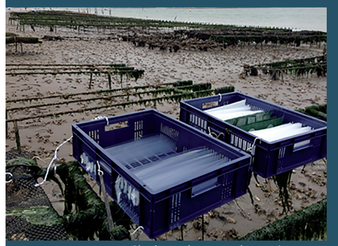
4,5 million euros

10 COUNTRIES
8 in the EU
+ Norway and Israel

150 researchers and technicians

VIVALDI'S MAIN OUTCOMES

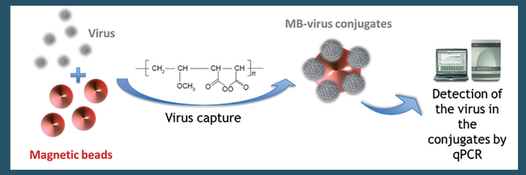
INVESTIGATING THE PATHOGENS



Plastic membranes used as passive sensors

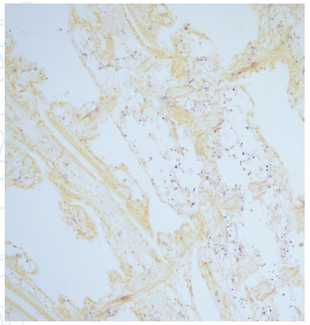
VIVALDI researchers have characterised new or poorly known pathogens but also the diversity of some already described oyster pathogens at multigene and whole genome levels. **Studying this diversity informs us about these pathogens' host range, geographic distribution and origin**. Our better understanding of the life-cycles of some pathogens and their interactions with plankton can be useful to design effective disease management plans.

IMPROVING DISEASE DETECTION



The **efficiency of environmental approaches** such as passive DNA/RNA sensors to reveal the presence of aquatic pathogens in controlled and field conditions has been demonstrated. Such tools could be useful for **pathogen surveillance in the open environment and development** of detection tools, including early warning systems. The use of magnetic beads and electrochemical biosensors could allow us to **better detect the OsHV-1 virus in aquaculture facilities**.

INVESTIGATING THE HOST DEFENCE MECHANISMS



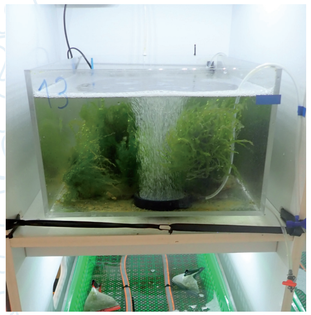
OsHV-1 infected cells (in purple) in C.gigas spat tissues

Some key mechanisms (e.g. autophagy pathway and Warburg effect) involved in the response of bivalves during a viral or bacterial infection have been identified. Several modulated genes were also found, which may help to identify potential markers related with resistance against diseases. VIVALDI has also demonstrated that **stimulating bivalve immunity is possible** by exposure to different immuno-stimulant molecules and that a better survival is observed after an exposure to inactivated pathogens. Additionally, a transgenerational improvement of offspring immune defenses is observed depending on parents' immunological experience.

ELABORATING BREEDING PROGRAMMES

Oyster and clam families have been produced and challenged regarding their susceptibility to pathogens. Genomic tools, consisting of a panel of well-selected SNP markers, are now available for oysters and clams. Combined with massive oyster and clam phenotyping, these panels have allowed us to identify markers associated with resistance/tolerance to some pathogens. **Marker panels for oysters and clams' parentage assignment will optimize breeding programs**: improving genetic gain without increasing inbreeding.

INVESTIGATING THE INTERACTIONS WITH THE ENVIRONMENT



Experiment testing the impact of macroalgae on OsHV-1 development

VIVALDI researchers have confirmed that **environmental parameters**, such as temperature, acidification, UV-B, presence of macro algae... have an influence, either positive or negative, on the development of diseases. It has also been shown that **plankton organisms** are involved in the transmission and outcome of bacterial diseases in oysters.

The characterization of **bivalve microbiota** under different scenarios, including disease development associated or not with mortality events and environmental perturbations, should contribute to the identification of bivalve health markers.

ELABORATING DISEASE MANAGEMENT MEASURES

Strategies to avoid OsHV-1 in hatcheries and nurseries were identified in the literature and are completed by field studies, so as to identify the best husbandry practices to reduce mortality. These practices have to be locally adapted. The efficiency of UV treatment to inactivate pathogens and remove oyster gametes and larvae from the wastewater has been confirmed. Finally, the **risk ranking shellfish farm model** elaborated in the context of VIVALDI could be used by competent authorities to implement risk-based surveillance of shellfish diseases

IMPROVING COMMUNICATION AND INFORMATION FLOWS AMONG STAKEHOLDERS

A stakeholders' analysis was carried out in Ireland, France, Italy and Spain to **map the key stakeholders** such as producers, retailers, competent authorities and researchers and better understand their relations. **Their perception of the risks related to diseases was investigated**, based on individual and group interviews.This work highlights the critical importance of **variation in beliefs and priorities across locations, mollusc species, and stakeholder categories**. These differences should be taken into account for prevention strategies to be successfully and sustainably implemented at EU and national levels.

CO-BUILDING A BIOSECURITY MANUAL

Recommendations to prevent, mitigate and control bivalve diseases have been identified from the different studies carried out in VIVALDI. They have been included together with already existing recommendations at international, national or local level in a **manual for disease management and biosecurity,** which is being co-constructed with a group of stakeholders and encompasses all the dimensions and perceptions of the risks and consequences related to shellfish diseases in Europe today.

PERSPECTIVES

• **Global change** : many studies have been carried out in VIVALDI on the **impact of factors such as environmental degradation on shellfish diseases**. These research activities lay the foundations for future work on global change.

• The intensification of the production, associated with an increase of mortalities in general, has an impact on native species also. Therefore, perspectives in the field of **restoration of local endangered-species are also being considered**. Restoration programmes require building pluri-disciplinary approaches, involving ecologist experts, pathologists, geneticists, competent authorities, environmental associations, shellfish/fish producers...

• Finally, VIVALDI greatly contributes to develop solutions, recommendations for a **better implementation of the international and European legislation**. VIVALDI outcomes will also bring helpful information for the evolution of this legislation. Our risk-based evaluation models are an example of supporting tools in this field.