Can we prevent and mitigate bivalve diseases?

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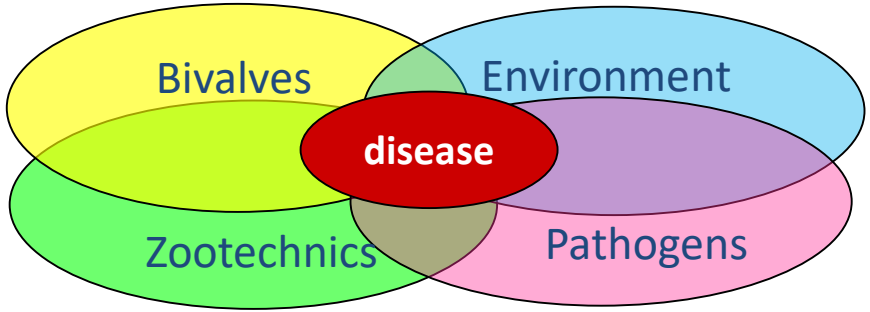
VIVALDI
Preventing and mitigating farmed bivalve diseases

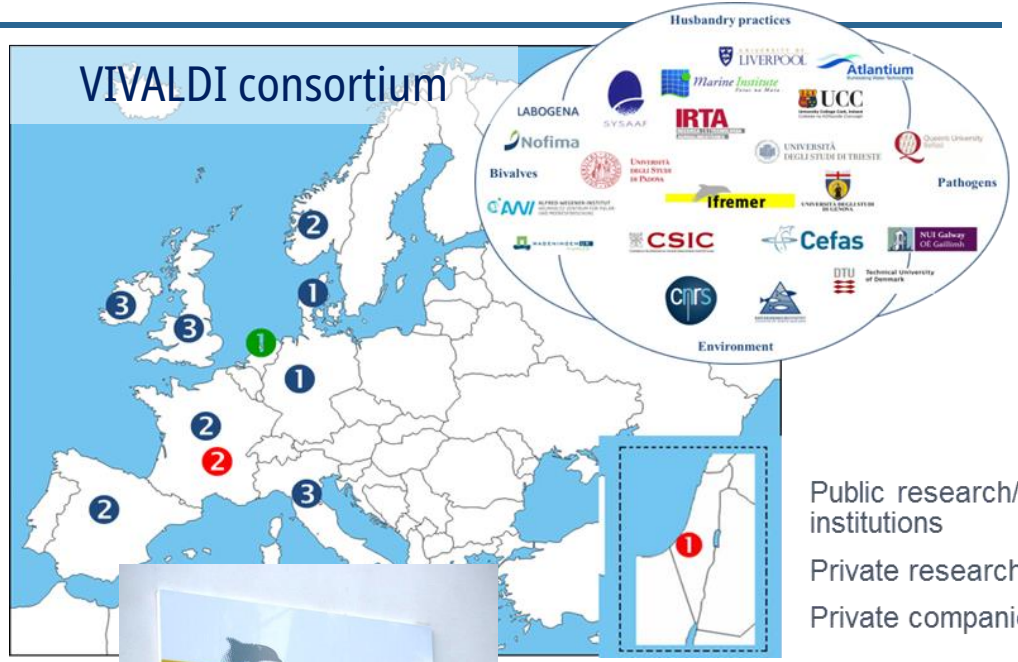

VIVALDI
Preventing and mitigating
farmed bivalve diseases

VIVALDI : a H2020 project “Research and Innovation Action”

Global budget: 5 millions €
Duration : 2016-2020



-> Better knowledge of factors triggering disease emergence
-> Development of tools and strategies



Public research/education institutions
Private research institutions
Private companies

21 partners

Prevent, control and mitigate impact of diseases

Control of mollusc diseases

Molluscs do not produce antibodies

→ No vaccine

Most of molluscs are farmed in the field

→ No treatment /No disinfection

Pathogen exchange easy

Molluscs act as carrier for many pathogens

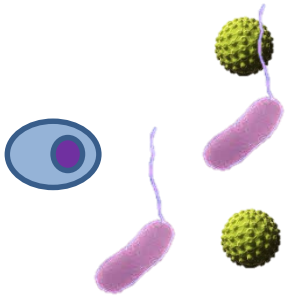
→ Eradication difficult/impossible

Prevent introduction and spread
Mitigate impact of diseases?

- ✓ Better disease detection
- ✓ Better defense mechanisms
- ✓ Less pathogen spread

Improving detection/identification of pathogens

Diversity of known pathogens



OsHV-1
V. aestuarianus
Marteilia refringens
…

Compartment/Reservoirs

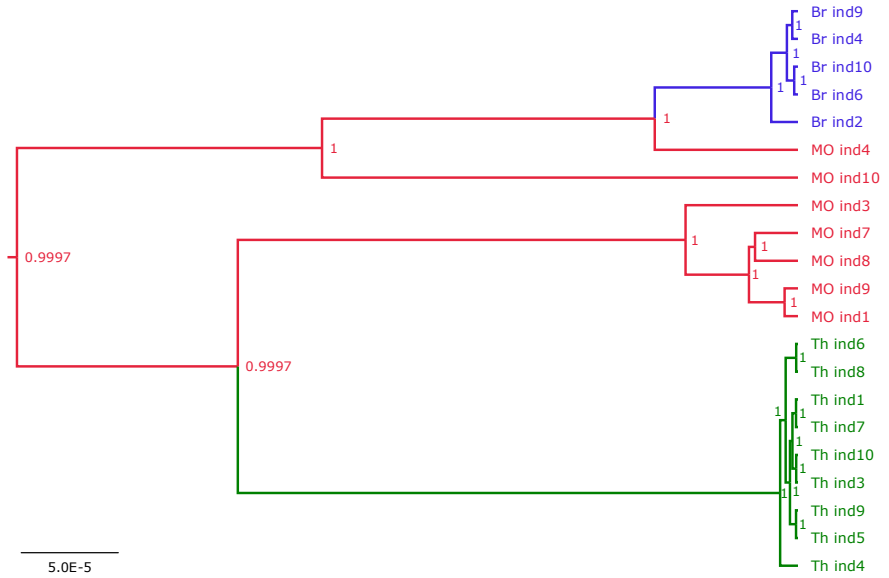
Pathogens can be found in sediment, water, plancton and other species…

Early warning tools

Passive samplers allow successful detection of OsHV-1, NoV and Vibrios/

Focus on the diversity of OsHV-1

A)



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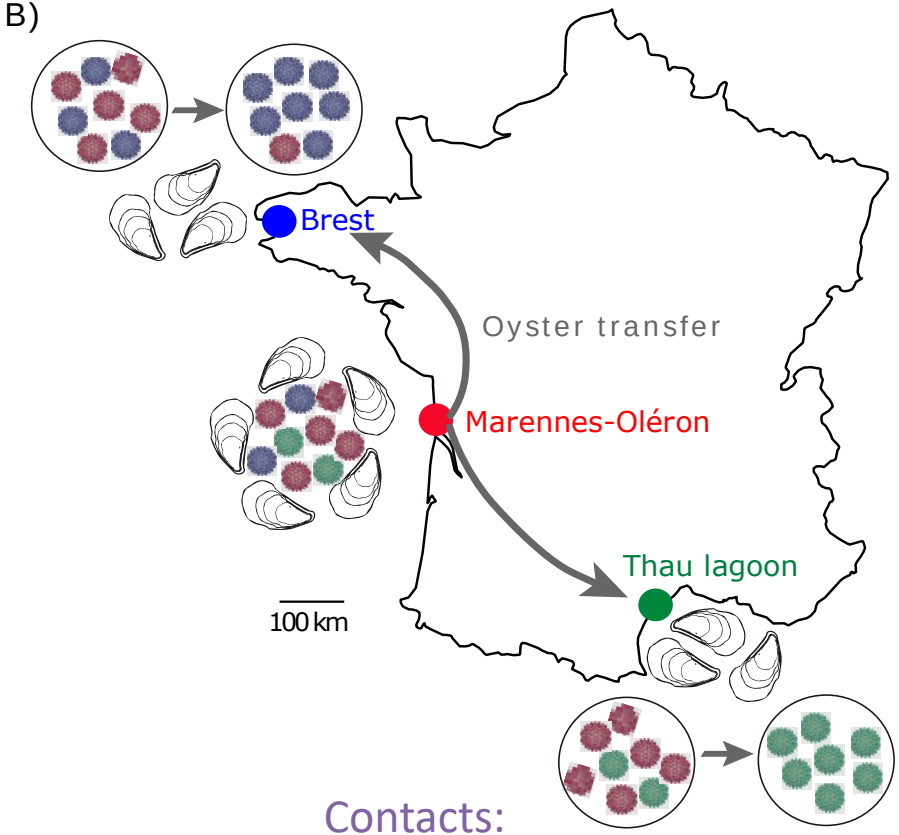

Delmotte-Pelletier *et al.* 2022 *Virus Evolution*

Contacts:
Maude Jacquot; Germain Chevignon; Benjamin Morga

Focus on Passive samplers

frontiers in Microbiology

ORIGINAL RESEARCH
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Passive Samplers, a Powerful Tool to Detect Viruses and Bacteria in Marine Coastal Areas

Françoise Vincent-Hubert[†], Candice Wacrenier[1], Benjamin Morga[2], Solen Lozach[†‡], Emmanuelle Quenot[1], Mickaël Mège[2], Cyrielle Lecadet[2], Michèle Gourmelon[1], Dominique Hervio-Heath[†‡] and Françoise S. Le Guyader[1]

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OPEN ACCESS

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The detection of viruses and bacteria which can pose a threat either to shellfish health or shellfish consumers remains difficult. The current detection methods rely on point sampling of water, a method that gives a snapshot of the microorganisms present at the time of sampling. In order to obtain better representativeness of the presence

Membrane were displayed for 48h and 15 days in two sites

PCR analysis for the detection of bacteria and viruses including **OsHV-1**

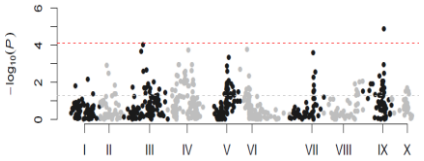
Detection of OsHV-1 DNA between March and July

→ Approach of interest for the detection of OsHV-1 before mortality outbreak

→ Approach that can be used for the detection of other pathogens

Contacts: Françoise Hubert-Vincent; Benjamin Morga

Having more resistant shellfish



Identify best markers

Optimization of selection programme

Tools for parentage assignment

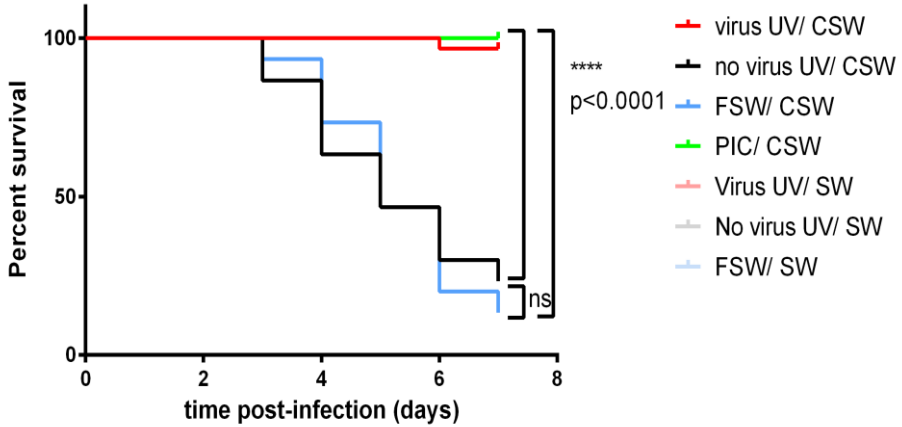
Identify markers associated with better survival

Stimulate immunity

Exposing oysters to virus like particles protect against OsHV-1

Focus on the stimulation of anti viral immunity

Comparaison between inactivated virus vs « normal » virus

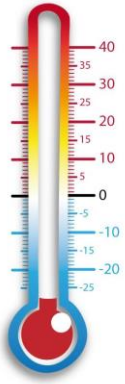


Contacts:
Benjamin Morga and
Caroline Montagnani

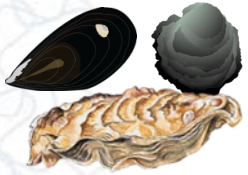
Decreasing risk of pathogen emergence and spread

UV-B radiation decreases OsHV-1 load

Factors acting on transmission and mortality



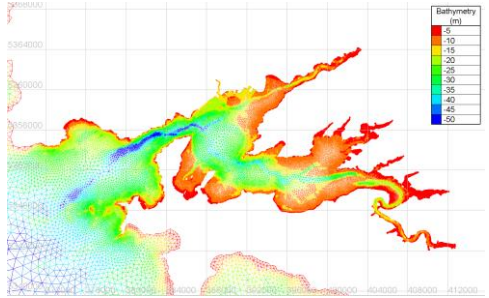
Temperature impacts mortality associated with OsHV-1



Species diversity decreases mortality

Disease transmission modelling

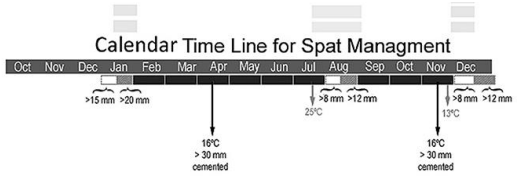
Allows predicting pathogen spread



Inactivate pathogens

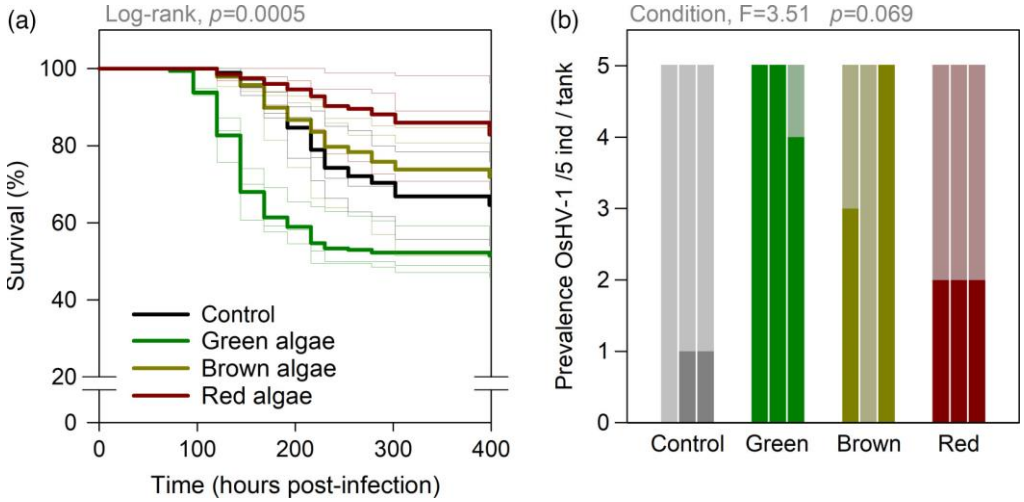
HOD system successfully inactivate OsHV-1 and Vibrio

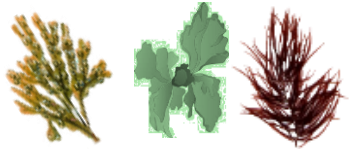
Husbandry practices



Calendar allowing decreasing mortality

Focus on the impact of other species



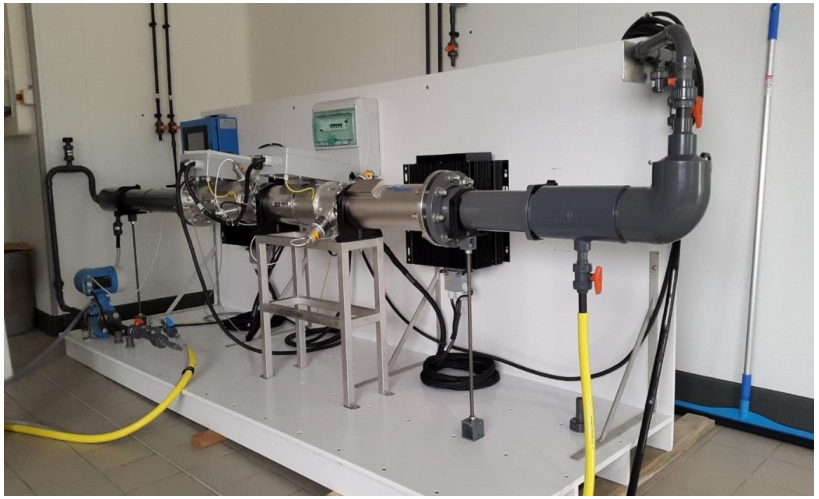


Oyster survival = ↓ ↑

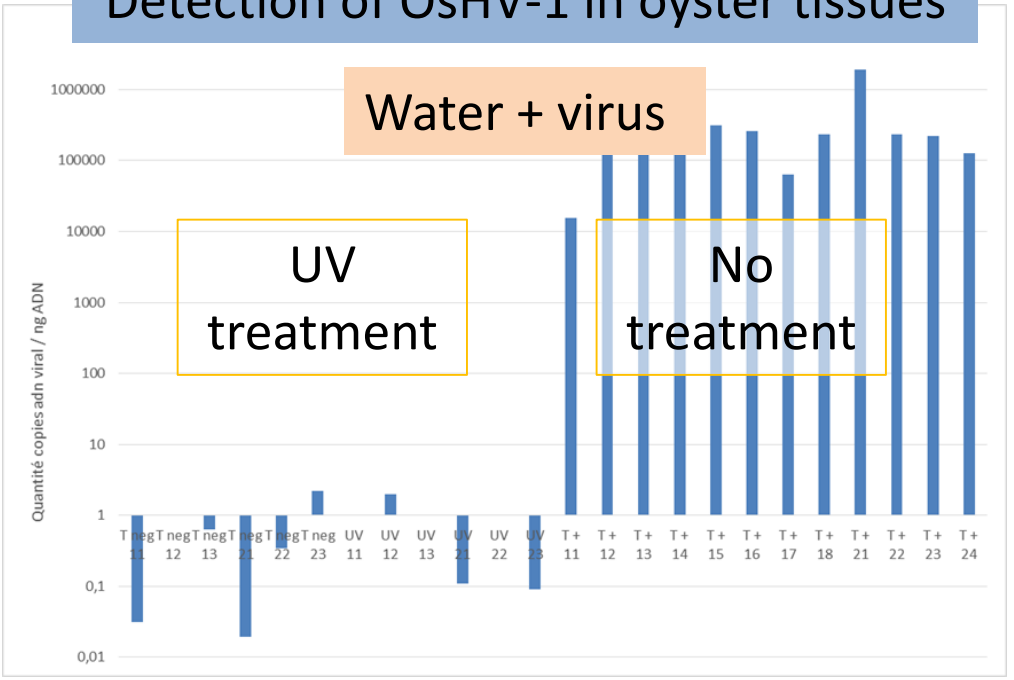
Impact of macro- algae on oyster survival against OsHV-1 tested by Dugeny et al. 2022

Contact:
Fabrice Pernet

Focus on UV inactivation



Detection of OsHV-1 in oyster tissues

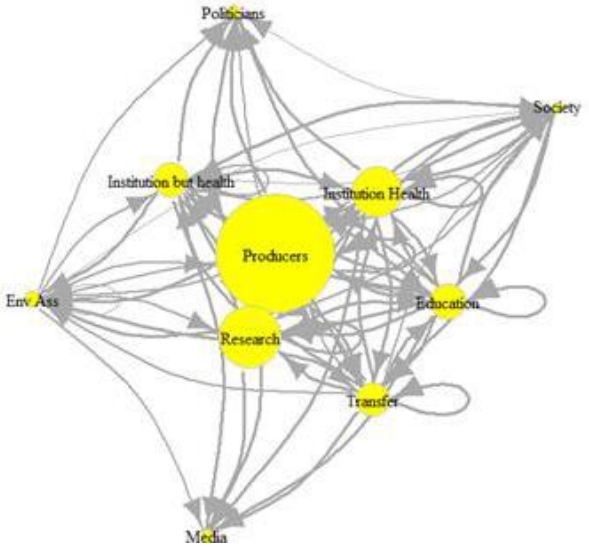


Contact: Christophe Stavrakakis; Dolors Furones

Sharing and disseminating results

List of stakeholder categories

Stakeholders mapping



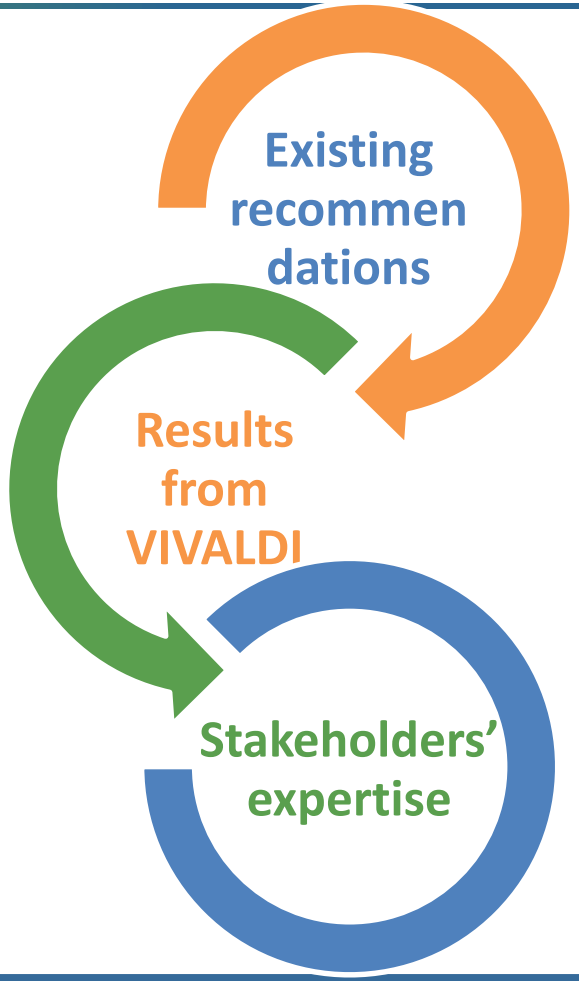
Stakeholders mapping and analysis

Risk perception

Interviews to evaluate risk perception regarding shellfish diseases

A Manual for disease management and biosecurity?

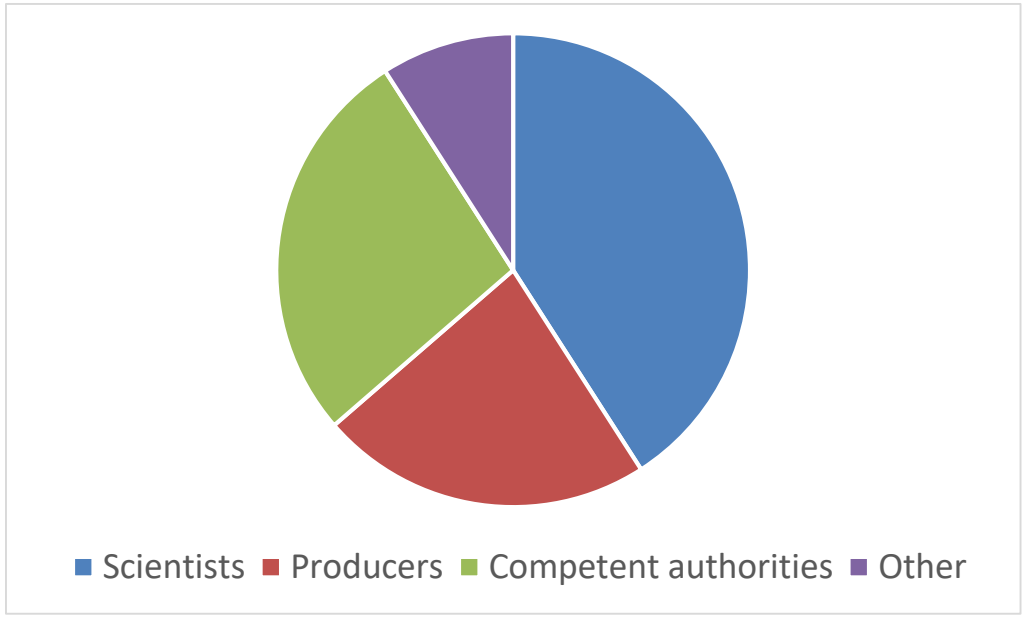
Producers, competent authorities and scientists from d**ifferent countries**

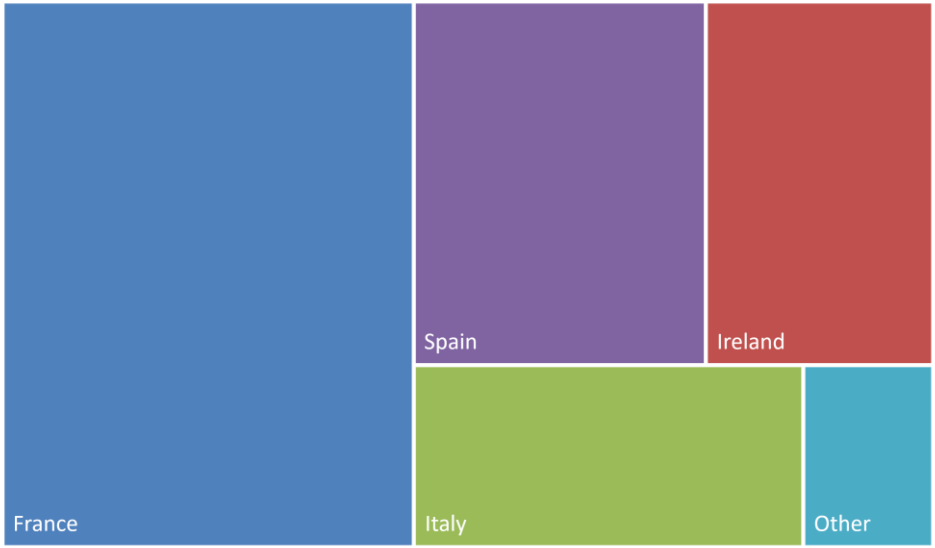


Preparing a tool relevant and easy-to-use for the greatest possible number of stakeholders


Ifremer

Authors and contributors





Results

17 recommendations

Answering 8 main objectives…

and 3 categories of issue…

COMMUNICATION ISSUES

Training, knowledge transfer, information and methodology

1. Technology transfer, training and exchange of best practices on disease risk-management
2. Informing stakeholders about disease status and risk
3. Facilitating crisis management
4. Lesson-learning from past disease outbreaks

GOVERNANCE ISSUES

Identifying zone status

5. Improving surveillance and determining zone status using risk-based and spread models

Acting on animal movements

6. Avoid bivalve transfers presenting a risk to spread pathogens (non-regulated pathogens)
7. Minimizing the source of pathogens based on early detection

Mortality reporting

8. Develop a harmonised method to evaluate mollusc mortality at the EU level
9. Improving reactivity, sensitivity and standardisation of reporting and investigating mortality

TECHNICAL ISSUES

Animal selection

10. Development of breeding programmes to improve disease resistance following good practices for product
11. Farming of spat selected for lower susceptibility to diseases

Treating water

12. Water treatment measures for land-based shellfish systems

Elaborating technical recommendations based on geographic and species specificities

13. Establish a cultivation calendar
14. Biosecurity and good farming practices
15. Temperature management in cultivation, handling and harvesting practices for Crassostrea gigas

Adapting farming practices and structures

16. Develop local production systems
17. Disposal of dead animals

Results

Tittle

Stakeholders involved

Description

1. TRANSFERT DE TECHNOLOGIES, FORMATION ET ÉCHANGE DE BONNES PRATIQUES EN MATIÈRE DE GESTION DES RISQUES LIÉS AUX MALADIES

Cette responsabilité incombe principalement aux autorités compétentes, qui travaillent en collaboration avec l'industrie et les institutions de formation.

DESCRIPTION :

- **Des groupes de travail** ou organisations, représentant toutes les parties prenantes, y compris les instances de formation à différentes échelles (locale, régionale, nationale, européenne et internationale), doivent être créés. Les organismes d'éducation et de formation doivent en faire partie.

  Les organigrammes des différentes parties prenantes, mentionnant les fonctions et noms des contacts, doivent être régulièrement mis à jour.

  Il est nécessaire de partager un "langage commun". Toutes les parties doivent veiller à être comprises par les autres parties.

  Des coordinateurs/modérateurs pourraient contribuer à faciliter les échanges d'informations, par exemple en définissant les mots et concepts techniques.

- Différents outils pourraient être envisagés pour favoriser la communication entre les parties prenantes :

  Développement d'une application pour faciliter une communication fluide et interactive;

  Mise en place de calendriers et d'agendas pour assurer un contact régulier et la pérennité des groupes de travail.

- Différents supports peuvent être utilisés pour échanger sur les meilleures pratiques et la biosécurité :

  Un manuel distribué aux parties prenantes, rédigé dans leur langue maternelle;

  Des cours en ligne ;

AVANTAGES :

- L'amélioration des connaissances des parties prenantes se traduira par plus de biosécurité et une production plus durable.
- La compréhension du rôle et des responsabilités de chacun facilitera l'engagement des parties prenantes dans la prévention des maladies et l'atténuation de leur impact.
- La mise en œuvre des plans de lutte contre les maladies sera plus rapide et plus efficace.
- Une production plus durable conduira à une meilleure productivité.

LES PRINCIPALES LIMITES :

- Il n'y a pas de modèle établi pour la formation.
- Les différents rôles et responsabilités des parties prenantes en matière de formation, d'échange de connaissances, etc. doivent être définis.
- Coût économique de la formation.
- Le flux d'informations doit être amélioré.

Main benefits

Main limits

Results

5. IMPROVING SURVEILLANCE* AND DETERMINING ZONE STATUS USING RISK-BASED AND SPREAD MODELS

This is primarily the responsibility of the competent authority working in collaborat

DESCRIPTION :

- Use **risk-based and hydrodyna** combine all relevant information t geographic limits of zones free of d
- Implement a **range of surveillance** depending on the circumstances of

  If observable mortality is unlikel pathogen of interest and the hos (e.g. infection with *Bonamia exitiosa* in *Ostrea edulis*), then **targeted active surveillance*** is required to maintain a free status.

  Risk based surveillance (RBS)* methods should be used to identify high risk farms and locations within the zones (using criteria such as proximity to depuration plants and live animal movements).

  Other surveillance approaches should be considered, including **use of sentinel animals***, e.g. in areas where infection in farmed species is expected to exist only at low levels and without observable signs.

- Cover known pathogens but also new and **emerging pathogens***.

THE MAIN LIMITATIONS :

- Risk-based and hydrodynamic models and active surveillance* are costly and require technical expertise:

  To construct the models and keep them updated;
  To obtain the data parameters needed to feed the models.

* Terms for which the definition is provided in the glossary

Surveillance
The systematic, continuous or repeated, measurement, collection, collation, analysis, interpretation and timely dissemination of animal health and welfare related data from defined populations.

GLOSSARY

Breeding programmes
Breeding programmes are the planned breeding of a group of animals or plants, usually involving at least several individuals and extending over several generations. Breeding programmes are set up with the aim to exploit genetic variation in a sustainable way.

Closed system
Aquaculture facility where water is recirculated and, usually, treated (oxygenated, disinfected and temperature regulated), to improve its quality for stock holding and safety for the environment before its discharge.

Contingency plan
Work plan describing actions, requirements and resources (including human resources) needed to control and eventually eradicate a disease.

Current (daily) mortality and cumulative mortality
Daily mortality is the number of animals dying in a 24 hour period. Cumulative mortality is the number of dead individuals over a fixed period. For example, if 10,000 oysters are stocked at one point of time and 5,000 are harvested 12 months later, by difference the cumulative mortality for that period is 50%.

Disease resistance /tolerance
Resistance is the ability of the host to limit pathogen burden whereas tolerance is the ability to limit the disease severity induced by a given pathogen burden.

Emerging pathogen / Endemic pathogen
An emerging pathogen is a previously unknown microorganism infecting bivalves or a previously known pathogen infecting a new bivalve host species, exhibiting a different pathology (e.g. increased virulence), or rapidly

Environmental DNA (eDNA)
Environmental DNA or eDNA means DNA extracted from environmental samples including water or sediment without prior isolation of any targeted organism. This DNA includes DNA from cells or live organisms, extracellular DNA coming from degraded or dead cells.

Expedition centre/dispatch centre
Logistic wet facility for preparation of shellfish for the distribution chain.

Flow-through system
Continuous water flow aquaculture facilit y with neither reused nor retention of the water that passes through, and is directly discharge after its use.

Genetic parameters
Heritability and genetic correlation are genetic parameters which describe possibilities for selection. Heritability of a trait is the part of phenotypic variability explained by the genetic resemblance between individuals from the population, it measures the ability of parents to pass on their capacity for a trait to their offspring. Genetic correlation quantifies the genetic relation between two traits.

Genetic variability
Genetic variability describes the variety of genes in the population. This parameter has to be considered in the long-term management of population to avoid potential deleterious impacts of inbreeding, conserve adaptative capacities and maintain accuracy of breeding values in genetic evaluations.

Some general recommendations

Neither geographic nor species/production system specific

Examples:

1. Technology transfer, training and exchange of best practices on disease risk-management
2. Informing stakeholders about disease status and risks
3. Facilitating crisis management
4. Lesson-learning from past disease outbreaks

Training, knowledge transfer, information and methodology

Some more specific recommandations

Treating water

Example:

12. Water treatment measures for land-based shellfish systems

Elaborating technical recommendations based on geographic and species specificities

Examples:

13. Establish a cultivation calendar
14. Biosecurity and good farming practices
15. Temperature management in cultivation, handling and harvesting practices for *Crassostrea gigas*

Conclusions

- The manual does **not** have regulatory goals but it aims to provide technical advices to assist implementing the legislation.
- When covering farming activities, recommendations identify best practices that **need to be adjusted** taking into account geographic and species specificities.
- Importance of **communication** issues in particular training, knowledge transfer, information and methodology.
- Interest of the **co-construction** methodology used herein

Where can you find the VIVALDI Manual ?

On line on the VIVALDI website

https://www.vivaldi-project.eu/fr/content/download/158545/file/VIVALDI-Manual%20EN.pdf

- In French
- In English
- In Spanish

Paper version available

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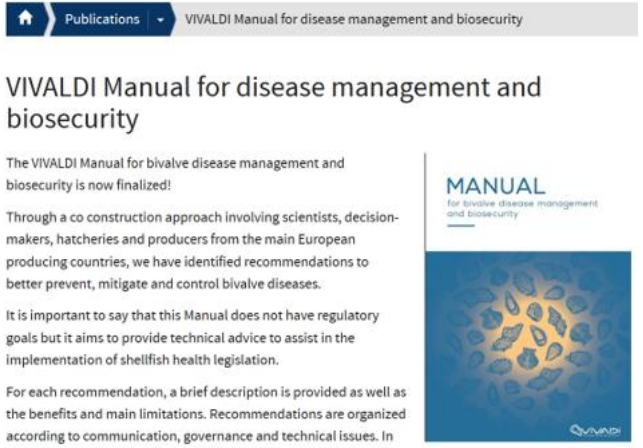
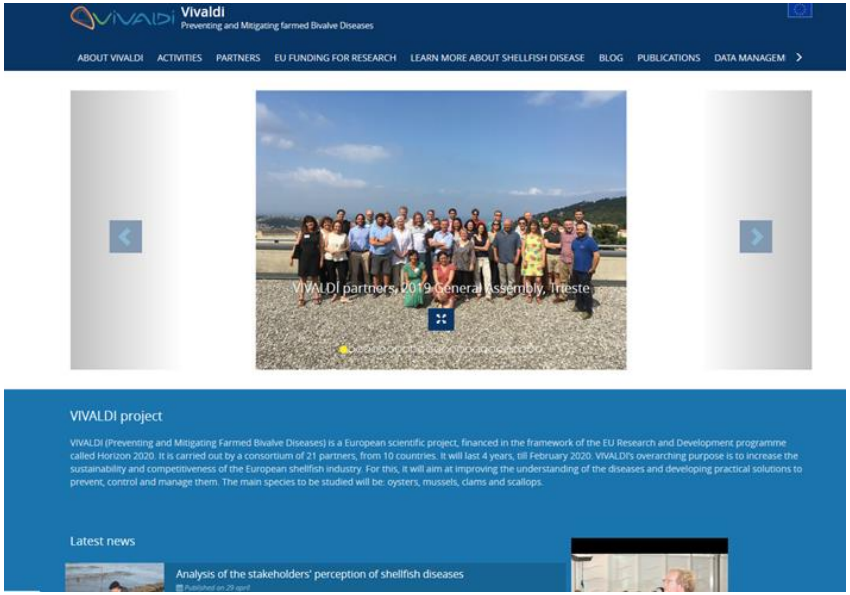


More information about VIVALDI?

Visit the website
https://www.vivaldi-project.eu/



Watch the video of the project
https://image.ifremer.fr/data/00640/75216/#29871

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