JOURNÉES SCIENTIFIQUES

28 NOV 2022

SERVICES ÉCOSYSTÉMIQUES
CONTRIBUTION DE LA NATURE À L'HOMME

29 NOV 2022

SOLUTIONS FONDÉES SUR LA NATURE

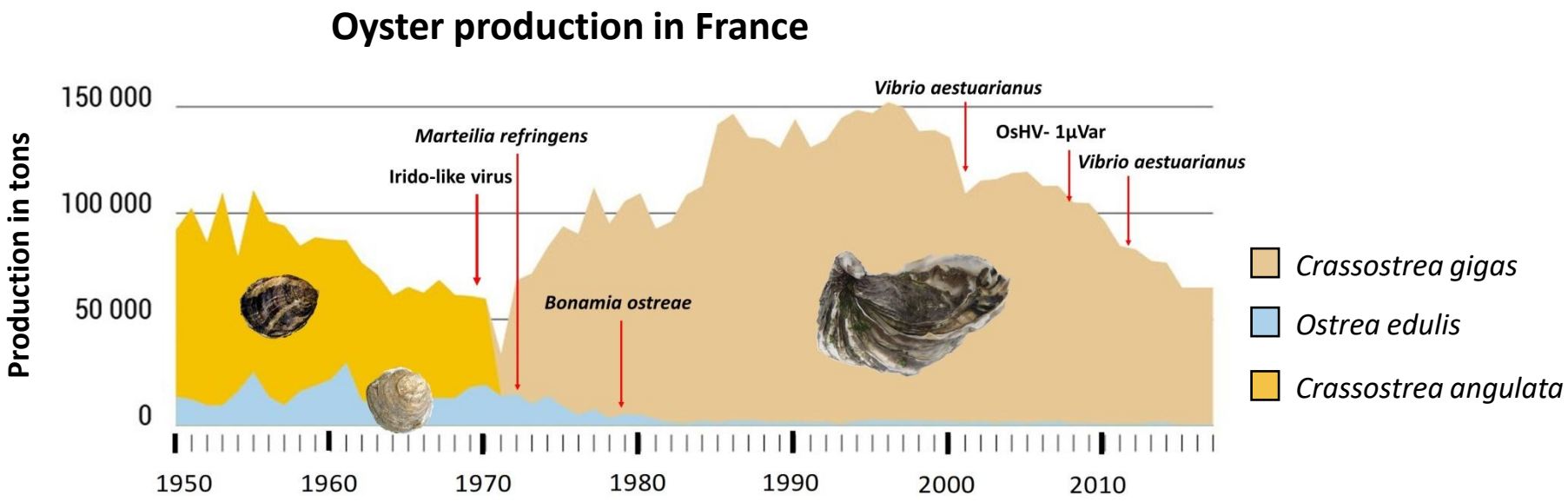
Journée SFN organisée en partenariat avec :

Valorization of the natural MICroflora of the *Crassostrea gigas* oyster for the development of PROBIOtics applied to shellfish farming (ProBioMic)

L. Dantan, J. Vidal-Dupiol, B. Petton, Y. Gueguen, L. Degremont, B. Morga, I. Bonnard, E. Toulza,

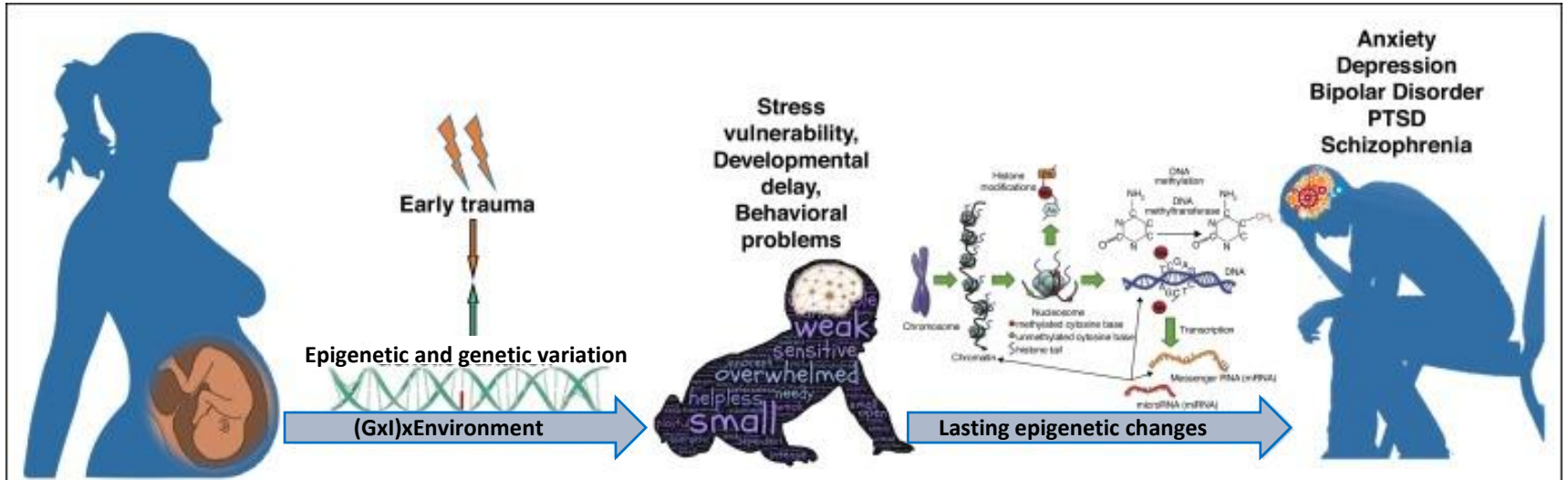
Céline Cosseau

Oyster Production in France



Can we use the « biological embedding » to influence oyster adaptation to disease outbreacks ?

The biological embedding

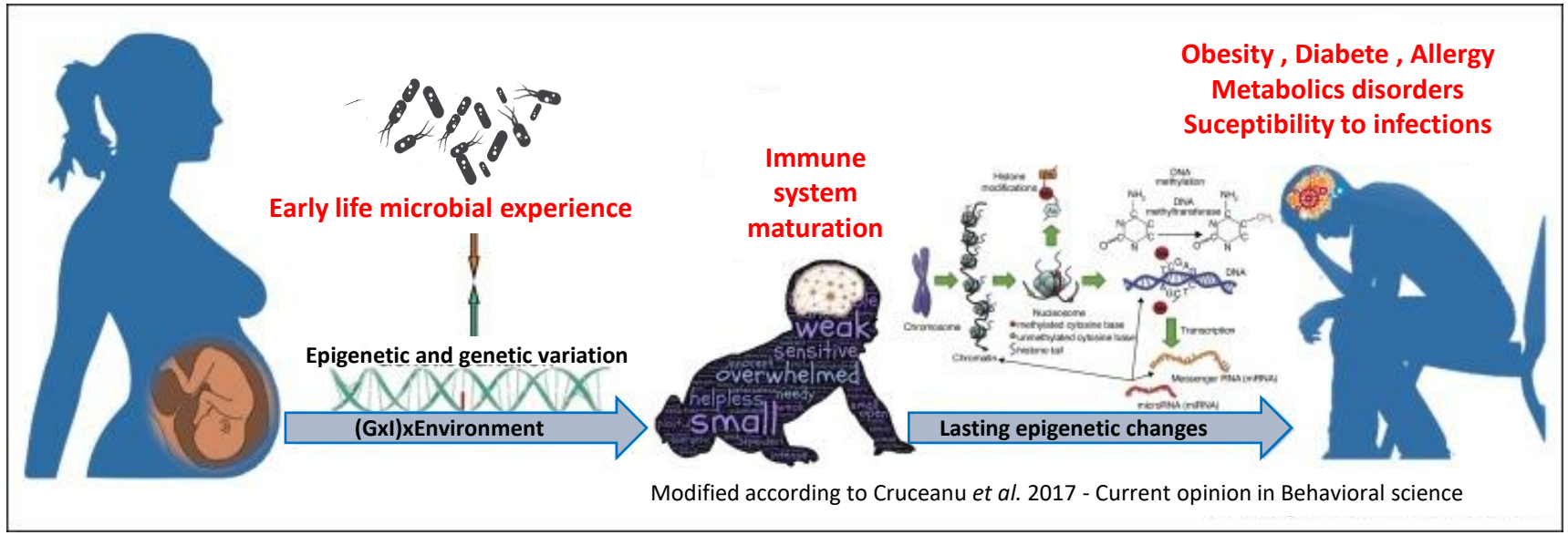


Modified according to Cruceanu *et al.* 2017 - Current opinion in Behavioral science

"Biological embedding" occurs when early life experience alters biological processes to affect later life health and well-being

Early development environments work together with genetic and epigenetic variation to generate health across the life course.

The biological embedding



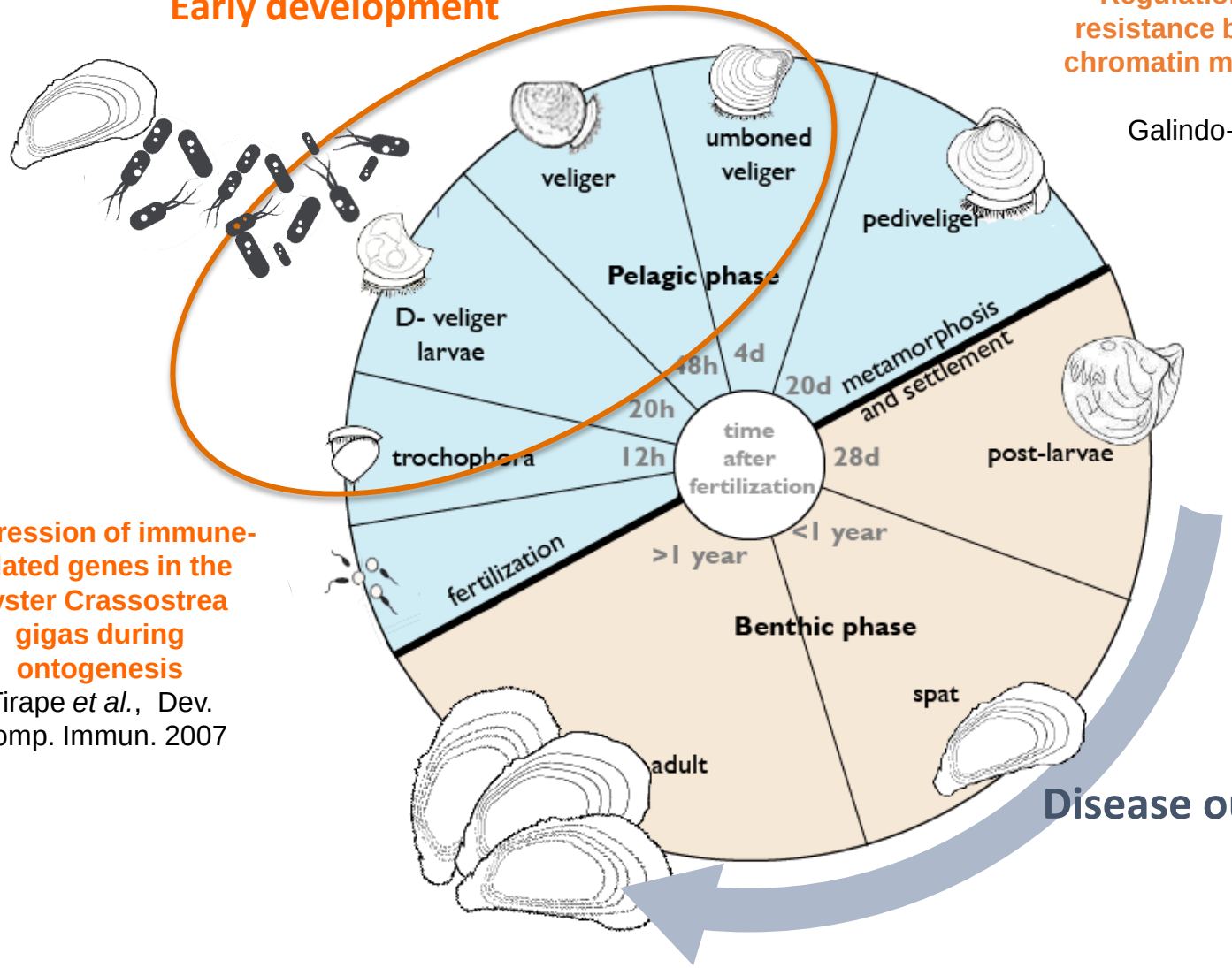
Modified according to Cruceanu *et al.* 2017 - Current opinion in Behavioral science

An exposome perspective: Early-life events and immune development in a changing world. *J Allergy Clin Immunol* **140**, 24-40

Gensollen, T., Iyer, S. S., Kasper, D. L., and Blumberg, R. S. (2016) How colonization by microbiota in early life shapes the immune system. *Science* **352**, 539-544

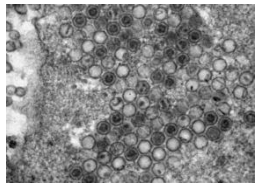
Can we educate the oyster immune system with an appropriate microbial exposure?

Early development



Regulation of immunity and disease resistance by commensal microbes and chromatin modifications during zebrafish development.
Galindo-Villegas et al. *PNAS* 2012

Expression of immune-related genes in the oyster Crassostrea gigas during ontogenesis
Tirape *et al.*, Dev. Comp. Immun. 2007

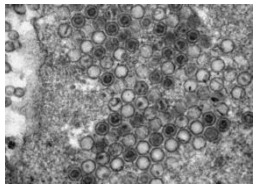


OsHV-1

Manon fallet
PhD thesis
University of Perpignan

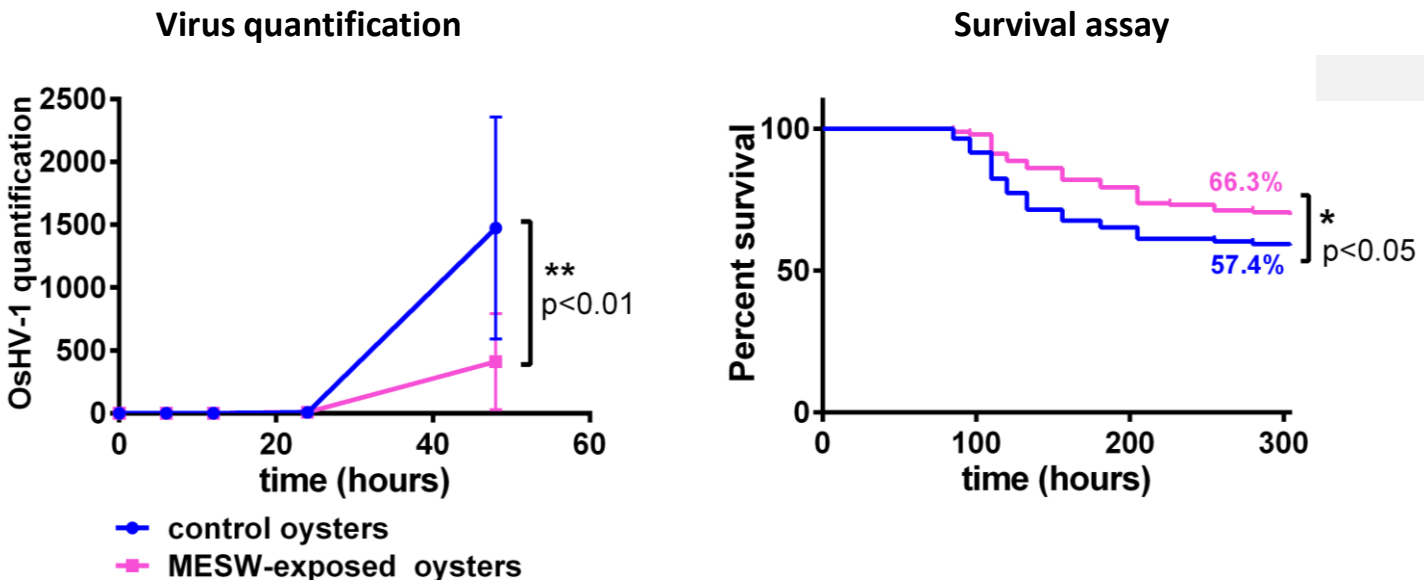
Disease outcomes at juvenile stages (POMS)

The survival increases in microbiota exposed oyster during a POMS disease outbreacks



OsHV-1

F1

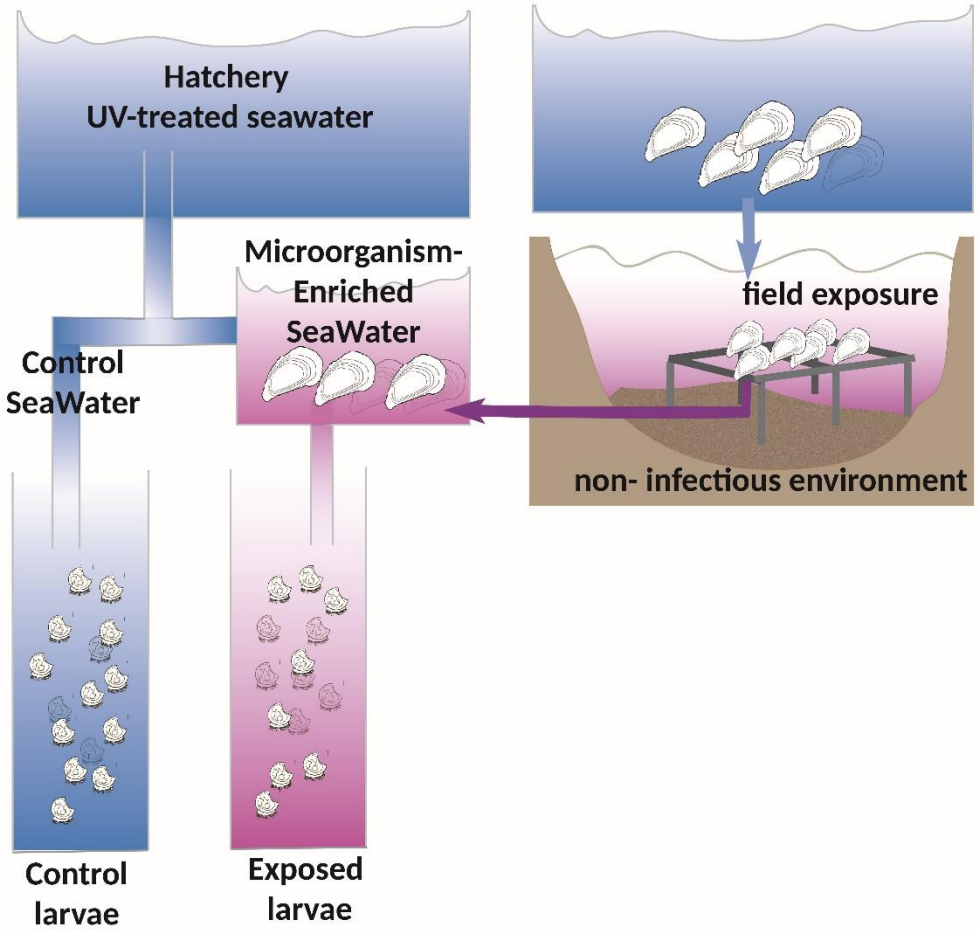


Manon fallet
PhD thesis
University of Perpignan

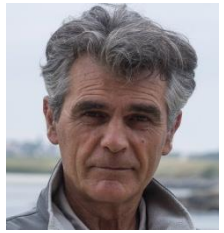
- Modulation of genes involved in immunity
- Intergenerational effect
- Epigenetic supports long term memory effect

Microbiome, 2022

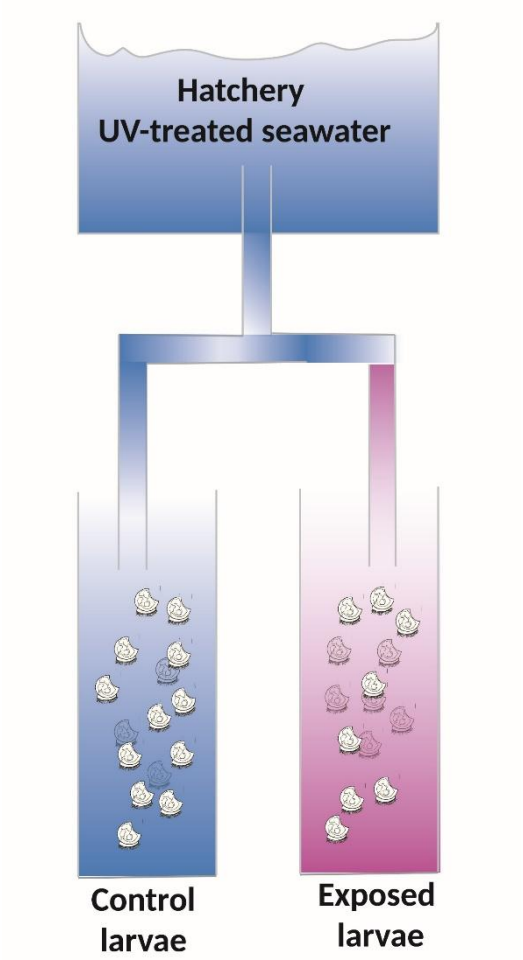
Experimental design for an appropriate microbiota early life exposure



Zootechny
Bruno Petton (IFREMER engineer)
Argenton facilities



Experimental design for « controlled » microbiota early life exposure

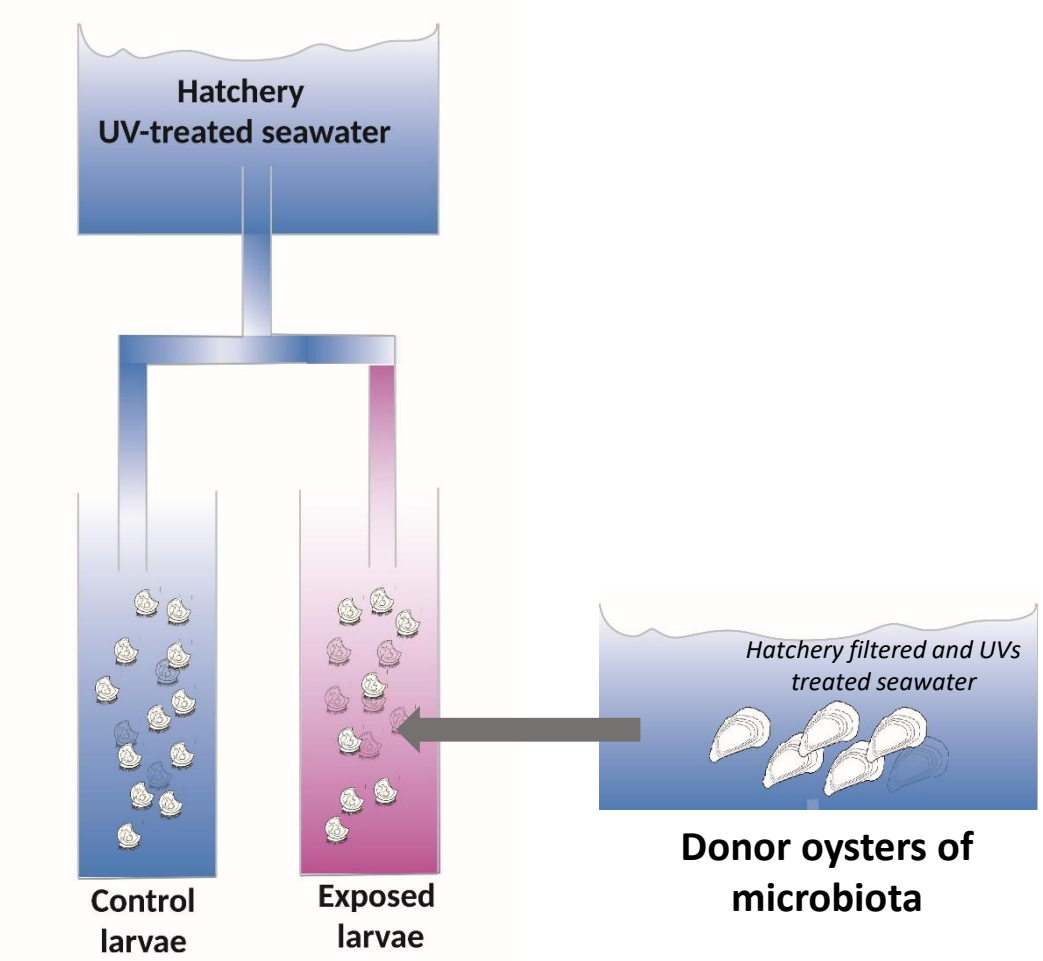


Station Ifremer de la Tremblade

Benjamin Morga

Lionnel Degremont

Experimental design for « controlled » microbiota early life exposure



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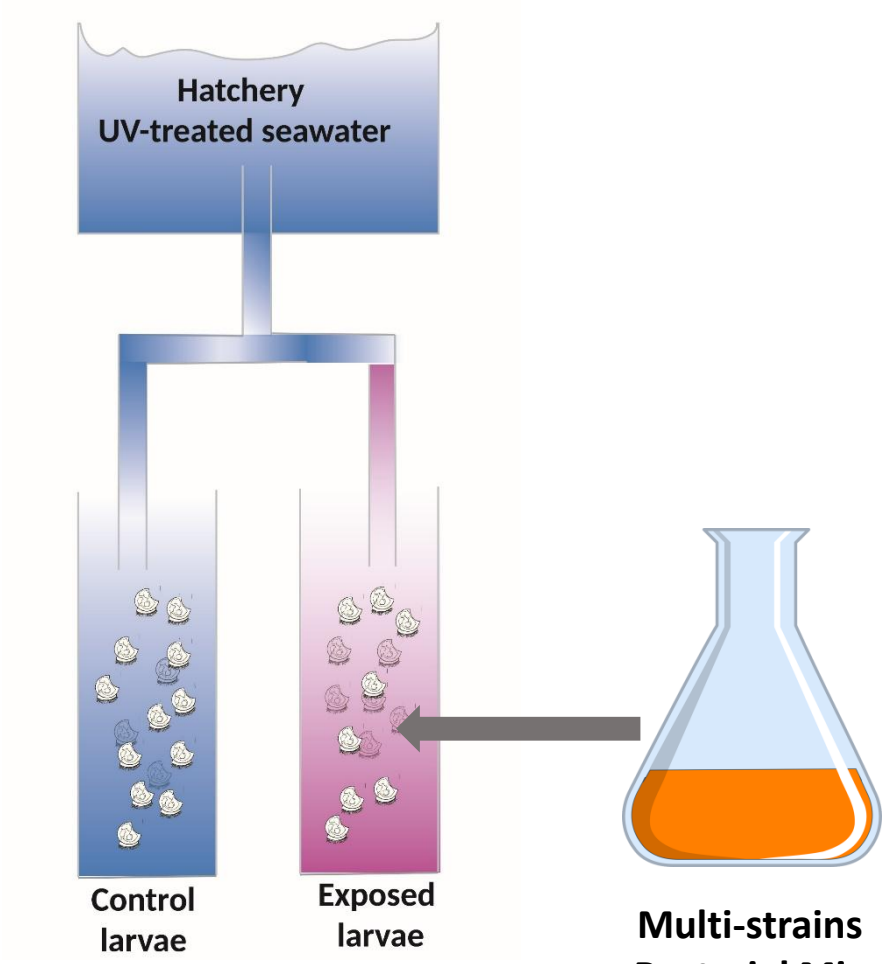


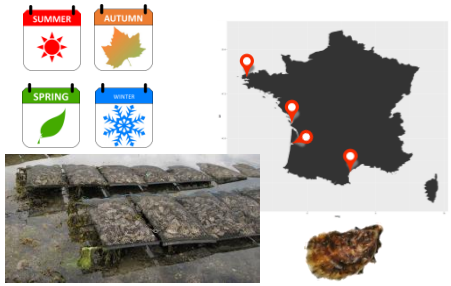
Station Ifremer de la Tremblade

Benjamin Morga

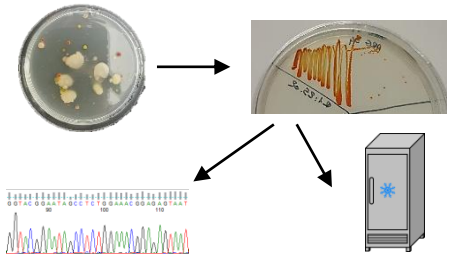
Lionnel Degremont

Bacterial cocktail design

Animals sampling



Bacteria isolation and identification (n=328)

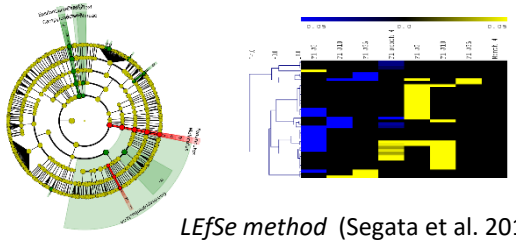


SANGER sequencing

Cryopreservation at -80°C

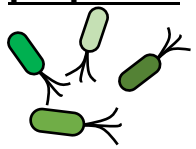
Bacterial collection

Correlation study of microbiota

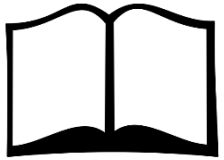


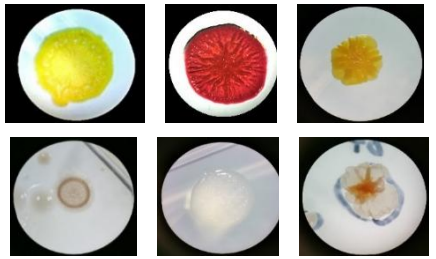
LEfSe method (Segata et al. 2011)

Candidate bacterial proposals



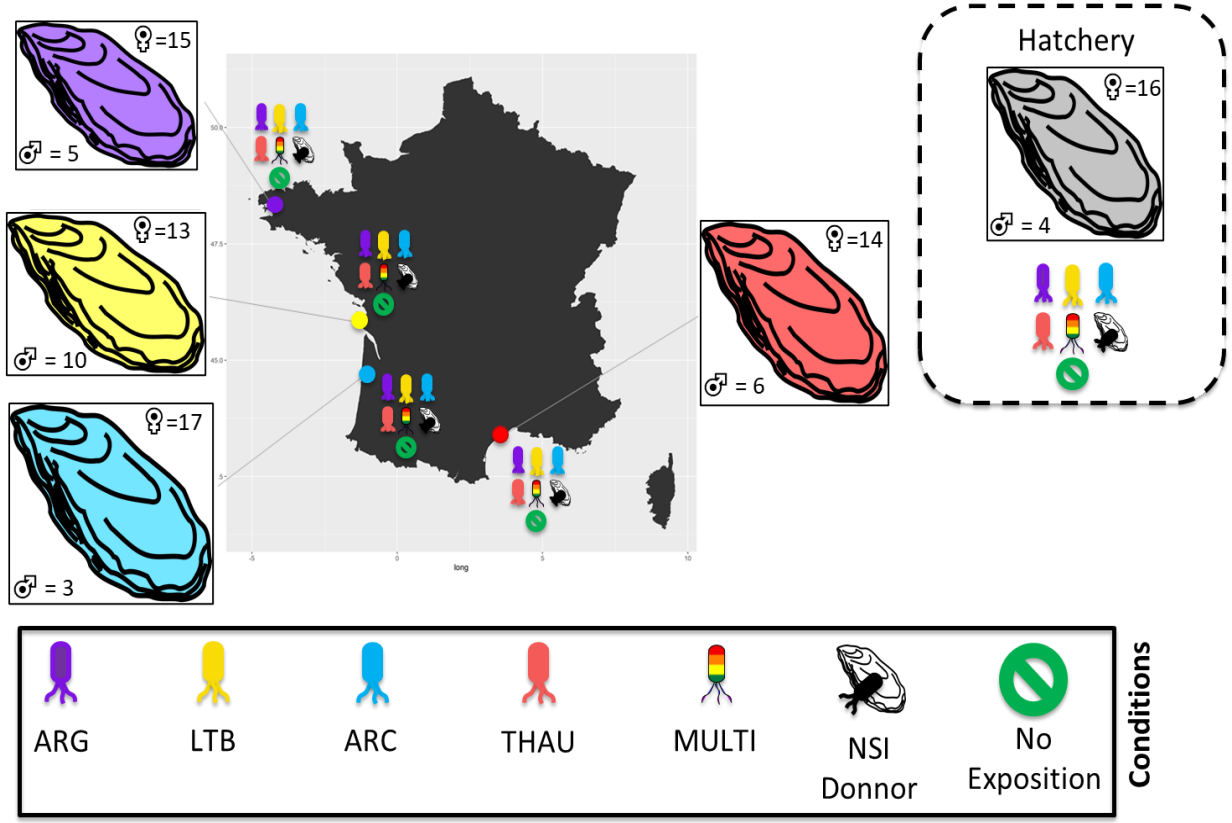
Scientific literature





Doctorant
Luc Dantan (IHPE - UPVD)
Région Occitanie

Bacterial cocktail design



- 4 bassins d'élevage
- 2 saisons
- Huitres résistantes
- Sélection sur 2 milieux de culture et 2 températures

Multi-strains Bacterial Mix

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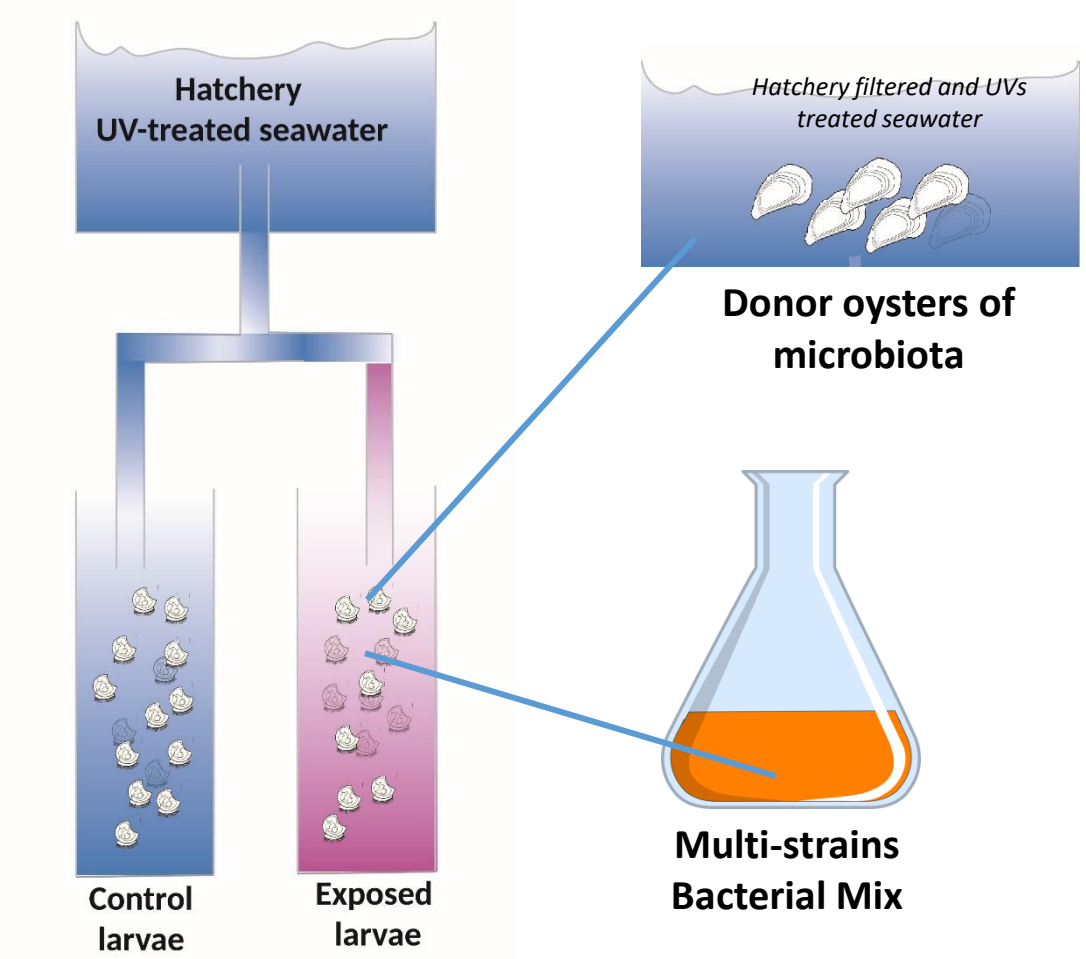
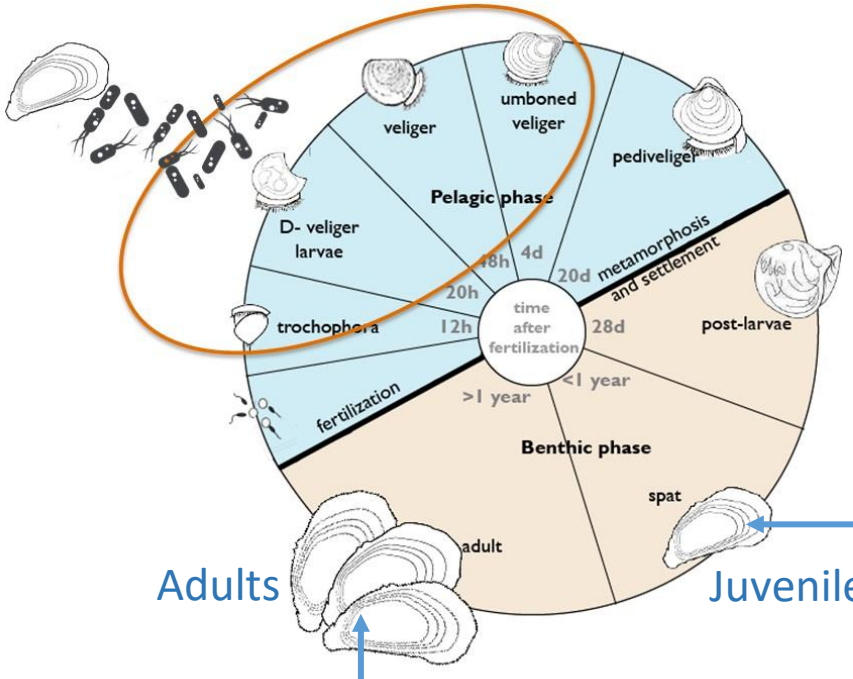
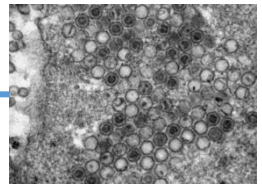
Région Occitanie

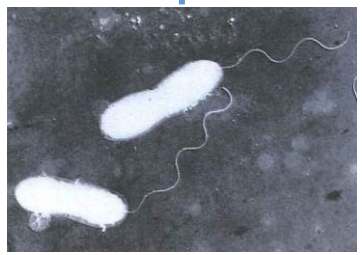
Experimental design for « controlled » microbioba early life exposure





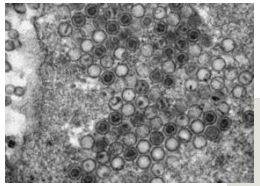


OsHV-1



Vibrio aestuarianus

Experimental infection results against the POMS disease – *OsHV-1* – Juvenile stages



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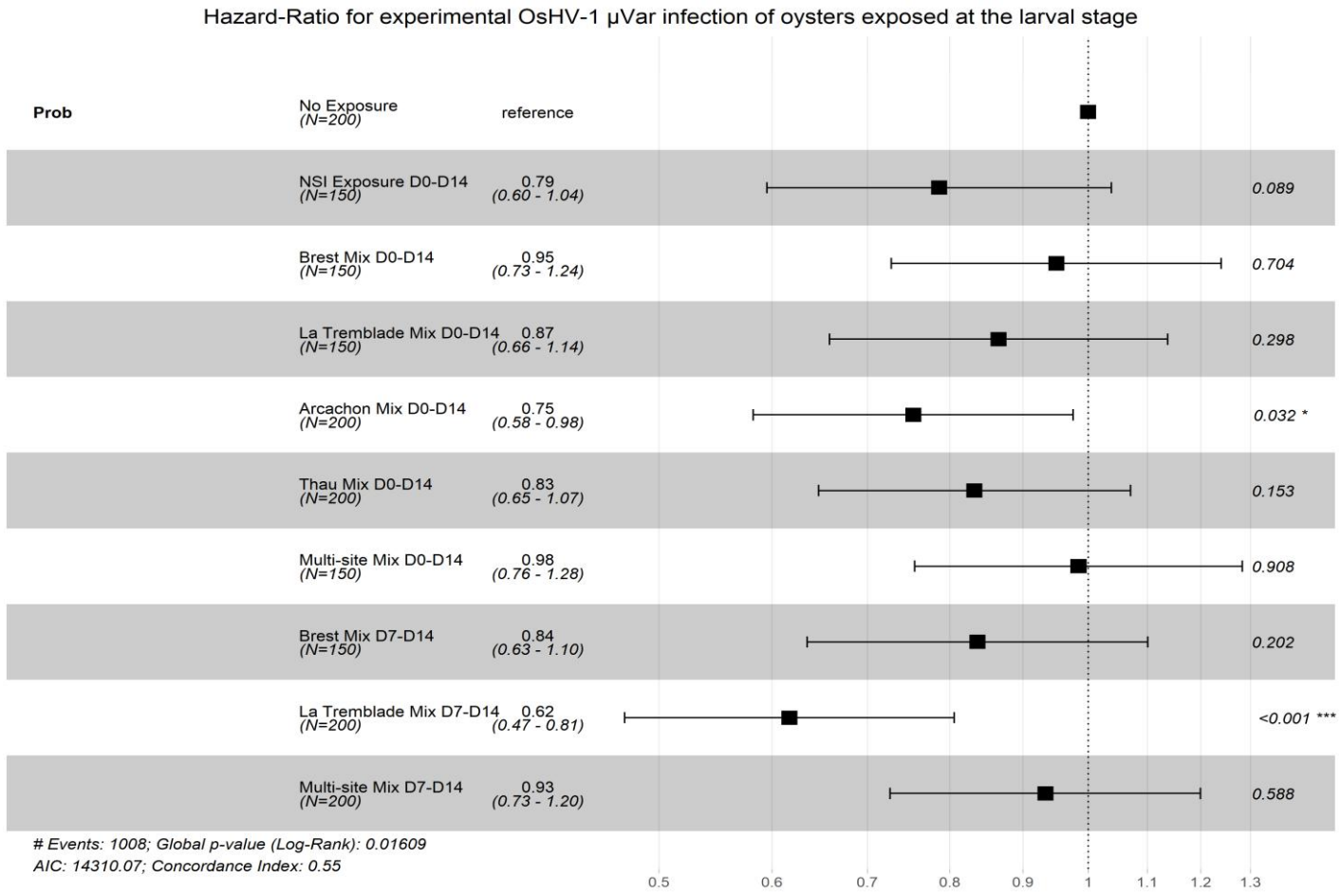

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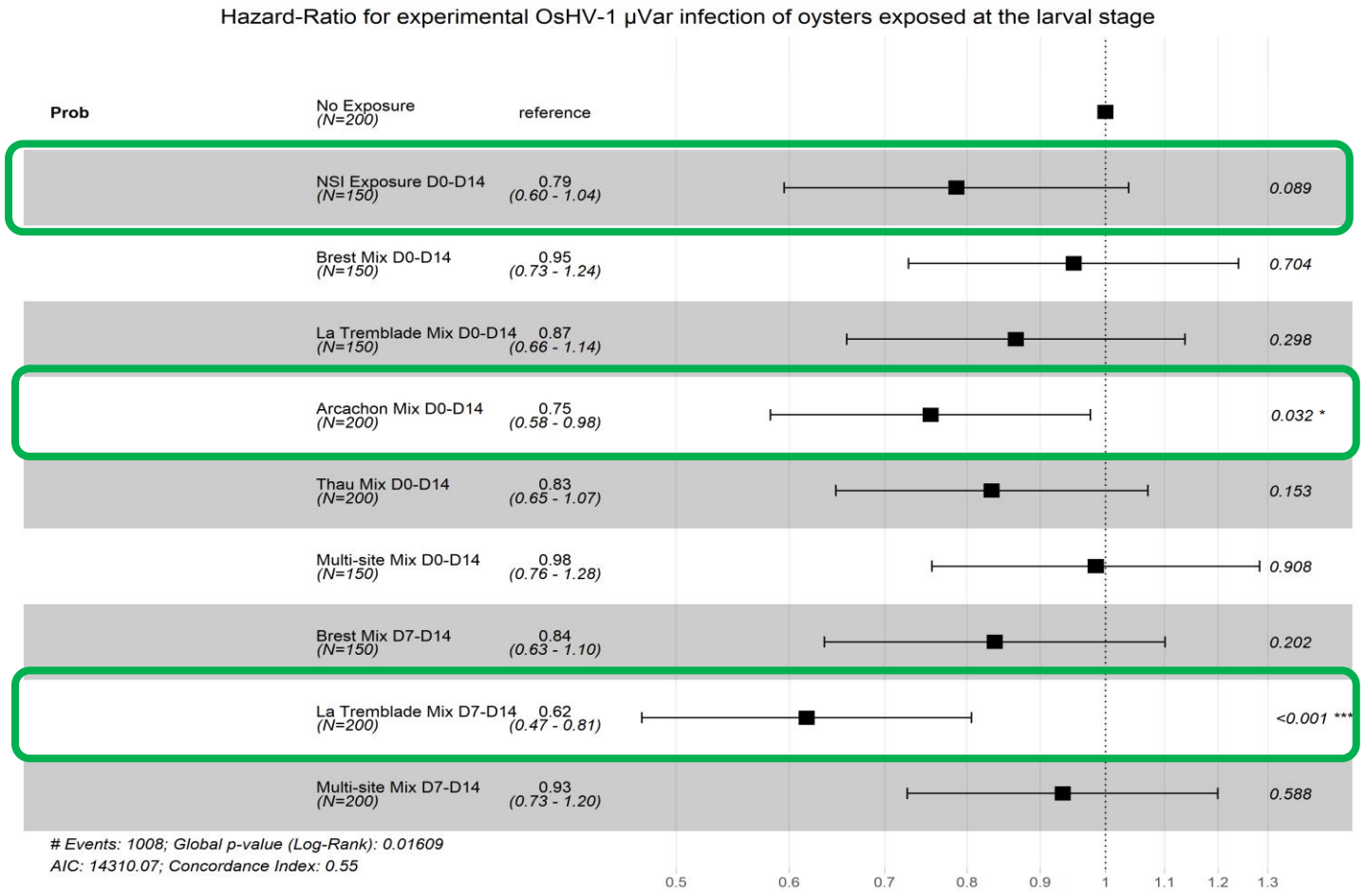
Experimental infection results against the POMS disease – *OsHV-1* – Juvenile stages



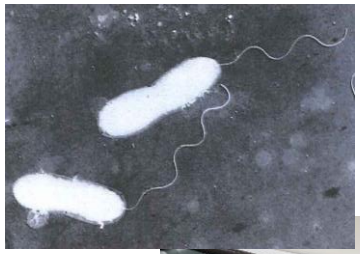
21% reduction in mortality risk due to bacteria exposure compared to the no exposure condition

25% reduction in mortality risk due to bacteria exposure compared to the no exposure condition

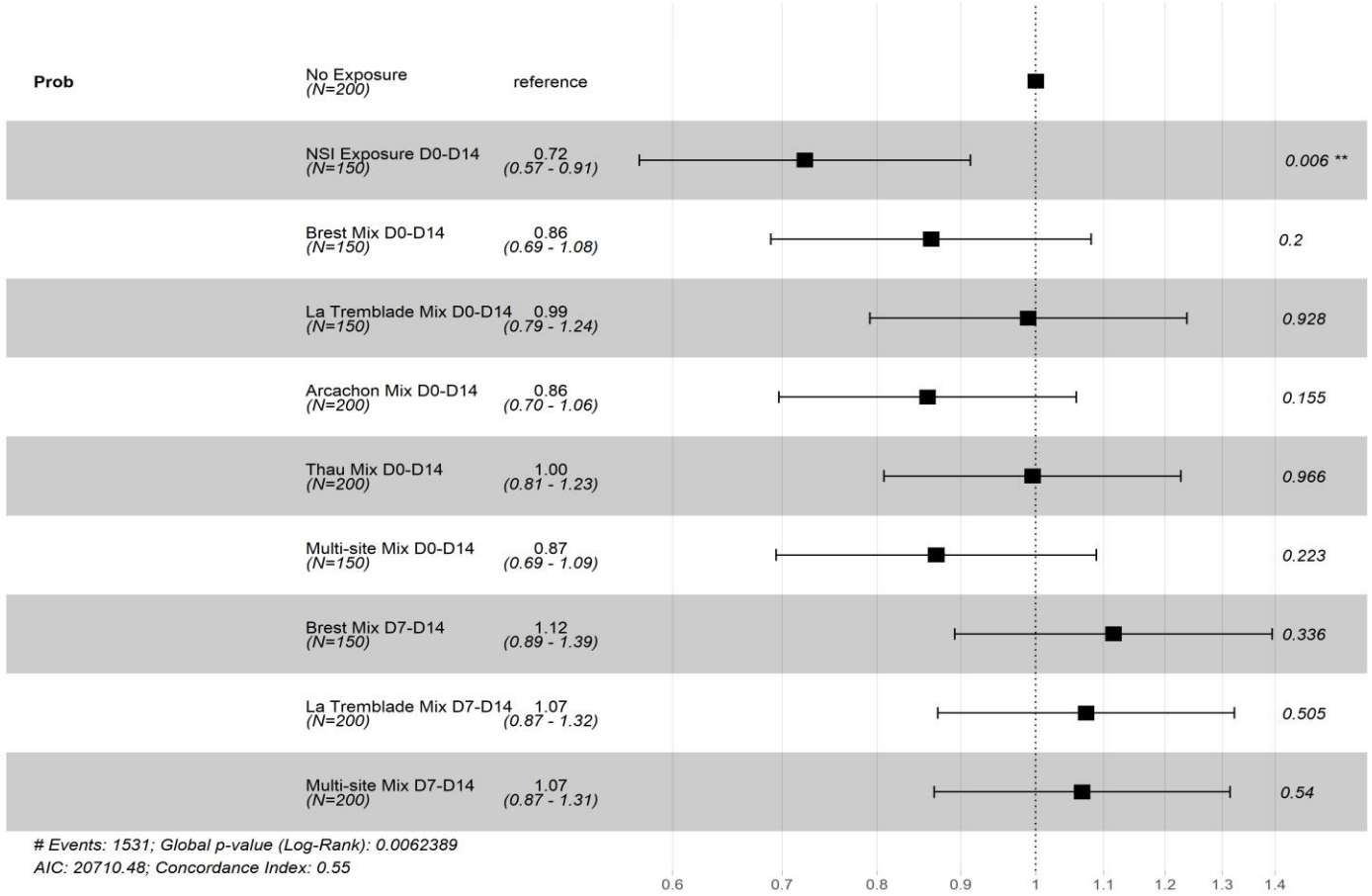
38% reduction in mortality risk due to bacteria exposure compared to the no exposure condition

Experimental infection results against *Vibrio aesturianus* – *Vibrio* - Adults stage

Vibrio aestuarianus

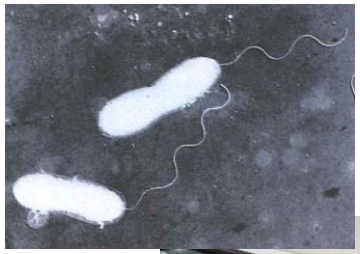


Hazard-Ratio for experimental V. aestuarianus infection of oysters exposed at the larval stage



Experimental infection results against *Vibrio aestuarianus* – *Vibrio* - Adult stage

Vibrio aestuarianus



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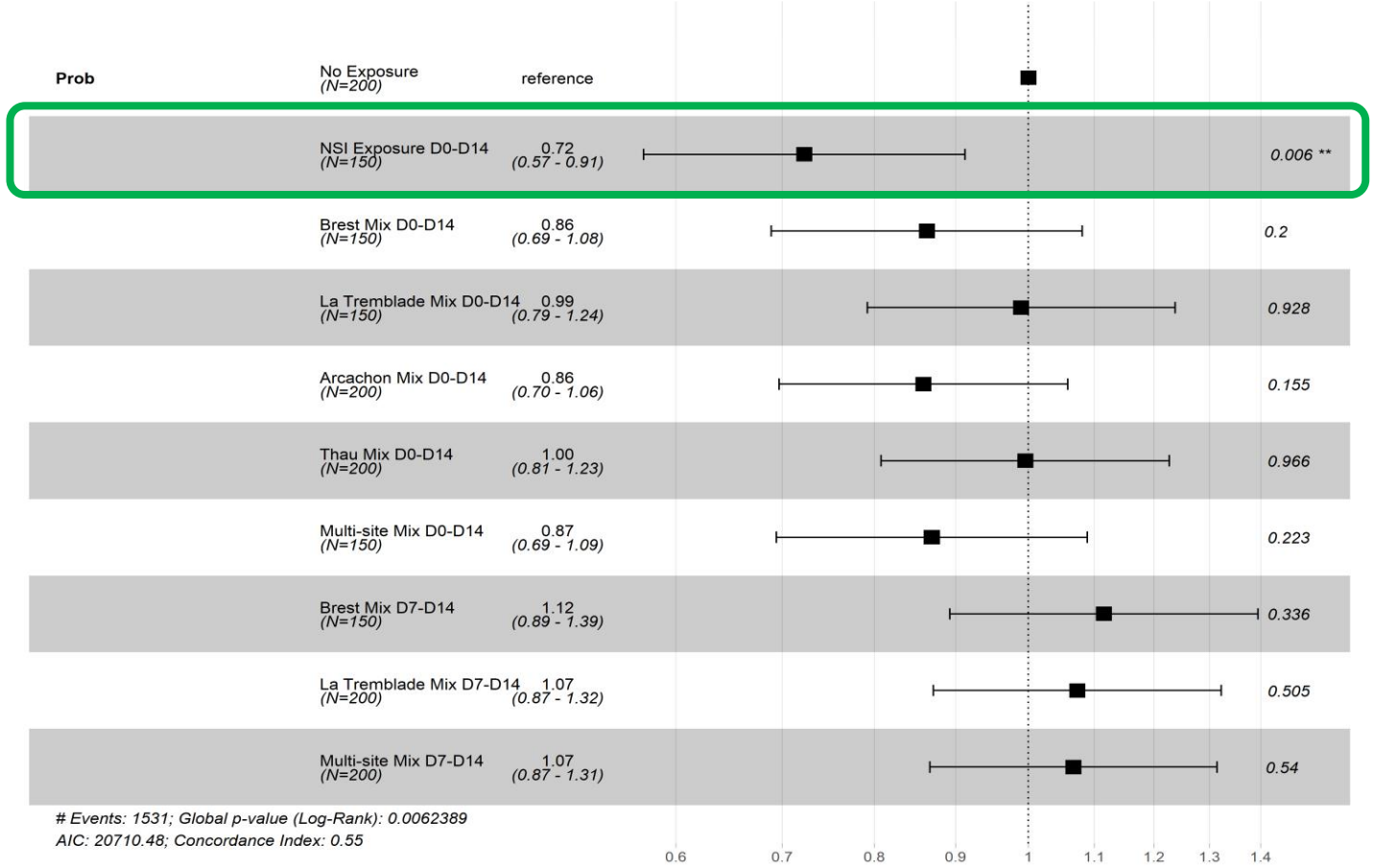
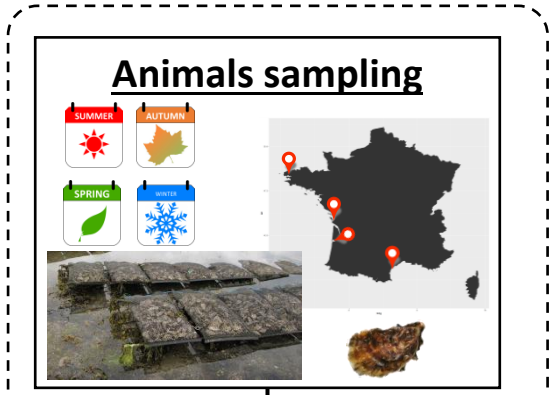
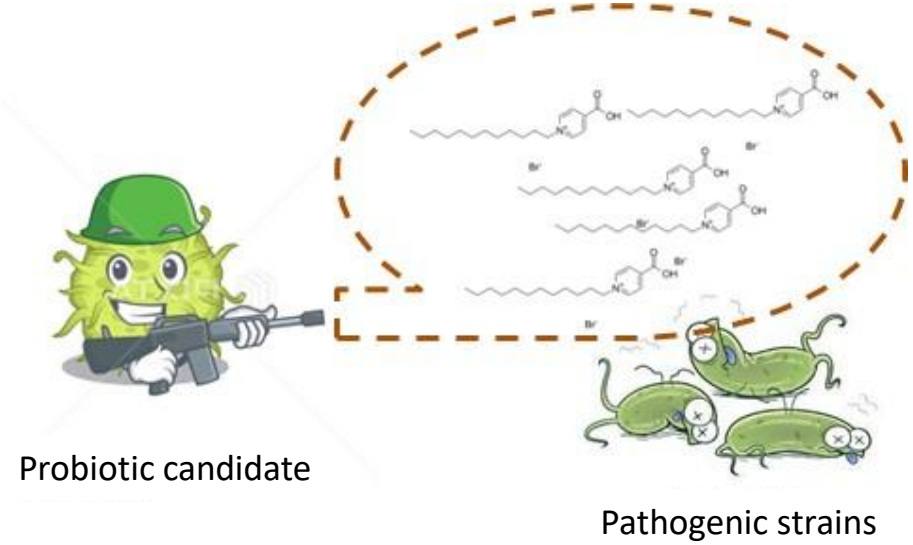


28% reduction in mortality risk due to bacteria exposure compared to the no exposure condition

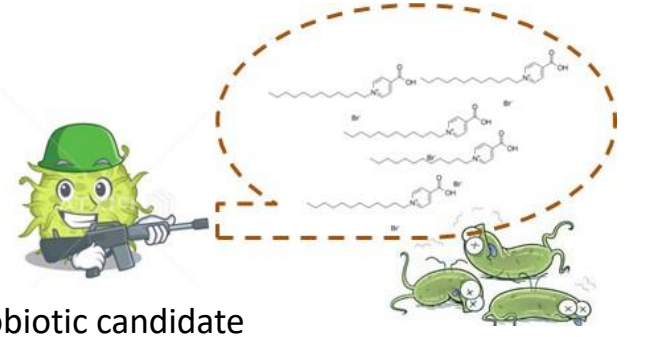
Identification of probiotic strains with antagonist effects





Prunelle Carcassonnes
Master 2 student
ERJ Cemeb Luc Dantan

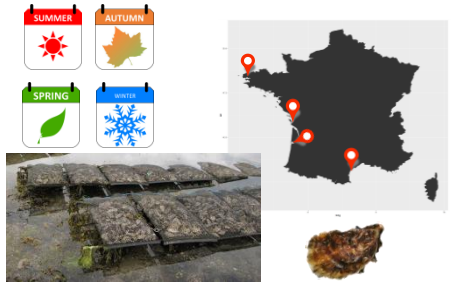
Identification of probiotic strains with antagonist effects



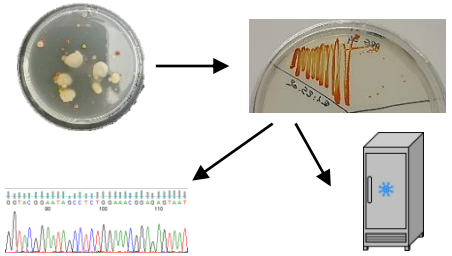
Probiotic candidate

Pathogenic strains

Animals sampling



Bacteria isolation and identification (n=328)

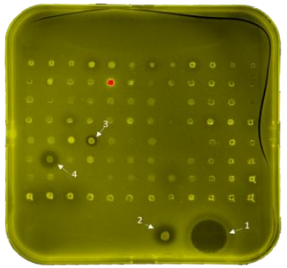


SANGER sequencing

Cryopreservation at -80°C

Bacterial collection

78 bacteria with antimicrobial effect against oyster pathogens

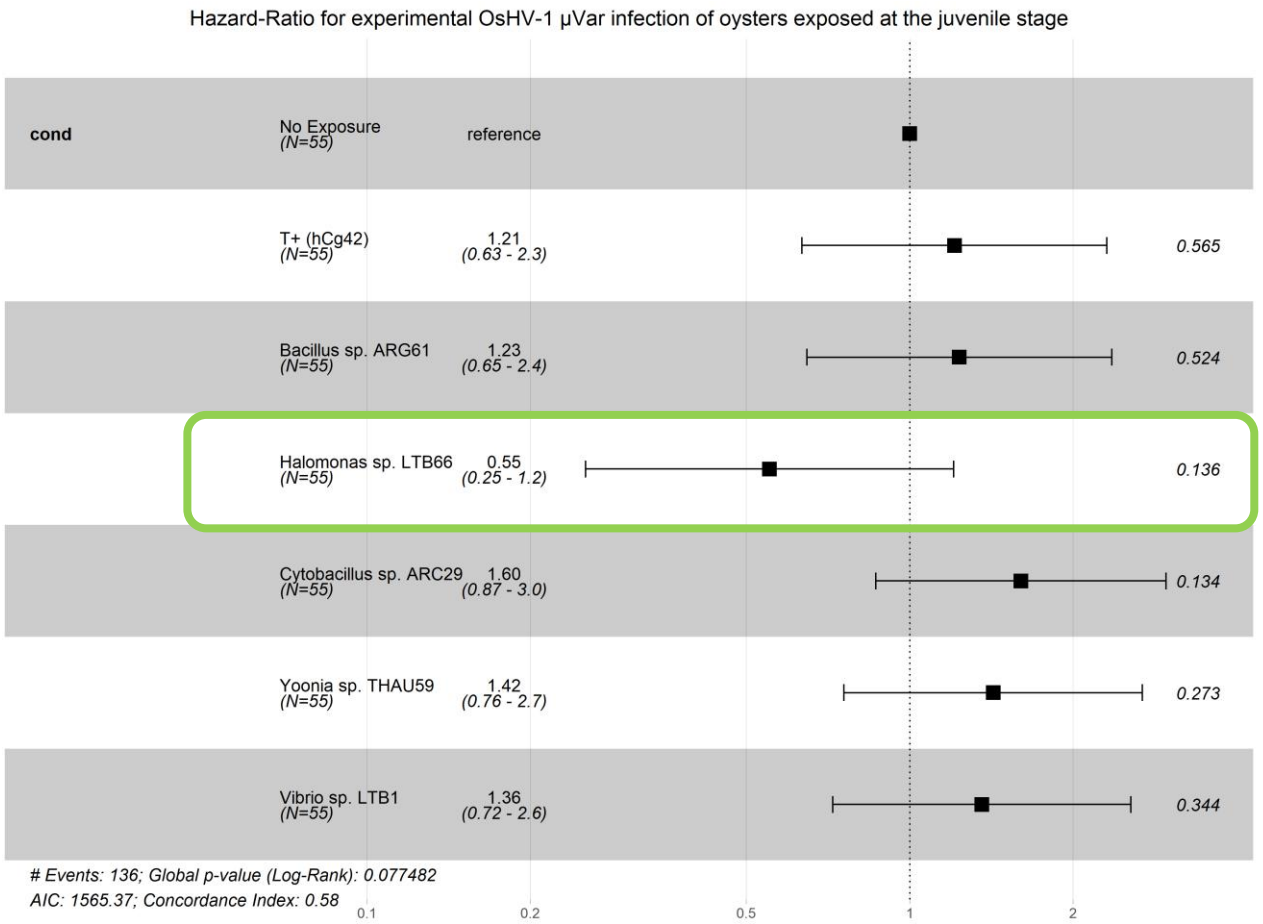


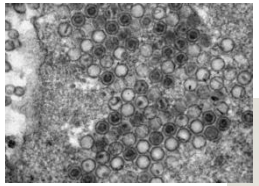
Screening for *in vitro* antimicrobial activity

Tests of 5 candidates for antagonistic effect

Experimental infection

Experimental infection results against the POMS disease – *OsHV-1* – Juvenile stages



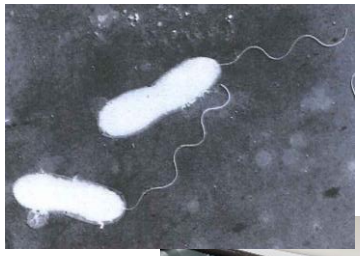


OsHv-1

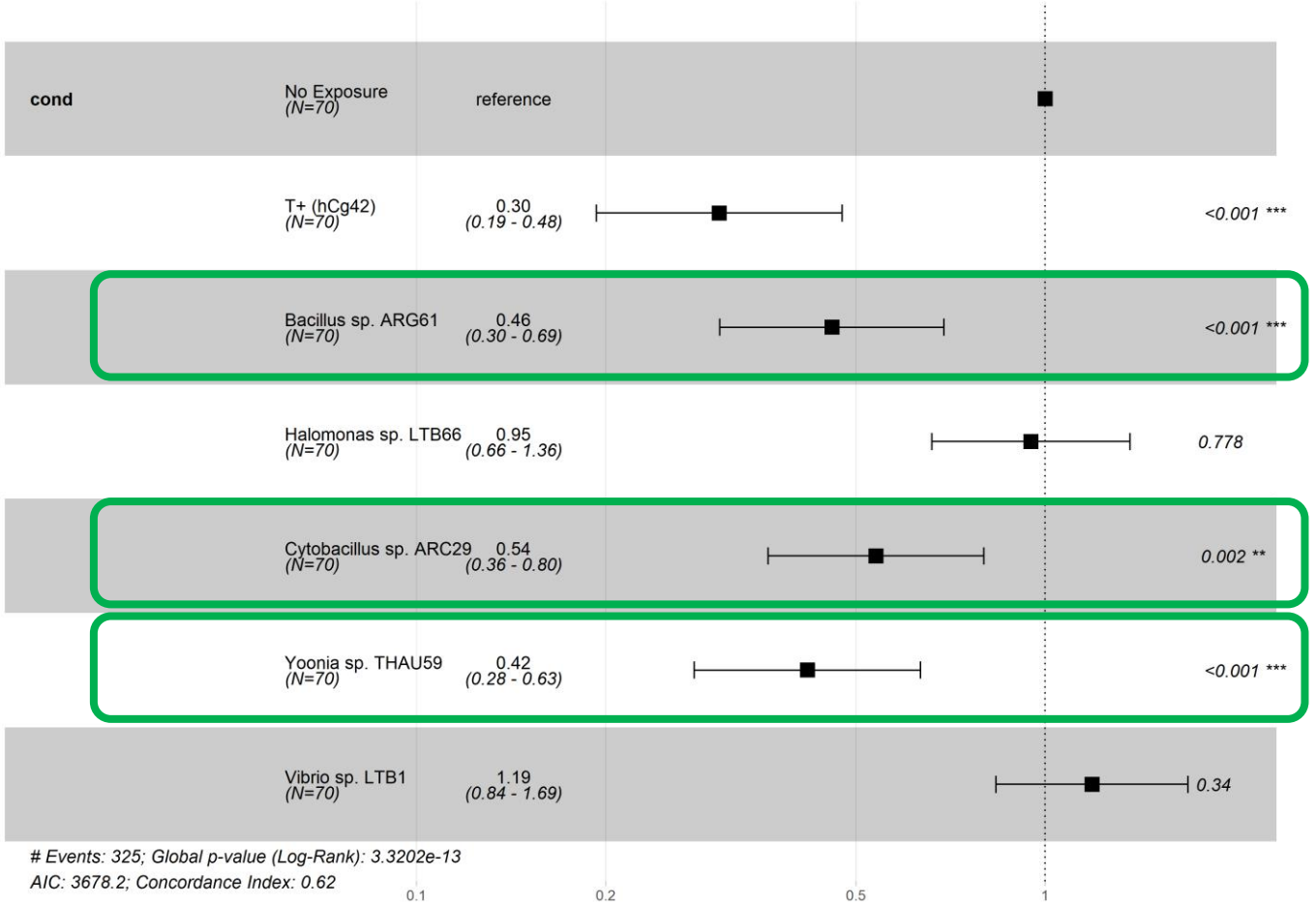
45% reduction in mortality risk

Experimental infection results against *Vibrio aesturianus* – *Vibrio* - Adults stage

Vibrio aestuarianus



Hazard-Ratio for experimental Vibrio aestuarianus infection of oysters exposed at the juvenile stage



54% reduction in mortality risk

46% reduction in mortality risk

58% reduction in mortality risk

Acknowledgments

UMR 5244 IHPE

Caroline Montagnani *Manon Fallet*
Julien de Lorgeril *Guillaume Mitta*
Eve Toulza *Jérémie Vidal-Dupiol*
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Yannick Gueguen *Cristian Chaparro*
Jean-Michel Escoubas *Agnès Vergnes*
Ingo Bulla *Marie Agnes travers*
Prunelle Carcassonne *Luc Dantan*
Delphine Destoumieux *Gaelle Courtay*
Noémie de San Nicolas *Laeticia Essomba*
Océane Romatif *Cécile Blanchon*

Ifremer La Tremblade

Lionel Degremont
Elise Maurouard
Benjamin Morga
Mickaël Mege
Delphine Tourbiez
Cyrielle Lecadet
Abdellah Benabdelmouna
Christophe Ledu

Lbbm

Raphaël Lami
Laurent Intertaglia
Carole Veckerle
Emilie Adouane

CRIOBE

Isabelle Bonnard

LBCM

Yannick Fleury
Hélène Laguerre

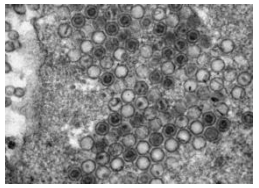
UMR 6539 LEMAR- station Ifremer Argenton

Bruno Petton
Marianne Alumno-Bruscia
Isabelle Queau
Jacqueline Le Grand

CBGP - *Simon Boitard*

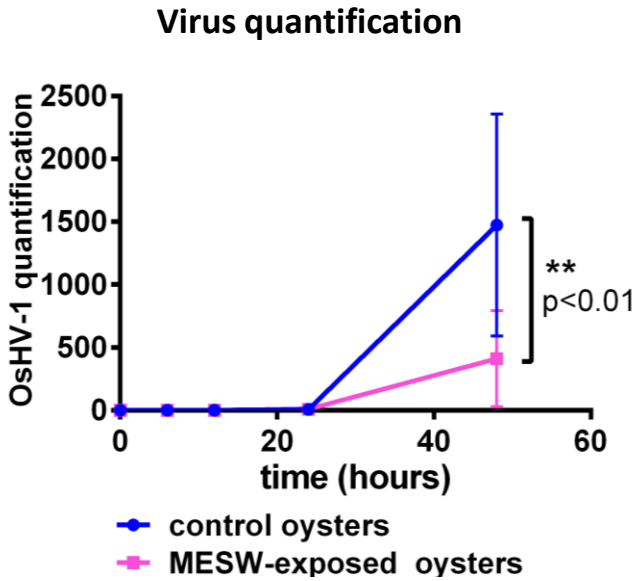
CRCM- Adeline Perignon/Denis Regler

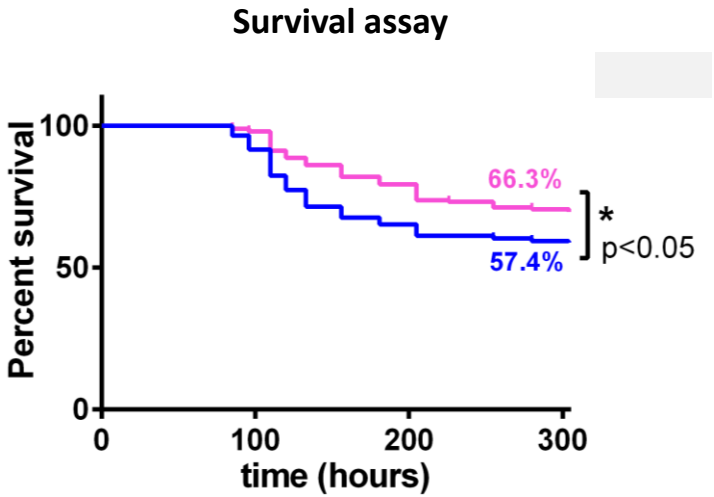
The survival increases in microbiota exposed oyster during a POMS disease outbreacks



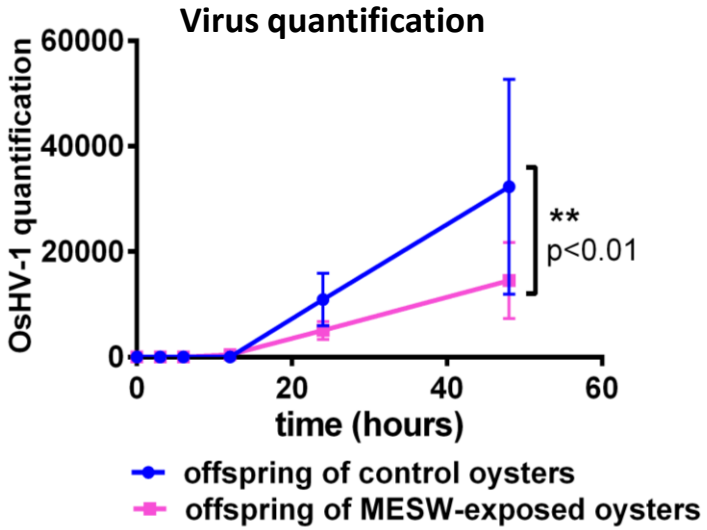
OsHv-1

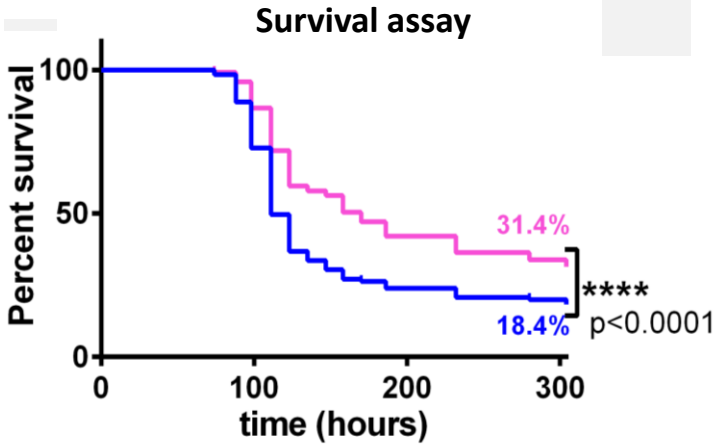
F1





F2





Also observed in the field