

First experimental insights of key transmission parameters for *Vibrio aestuarianus* infection of Pacific oyster, *Crassostrea gigas*

Coralie Lupo¹, Delphine Tourbiez¹, Pauline Ezanno^{2,3}, Marie-Agnès Travers¹

Background

- Since 2012 in France, an apparent increase of mortality events was observed in adult Pacific oysters, *Crassostrea gigas*, in association with the detection of the bacteria *Vibrio aestuarianus*.
- No representative field data.
- Knowledge on transmission parameters of *Vibrio aestuarianus* infection could be useful to limit its spread and establishment in oyster populations.

Objective

To develop and calibrate a simulation model representing the spread of *Vibrio aestuarianus* within an oyster population

The model

We described the within-population dynamics of *Vibrio aestuarianus* infection by a deterministic compartmental SWEI model incorporating a water reservoir of *Vibriosis*, which was adapted from an earlier model of *Vibrio cholerae* (Codeço, 2001, BMC Infectious Diseases, 1:1).

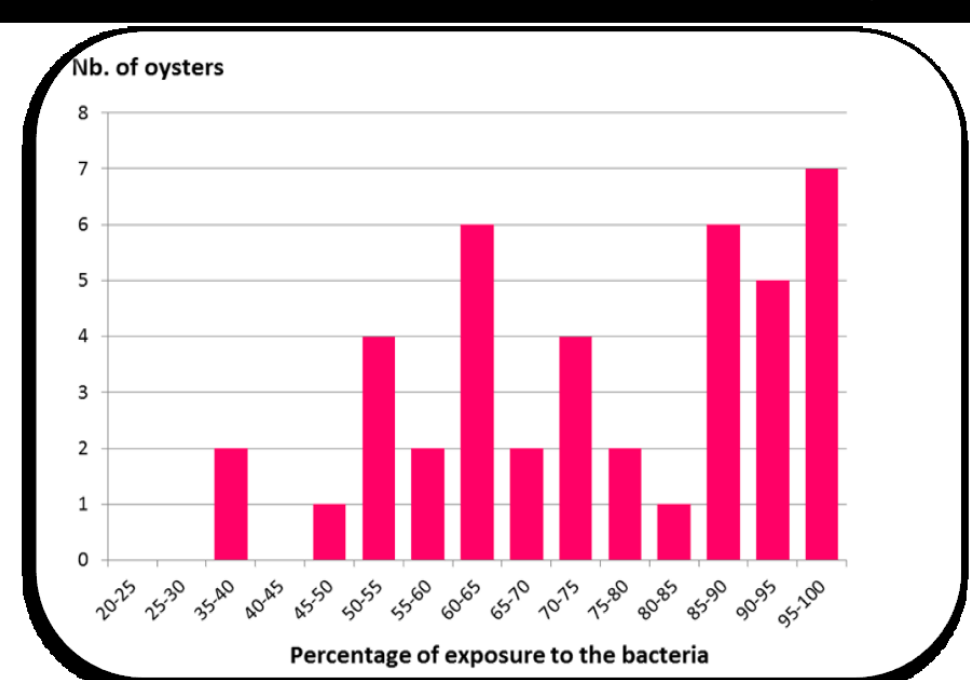


Estimation of model parameters

We estimated five parameters based on experimental assays:

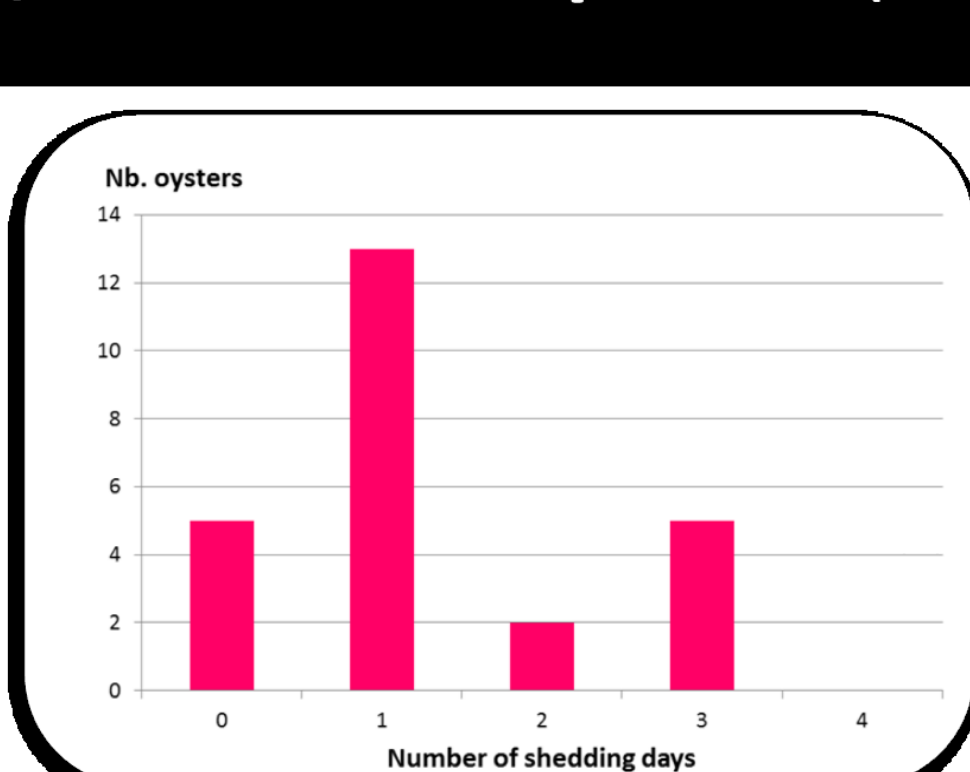
- exposure rate to the contaminated seawater
- concentration of bacteria in water that yields 50% of chances of catching the infection
- infectious period
- bacteria shedding rate
- pathogen lifetime in water

a: Exposure rate to the contaminated seawater (day⁻¹)



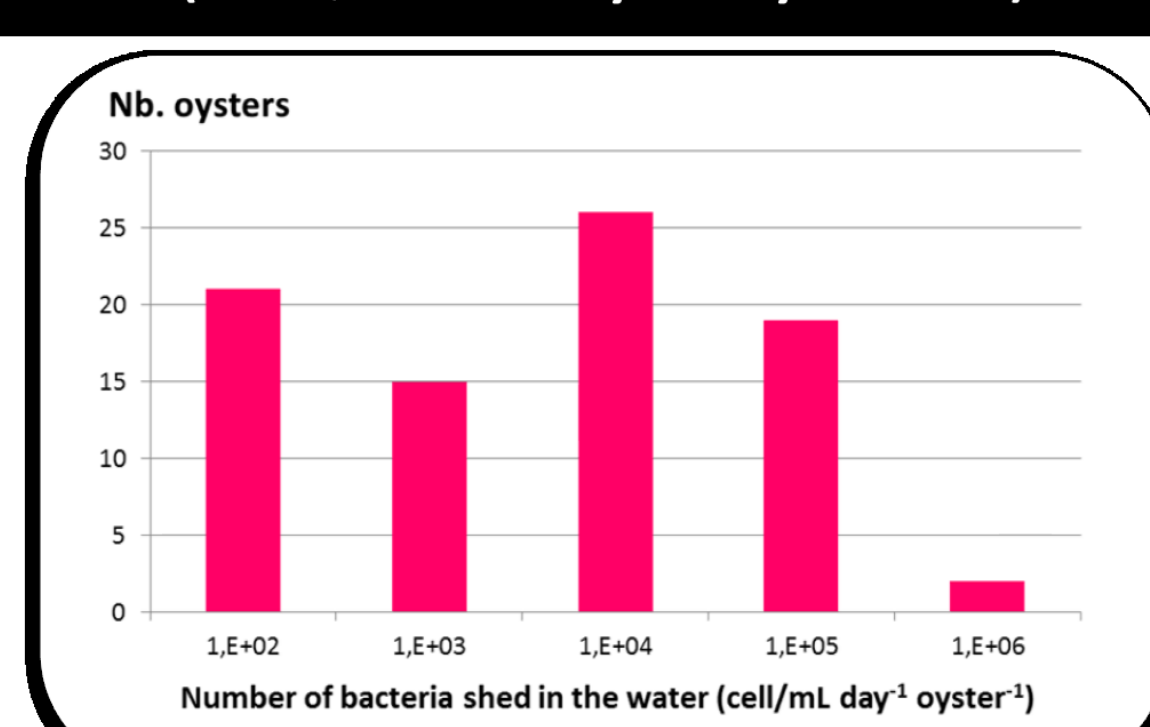
$$a \sim \text{Unif}(0.45, 1)$$

1/r: Infectious period (day)



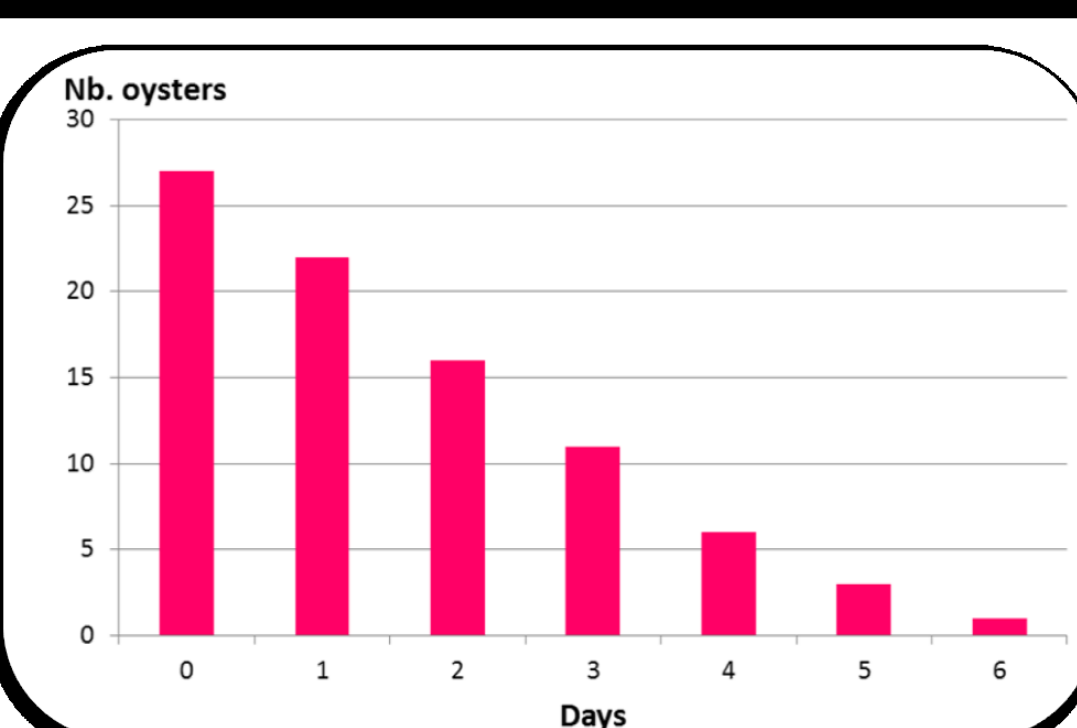
$$1/r \sim \text{Triangular}(0; 3; 1)$$

e: Bacteria shedding rate (cell/mL day⁻¹ oyster⁻¹)



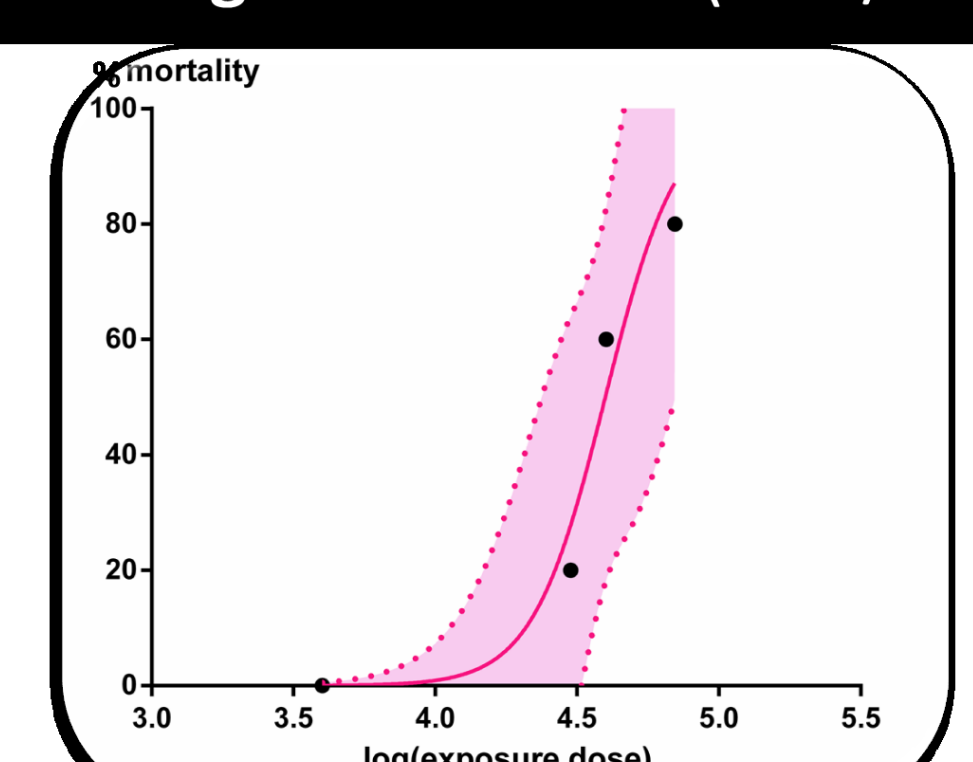
$$e \sim \text{Unif}(10^2; 10^5)$$

1/ξ: Pathogen lifetime in water (day)



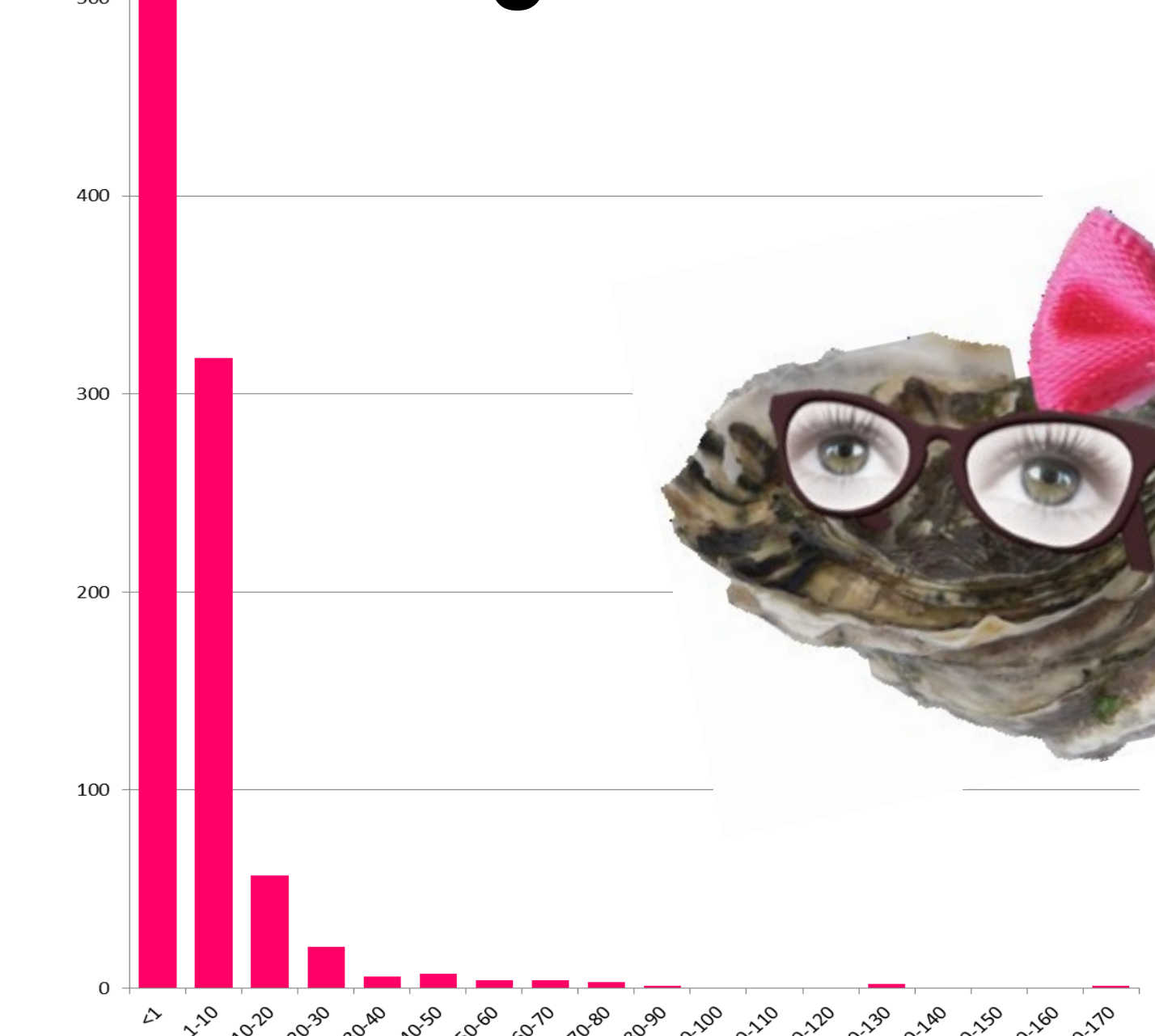
$$1/\xi \sim \text{Exp}(0.65)$$

K: Concentration of bacteria in water that yields 50% of chances of catching the infection (cells/mL)



$$K = 4.6 \times 10^{-4}$$

R₀ distribution



Median = 0.80
Lower quartile = 0.12
Upper quartile = 4.10



Perspectives

- Implement the influence of environmental conditions on the transmission parameters in the model
- Validate the model against dedicated field data

¹ IFREMER-French Research Institute for exploitation of the Sea, La Tremblade, France

² INRA, UMR 1300 BioEpAR, France

³ LUNAM Université ONIRIS, UMR 1300 BioEpAR, France