Environmental stress in the pacific oyster *Crassostrea gigas* during gametogenesis: role of herbicides?

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INTRODUCTION:

In the Atlantic French coast, significant mortalities were observed in oyster beds during the gametogenesis. Pacific oysters have genetically been selected on the basis of their resistance towards mortality in the field."R" and "S" families have been identified as low (R) and high (S) mortality rates. A field study with oysters reared at two different levels (15 to 70 cm) from the sediment has been conducted from March to July 2003. The aim was to evaluate the effort of adaptation between the two families and the distance from the sediment. The effort of adaptation is evaluated with the integrated response of six biomarkers (Metalothionein, catalase, glutathione-S-transferases, heat shock protein, glutamine synthetase and reactive oxygen species) calculated with the Integrated biological response (IBR) index.

MATERIAL & METHOD

1- Sampling design

Fig 1: The biggest site of oyster aquaculture along the Atlantic coasts of France is influenced by the flux of pollutants from the Charente river and the Gironde estuary. 18 months old oysters were cultivated at 15 and 70 cm of sediment in Perquis site between March and July in 2003

RESULTS AND DICUSSION

2- A « window of stress » during the gametogenesis

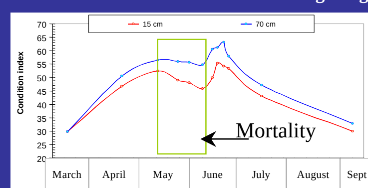

Fig 2: The condition index (CI) is a physiological indicator of quality expressed as the weight of tissue/ the weight shell) x 1000. The CI demonstrates a specific window of sensitivity between the mid-May and June with a highest decrease of oysters collected at 15 cm from the sediment bed.

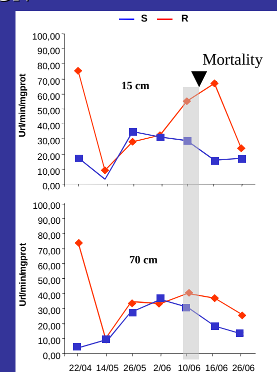

Fig 3: Vitellin (Vn) illustrates the effort of gametogenesis of R and S families reared at 15 and 70 cm from the sediment. The decrease of Vn on May the 14th confirms the stress observed with the CI (Fig 2) and a better capacity of R families.

2: Potential source of toxicity from sediment and water

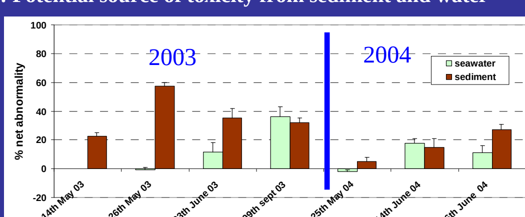

Fig 4: The embryotoxicity potential of water and sediment expressed as percentage of abnormable oysters larvae identified an increased toxicity of sediment in May 2003 and a combined toxicity of sediment and water in June 2003 and 2004.

3. Herbicide contamination in surface waters

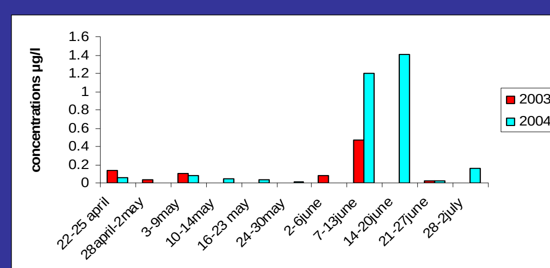

Fig 5 : The contamination with herbicides (cumulated values) in the surface water is highest in June during the period of mortality . Isoproturon and the glyphosate were the major contaminants identified in 2003 and 2004.

4: Comparison of stress between R and S families reared at 15 and 70 cm from the sediment with the Integrated Biological Response of biomarkers

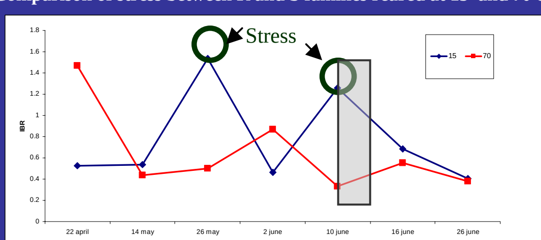

Fig 6 : The integrated biological index IBR developed by Beliaeff and Burgeot (2001), shows two major periods of stress from the sediment (15 cm) in May (26 th) and June (10 th). IBR variations shows a lower stress in June (2 sd) issue from the water before the mortality.

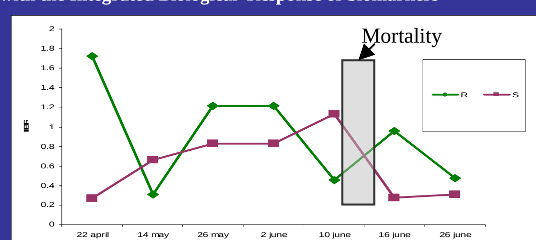

Fig 7: The IBR calculated for the R and S families shows two different strategies of adaptation. S families achieved a continuous effort of metabolism from April to the beginning of the mortality and a decline of the metabolism is observed during the mortality. The R families reduced their metabolism 8 days (2 June) before the mortality

CONCLUSIONS

- An increased stress came from the sediment in May and June.
- A combined stress issued from the sediment and the water during an advanced phase of gametogenesis in June could be a cause for mortality. Herbicides could be a source of toxicity in water.
- A different effort of adaptation was observed between the two families of oyster (R and S) before the mortality.

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REFERENCES: BELIAEFF, B. & BURGEOT, T., (2002). Integrated biomarker response: A useful tool for ecological risk assessment, *Environmental Toxicology and Chemistry*, 21, (6), 1316-1322.