



REPAMEP

REPONSE DES PALOURDES AUX STRESS ENVIRONNEMENTAUX COMBINANT METAUX, EFFLORESCENCES TOXIQUES ET PATHOGENES

MANILA CLAM RESPONSE TO ENVIRONMENTAL STRESS COMBINING METALS, TOXIC BLOOMS AND PATHOGENS

Programme LITEAU
Final report – Executive

Scientific Coordination:

Université Bordeaux 1 – CNRS, UMR 5805 EPOC
Xavier de Montaudouin, MCU-HDR
Station Marine d'Arcachon
2, rue du Pr Jolyet F-33120 Arcachon
x.de-montaudouin@epoc.u-bordeaux1.fr
Téléphone : 05 56 22 39 04
Télécopie : 05 56 83 86 51

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1. CONTEXT

The Manila clam *Ruditapes philippinarum* is the second exploited bivalve in the world. Fifty-seven fishing licences are yearly delivered in Arcachon Bay by the Regional Fishing Committee (Comité Régional des Pêches Maritimes et des Elevages Marins d'Aquitaine (CRPMEM Aquitaine)), in close association with the local department (Comité Départemental des Pêches Maritimes et des Elevages Marins de la Gironde (CDPMEM 33)). This fishery concerns ca. 100 fishermen (up to two fishermen per licence). Manila clams rank in second position in terms of intra-bay catch with 613 tons (Source: Base Pêche Aquitaine of CRPMEM Aquitaine (2011)). Clams are fished by foot, on the tidal flat at low tide.

Thus, Manila clams represent a major marine resource for fishermen of the bay. Consequently, fishermen have been implemented management rules for several years and they work in collaboration with scientists, mainly from EPOC (Université Bordeaux 1-CNRS) and Ifremer laboratories. REPAMEP studies contributed to the knowledge of Manila clam ecology and biology in the bay.

The originality of this project consists in the interdisciplinary approach gathering the impact of toxic phytoplankton blooms and metallic pollution on health (behaviour, stress, immunity, genetic) and disease development of the Manila clam (Figure 1). This study considered the Manila clam within its environment, including associated bacteria communities.

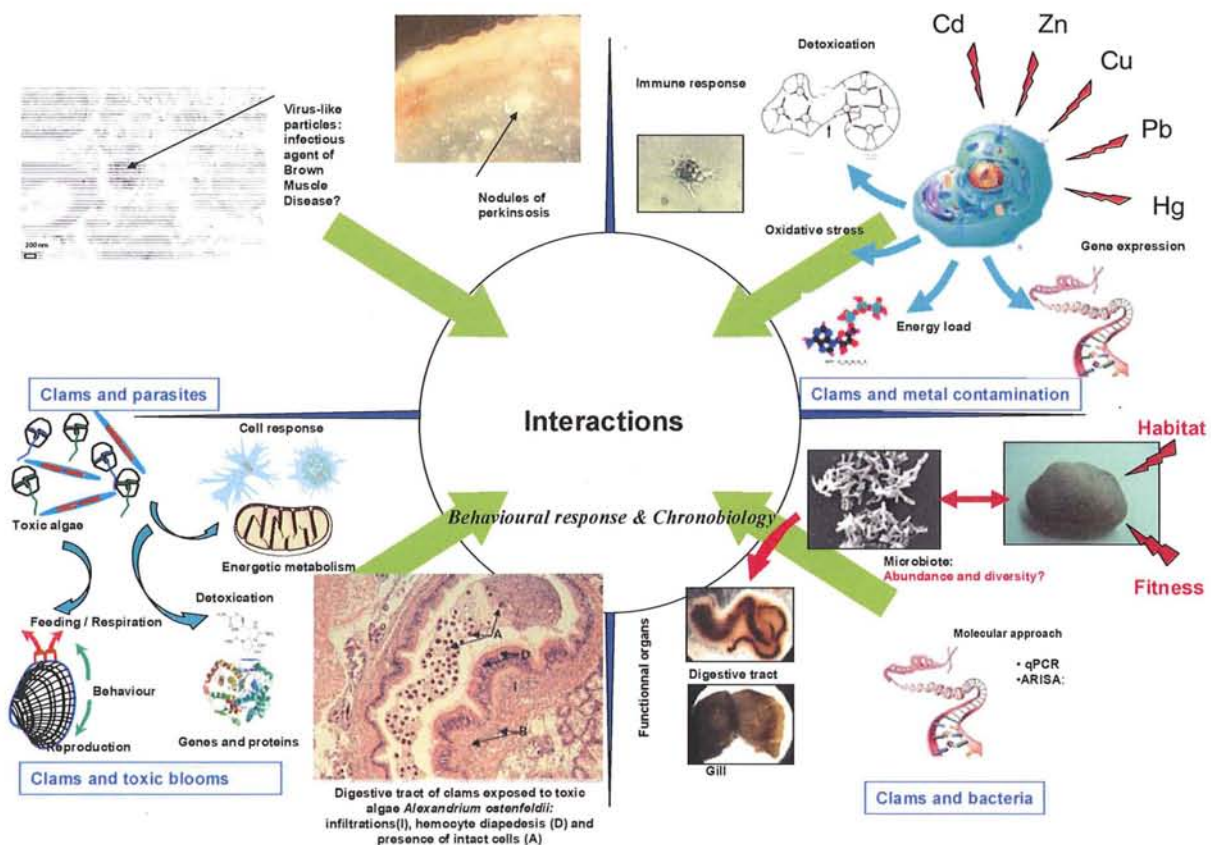


Figure 1: Schema of the 4 main orientations investigated in REPAMEP project and influencing Manila clam population: 1. Clams & parasites (Diseases); 2. Clams & toxic blooms; 3. Clams & metal contamination; 4. Clams & bacteria communities.

2. RESULTS

As a scientific project, REPAMEP provided precise and innovative results describing Manila clam population. The project confirms the presence of pathologies with high prevalence and intensity, impacting clams growth and condition index: perkinsosis and BMD (Brown Muscle Disease). These diseases rather develop in elevated mudflats with lower water turnover (north-western area). The hypothesis that the BMD agent would be a virus is still valid although it had not been yet demonstrated. Phytoplanktonic related toxins in Manila clams remain very low (2010-11) but the occurrence of spirolids justifies our aim to experiment with a multi-contamination design. Beyond the technological challenges (toxic algae culture, multi-treatments and multi-responses protocol), this project highlighted the effects of “toxic algae” and/or “metal” contamination on histological, immune, behavioural and molecular parameters. Thus, we measured several biological parameters of clams and deduced that their “fitness” was poor. We provided a rather exhaustive overview of potential stress sources. Concomitantly, we listed propositions in terms of clam population management (Figure 2).

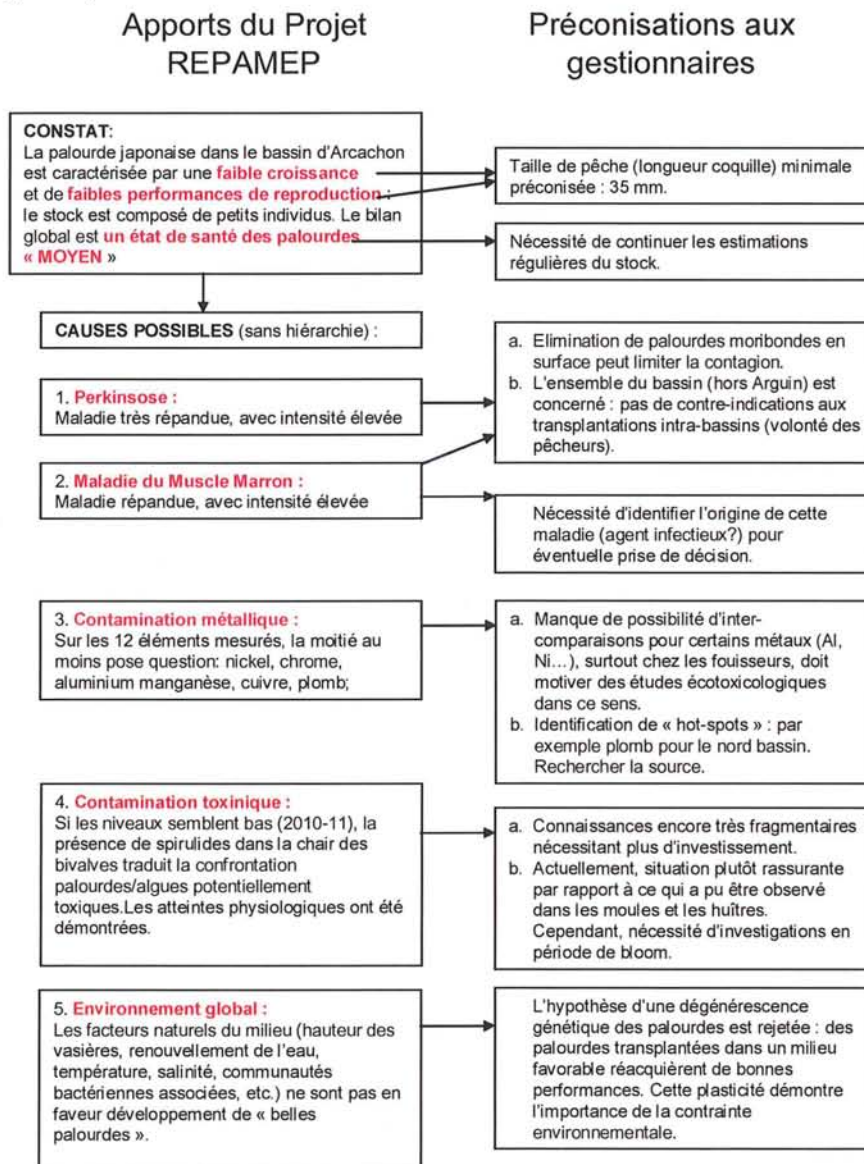


Figure 2: Summary of some REPAMEP results and advice to decision-makers.

3. CONCLUSION

On a scientific point of view, we are convinced that pluridisciplinary approach is of prime importance to study populations (as we partly demonstrated it). It is obvious that stressors act in interaction and with cascade effects.

For example, clams that undergo toxin and metal contamination are weakened. Their growth rate and condition index (proxy of reproduction effort) are impaired. A lesser reproduction induces a lower metallothionein (molecule involved in organism protection) synthesis, increasing clam vulnerability. At a higher level of severity, death of clams induces anoxic conditions in tissues (putrefaction). These conditions stimulate *Perkinsus* dispersion. *Perkinsus* infection increases, with possible interaction with BMD, and clams migrate to the sediment surface becoming even more vulnerable (desiccation, predation, etc.).

4. DELIVERABLES (SELECTION)

PUBLICATIONS (PUBLISHED OR IN PRESS)

- Binias C, Do VT, Jude-Lemeilleur F, Plus M, Froidefond JM, de Montaudouin X (sous presse) Environmental factors contributing to the development of Brown Muscle Disease and perkinsosis in Manila clams (*Ruditapes philippinarum*) and trematodiasis in cockles (*Cerastoderma edule*) of Arcachon Bay. Marine Ecology
- Dang C., de Montaudouin X., Salvo F., Caill-Milly N., Bald Juan, Soudant P. (en révision) Correlation between *Perkinsus* sp. abundance, growth and condition in clams *Ruditapes* spp. Diseases of Aquatic Organisms.
- Lelong, A., Hégaret, H., Soudant, P., Bates, S.S. (2012). *Pseudo-nitzschia* (Bacillariophyceae) species, domoic acid and amnesic shellfish poisoning: revisiting previous paradigms. *Phycologia* 51: 168–216.
- Medhioub, W., Séchet, V., Truquet, P., Bardouil, M., Amzil, Z., Lassus, P., Soudant, P. (2011) *Alexandrium ostenfeldii* growth and spiroclad production in batch culture and photobioreactor. Harmful Algae 10(6) : 794-803.

ORAL COMMUNICATIONS

- Binias C, Provost M, Do VT, Plus M, Gonzalez P, de Montaudouin X (2012) Perkinsosis and Brown Muscle Disease in Manila clam *Ruditapes philippinarum*: control by abiotic factors and/or synergic interaction? Physiomar 2012, Santiago de Compostela (Spain)
- de Montaudouin X (2012) Approche de la notion de Multistress chez les bivalves marins : les interactions hôtes-parasites chez la palourde japonaise (*Ruditapes philippinarum*) Groupement des Protistologues de Langue Française - Les protistes : adaptation à leur environnement, La Rochelle
- Hégaret, H., Henry, N., Bunel, M., Lassudrie, M., Le Goic, N., Lambert, C., Donval, A., Fabioux, C., de Montaudouin, X., Soudant, P. (2012). Impacts of *Alexandrium ostenfeldii* on behavioral and physiological responses of Manila clams *Ruditapes philippinarum* naturally infected with the parasite *Perkinsus olseni*. National Shellfisheries Association meeting NSA2012, Seattle, USA
- Meisterhans G, Raymond N, Lambert E, Girault E, Paul-Pont I, Bourasseau L, de Montaudouin X, Garabétian F, Jude-Lemeilleur F (2011a) L'état physiologique et/ou l'habitat de la palourde (*Ruditapes philippinarum*) conditionnent-ils la composition de son microbiote? AFEM symposium, Hammamet (Tunisia)

MUTUALIZED DELIVERABLE AND MEETINGS (EPOC – Ifremer – Fishing Committee)

- REPAMEP project presentation to the stakeholders (Fishing Committee): 13 December 2010.
- Collaboration of EPOC laboratory to the fishing orientations and strategies of different fishing committees.
- Coming next: oral presentation of REPAMEP results to the fishermen, stakeholders and decision-makers.