FINAL REPORT PROGRAM LEFE

Program LEFE/ CYBER	Project Title Environmental variability and benthic resources in the inverse Saloum estuary - VERTIS	Years 2019 – 2020

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Contribution to international program :
International Joint Laboratory *"Integrated climate and ocean studies in West Africa, and responses to climate change in Senegal - ECLAIRS"*

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Context

Coastal ecosystems have remarkable biological diversity, high productivity and accessibility. 40% of the world's population lives within 100 km of the sea and 500 million people depend on fisheries and aquaculture for their livelihood in developing countries. However, coastal ecosystems are subject to increasing pressures, due to the combination of human activities and global changes. It is therefore necessary to better understand the response of coastal ecosystems to the constraints to which they are subjected. This objective meets the dual need for sustainable development of human activities and biodiversity conservation.

Objectives

The general objective of VERTIS was to describe the environmental structure and dynamics of the Saloum inverse estuary (Senegal) in order to establish the link with the performances (i.e. growth, reproduction, recruitment) of a shellfish exploited by women's communities. This project combined disciplinary fields (physics, geochemistry, biology, ecology) and integrated different spatial and temporal scales (**Erreur ! Source du renvoi introuvable.***A*). The contribution to a better understanding of the processes associated with an artisanal fishing activity also aimed to strengthen the development of tools and knowledge for management support (**Erreur ! Source du renvoi introuvable.***B-D*). Specifically, we aimed to:

- A functional description of the Saloum Delta ecosystem.
- An assessment of the level of influence of the ocean on the delta ecosystem.
- An identification of the main environmental factors explaining the performances of exploited shellfishes.
- Assess new knowledge on the life cycle of a target exploited shellfish species (*Senilia senilis*).

Main results

After a year and a half of measurements and **three sampling campaigns**, we were able to describe precisely the alternation between a classic estuary structure in the monsoon period and the establishment of an inverted estuary in the dry period through the thermohaline structure dynamics (not shown). This seasonality is accompanied by a clear variation in phytoplankton abundance and diversity (**Erreur ! Source du renvoi introuvable.***A*) and also marks the seasonality of shellfish reproduction exploited by the women's communities (**Erreur ! Source du renvoi introuvable.***B-D*). The period following the monsoon is thus strongly enriched and corresponds to the recruitment period during which the young shellfish begin their benthic life phase buried in the sediment. All of this new information will be used to better understand the interactions between the variability of environmental conditions and the shellfish in order to assist fishing communities and managers in ensuring the sustainability of the fishing activity, in particular by identifying the key areas and periods for the growth, reproduction and recruitment of the animals.

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Figure 1 (A) Location of water sampling points (blue) and fixed stations for environmental monitoring (red), sampling areas for *S. senilis* stock monitoring (yellow) and experimental monitoring parks (red). (B, C) illustration of a participatory sampling action, (D) experimental park with a low-cost observation system powered by solar energy.

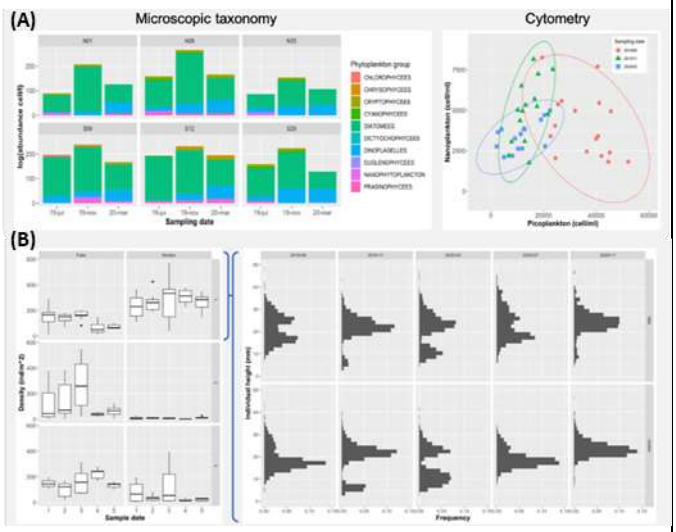

Figure 2 Illustration of the main results of the VERTIS project: (**A**) seasonal and spatial variability of phytoplankton communities: taxonomy identified by microscopy (left) and cytometry (right) and (**B**) temporal dynamics of the demographic structure of the S. senilis populations on the exploited sites (1, 2 and 3) of the villages of Falia and Niodior

Future of the project:

This project was the starting point for PI's research project within LEMAR laboratory, which resulted in the award of an ANR Jeune Chercheur project (IROCWA - *Learning from the past to envision the future: an integrated approach to bioclimatic interactions for a shellfish exploited in West Africa*; 2020-2024). It should be noted that B. Sané, a student who participated in the VERTIS project, is currently working on a thesis as part of the IROCWA project (IRD/ARTS funding, EDSML/UBO registration, UCAD/UBO co-direction).

In addition, the development, during the VERTIS project, of prototypes of a low-cost and open-source multi-parameter probe has led to the obtaining of funding in response to the joint CNRS-IRD call "Sciences Frugales": *Participatory science and sober observation system to support artisanal fisheries in the Saloum delta* - OBSALOUM (PI: Y. Thomas). This project involves 5 CNRS mixed units and two Senegalese partners.

1. Refereed journals

Three articles are currently being prepared:

- Thomas Y, Capet X, Sané B, Diouf M, Machu E *in prep*. Patterns of phytoplankton communities in the Saloum inverse estuary.
- Capet X, Thomas Y, Diouf M, Machu E *in prep*. Hydrodynamics and thermohaline structure in the Saloum inverse estuary.
- Sané B, Jean F, Diouf M, Flye-Sainte-Marie J, Thomas Y *in prep*. Population structure, growth and reproduction of the bloody cockle *Senilia senilis* in the Saloum inverse estuary.

2. Conference papers

- Thomas Y*, Machu E, Capet X, Sané B, Flye-Sainte-Marie J, Jean F, Diouf M 2019. Impacts de la variabilité environnementale sur les coquillages exploités par les communautés de femmes dans l'estuaire du Saloum. Colloque international LMI PATEO, UASZ 19-22 novembre 2019, Ziguinchor, Sénégal.
- Capet X*, Thomas Y, Machu E., Sloterdijk H, Ndoye S, Diouf M, 2019. Hydrodynamique et structure thermohaline dans l'estuaire du Sine-Saloum. Colloque international LMI PATEO, UASZ 19-22 novembre 2019, Ziguinchor, Sénégal.

3. Other communication

- Thomas Y, Sané B, Diouf M 2019. Comment grandissent les arches dans le Saloum ? Séminaire de restitution des travaux de recherche auprès des femmes du village de Niodior. Juin 2019, Niodior, Sénégal.