TNA PROJECT REPORT

1. Project Information

Proposal reference number	JN_CALL_3_7
Project Acronym (ID)	WGMP-SPI
Title of the project	Assessment of the ECOcological Quality status of the West Gironde Mud Patch, taken as an example of offshore marine system, using Sediment Profile Imagery
Host Research Infrastructure	Sediment Profile Imager (SPI-H)
Starting date - End date	28/01/2019 – 28/02/2019
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User group members	Adriana Galindo Dalto, Márcio Murilo Barboza Tenório Federal University of Rio de Janeiro

2. Project objectives

The aim of the WGMP-SPI project was to assess the potential of Sediment Profile Images (SPIs) for characterizing the Ecological Quality Status (ECOQ) of marine offshore systems, which is required by the EU Marine Strategy framework Directive. In order to do so, the project is using the West Gironde Mud Patch as a model of marine offshore systems. JERICO-NEXT supported our participation to the project. This included assistance in the collection, processing of the sediment profile images (SPIs) collected with SPI-H during two cruises achieved in April-May and June 2018. SPIs were analysed using the SPIArcBase software (Romero et al. 2013), which is made available through SPI-S within JERICO-NEXT. It was also initially planned to take part to a third cruise in February 2019.

3. Main achievements and difficulties encountered

Main achievements:

1) Processing of the Sediment Profile Images collected during the Jericobent-4 (19/04/2018 to 02/05/2018) and Jericobent-5 (07/06/2018 to 13/06/2018) cruises
2) Setting up of a spectrofluorometric method for chlorophyll and phaeopigment analyses and training of the scientific staff from the hosting group;
3) Assessments of microgranulometry, organic carbon, chlorophyll and phaeopigment concentrations in the surface sediments collected during the Jericobent 4 and 5 cruises.
4) Data analysis procedures

The activity described in this report has received funding from European Commission's H2020 Framework Programme under JERICO-NEXT project, grant agreement No. 654410.

Difficulties encountered:
Cancellation of the JERICObent-6 (January-February 2019 cruise) due to exceptionally severe meteorological conditions. This cruise has been rescheduled in April 2019 (i.e., outside our period of stay in France and with no much success since only 1 station was finally sampled). The processing and interpretation of SPIs have therefore only been carried out on the images collected during two cruises (i.e., Jericobent 4 and 5) instead of three as initially planned.

4. Dissemination of the results

The results produced within the framework of the WGMP-SPI project have been the subject of a Master 2 report by Pierre Thouzerie. They will be part of Bastien Lamarque's PhD thesis and will be published as scientific articles and/or presented as communications/posters in scientific journals and meetings (including the final JERICO-NEXT General Assembly).

5. Technical and Scientific preliminary Outcomes

Overall, 5 stations ($39m<z<70m$) were sampled during Jericobent 4 and 32 ($32.5<z<79m$) during Jericobent 5 (**Figure 1**).

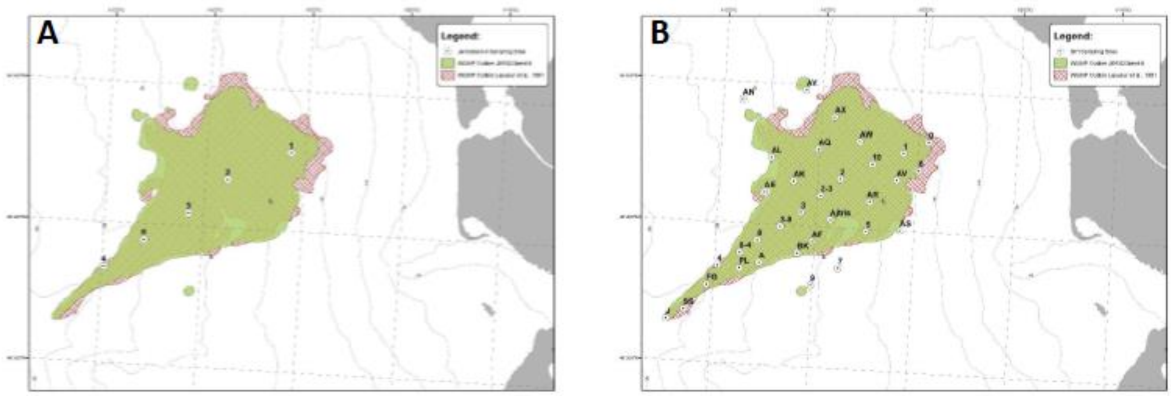

Figure 1*. Maps showing the West Gironde Mud Patch and the stations sampled during the Jericobent 4 (A) and the Jericobent 5 (B) cruises.*

Sediment granulometry: During Jericobent 5 the median diameter of surface sediment was between 13.4 and 64.6µm. It was highest at some of the shallowest stations in relation with transitory sand deposition. This pattern was much less clear during Jericobent 4 ($16.0<$ median diameter <20.1µm), which may reflect spatial microheterogeneity as suggested by the evidence of sand deposition on some of the SPIs collected at station 1.

Sedimentary organics: During Jericobent 5, surface sediment organic carbon concentrations were between 0.35 and 1.56%DW and clearly tended to increase with depth (N=32n $r^2=0.66$). This was also the case of chl *a* and phaeo *a* concentrations, which were between 0.74 and 6.09, and 2.96 and 26.38 $\mu g.gDW^{-1}$, respectively. The (chl *a* / chl *a* + phaeo *a*) ratios were between 0.132 and 0.302 and tended to slightly decline with depth. All these patterns are fully coherent with what was observed during Jericobent 4 ($1.15<OC<1.59$%DW, $0.58<$ chl $a<5.48$ $\mu g.gDW^{-1}$, $3.63<$ phaeo $a<27.91$, $0.140<$ chl a / chl a + phaeo <0.200).

Sediment Profile Images: The 186 SPIs collected during Jericobent 5 and the 71 collected during Jericobent 4 have been analysed. This corresponds to 3-6 and 12-13 images per station, respectively.

Assessed characteristics were the numbers of: burrows, feeding pits, tubes, epifauna, oxic voids, associated oxic voids, infauna and the total number of biogenic structures; the apparent Redox Potential Discontinuity (aRPD, see **Figure 2** for examples of these types of structures) and the Benthic Habitat Quality index (BHQ, Nilson & Rosenberg 1997). Results from Jericobent 5 show a clear trend toward higher number and total surface of biogenic structures as well as deeper ARPD with depth. (**Figure 3)**. This trend was however not observed for all specific biogenic structures (e.g. feeding pit, epifauna and infauna). Results also showed a clear trend toward the increase of the depth of oxic void with sediment column with depth. Overall changes resulted in much lower BHQ values at stations 6 and AV with values around 4 and then a tendency toward slightly increasing (i.e., from around 8 to around 11) BHQ values with depth (**Figure 3**). This pattern is likely related with the strong hydrodynamics in the inner part of the WGMP, which results in frequent transitory hydrosedimentary (i.e., sedimentation/resuspension) events (Jouanneau et al 1989), which preclude the development of a mature benthic macrofauna community penetrating deep in the sediment and indicative of a good ECOQ (Nilsson & Rosenberg 2000).

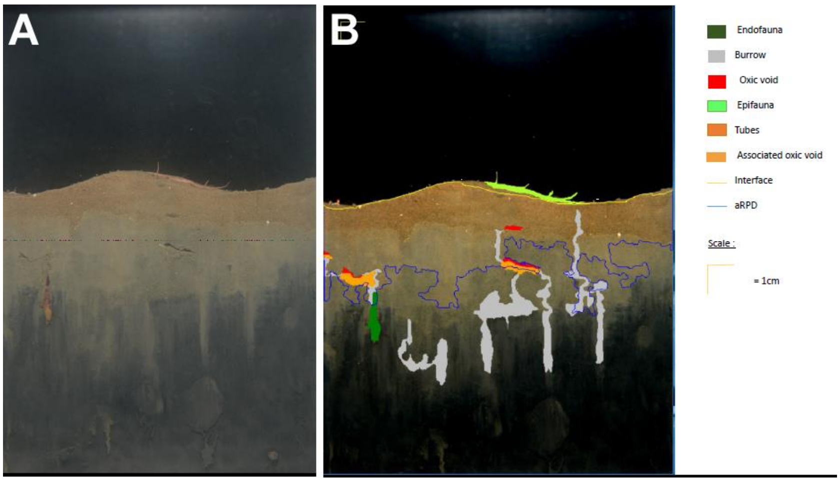

***Figure 2**: Example of a SPI image before (A) and after processing by the SPIArcbase software (B). The later shows the different kinds of biogenic structures that can be identified and quantifed.*

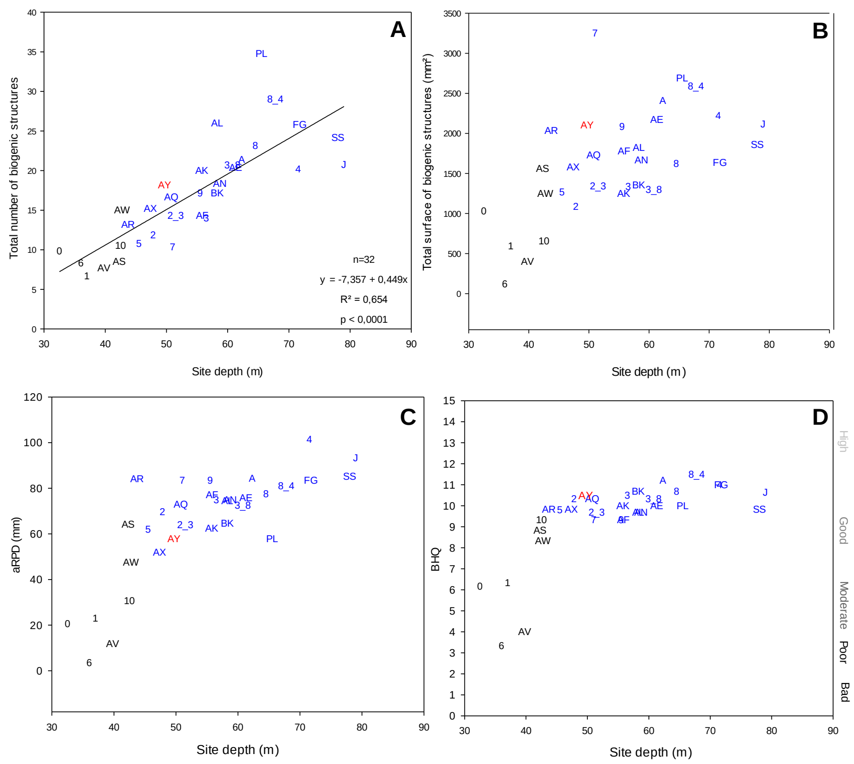

***Figure 3**: Relationships linking depth with the total number and surface of biogenic structures (A -B), the mean ARPD thickness (C) a,d BHQ values (D). See Figure 1B for station codes.*

Here again, these observations are in full agreement with the results of the Jericobent 4 cruise during which the burrows at the shallowest station were smaller and located closer to the sediment surface than at the deepest ones.

Remaining ongoing work. One main objective now consists in: (1) relating spatiotemporal changes in SPI characteristics with those in benthic macrofauna composition, and (2) compare the ECOQ assessment derived from SPI and benthic macrofauna composition. This will be achieved based on the results of all Jericobent seasonal cruises (i.e., Jericobent 1-4) and therefore overpass the objectives of the WGMP-SPI project.

SUBMITTED, 28 MARCH 2019; FINAL REVISION, 16 JUNE 2019.