APPENDIX 3

TA PROJECT REPORT (TEMPLATE)

(see following pages)

TA PROJECT REPORT PACKAGE

- The completed and signed forms included in this package should be sent by email to jerico.ta@marine.ie and **jerico**-s3**@ifremer.fr** within **one month after the completion of the TA experiment** by the User Group Leader.
- **Refunding of the TA reimbursement to the user group will be processed as soon as these forms will be submitted**.
- The TA Project Report will be published in the JERICO-S3 website. The report, as well as other information collected with the attached forms, will be used to report to the European Commission.
- **Please note that any publication resulting from work carried out under the JERICO-S3 TA activity must acknowledge the support of the European Commission – H2020 Framework Programme, JERICO-S3 under grant agreement No.871153.**

1. Project Information

Proposal reference number[1]	**JS3_CALL_3_4057_OBS-EXP Bridge**
Experiment Acronym (ID)[2]	OBS-EXP Bridge
Title of the project[3]	Bridge between OBServation and EXPerimentation communities of JERICO and AQUACOSM
Host Research Infrastructure[4]	SYKE MRC-lab Facility
Starting date - End date[5]	From 08/19/2022 to 09/03/2022 -
Name of Principal Investigator[6] **Home Laboratory** **Address** **E-mail address** **Telephone**	VIDUSSI Francesca MARBEC CNRS Place E. Bataillon, CC 093 34095 Montpellier Francesca.vidussi@cnrs.fr +33 631395499

2. Project objectives[7] (250 words max.)

The main objectives of the OBS-EXP Bridge project were:
1) Study the metabolic and structural responses of plankton communities of the Baltic Sea to a simulates heatwave using high-frequency sensors of LAMP-Sensor-System and Low-Cost-Sensor System that we have developed, and deployed in the inland mesocosms at the host SYKE laboratory,
2) Compare our high-frequency data obtained by LAMP-Sensor-System and Low-Cost-Sensor System with those acquired by host SYKE laboratory using the AQUABOX-device during this heat wave experiment, and
3) Compare the responses of the Baltic Sea communities to heat wave obtained by LAMP-Sensor-System which those obtained previously in the NW-Med Sea during *in situ* mesocosm experimentations that we have realised in the frame of Transnational Access of AQUACOSM-plus between April 25 and May 25 2022. This last project called "Effects of consecutive heat waves on the resistance, resilience and recovery of marine plankton communities (Heat Waves)"(https://ta.aquacosm.eu/facility-call/61af9b474b6b59001e3f7ffa). Finally, by intermediate of this project we would like to bring together the EU communities studying the marine ecosystems using observational infrastructures (JERICO S3) with those using experimental ones (AQUACOSM-PLUS).

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1 Reference number assigned to the proposal by the TA-Office.
2 User-project identifier used in the proposal.
3 Title of the approved proposal. The length cannot exceed 255 characters
4 Name of the installation/infrastructure accessed with this project. If more than one installations/infrastructures are used by the same project, please list them in the box.
5 Specify starting and end date of the project (including eventual preparatory phase before the access).
6 Fill in with the full contact of the Principal Investigator (user group leader).
7 Write the short-term, medium and long-term objectives of the project. Use no more than 250 words.

3. Main achievements and difficulties encountered (250 words max.)[8]

Seawater was collected at 5 m depth in the Baltic Sea (August 19 2022), screened at 100 µm to remove large particles and nutrients were added to simulate an upwelling and to avoid nutrient-limitation. Then water was preserved in tanks at controlled light and temperature (16°C) at the SYKE laboratory until filling the twelve inland mesocosms (August 22 2022). The set-up of the LAMP and the Low-Coast Sensor Systems, which have been sent before to SYKE, was achieved between August 20 and 22. All sensors were installed at mid-depth of four mesocosms using a support in plexiglass. Each of four Lamp-Sensor-System comprised sensors of light (Li-Cor), temperature and conductivity (Aanderaa), oxygen (Aanderaa), and Chlorophyll *a* (Chl *a*) fluorescence (Wetlabs) and a data acquisition and storage system. Each of four Low-Cost-Sensor-System included a fluorescence of Chl *a* sensor (two home-made versions), oxygen sensors (Aqualabo), and a data acquisition and storage system. Sensor frequency measurements were set at every minute and sensor data were checked daily or two time daily. Water temperature were increased using heating systems installed in the mesocosms to obtain four temperature level treatments: 16°C that it was the natural temperature of the seawater and maintained with the cooling system of the mesocosm's room , 18°C, 20°C and 22°C. Daily manual sampling started the day after filling the twelve mesocosms. (August 23) and included samples for phytoplankton pigment analysis (HPLC), and two size-fractions (< 2 and < 20 µm) for particulate organic carbon, nitrogen, phosphorous and chlorophyll *a*.

4. Dissemination of the results[9]

Raw data obtained using the LAMP sensor system will be available on open source as soon as quality cheking will be done. As raw data of the Low-Cost-Sensor-System need additional treatments, they will be available as the additional treatements , notably post-calibration and quality cheking will be done. These sensor data and the accessory data on pigments and those on size-fractionated (< 2 µm and < 20 µm) particulate organic carbon, nitrogen, phosphorous and chlorophyll *a* would be part of an open access paper describing the effect of a simulated heat-wave on the plankton community metabolism. All these data will be available on open source (by CC) in an open source publisher (as for example Seanoe https://www.seanoe.org) and on the journal site (if available). Two technical papers in open access journals are also planned: one comparing the LAMP and Low-Cost-Sensor-System and one comparing the data obtained by the LAMP-System-System and the AQUABOX system.

So all the data obtained during this project will be available on open access. In addition, we plan to communicate these results in scientific conferences and meetings.

[8] Describe briefly the main achievements obtained and possible impacts, as well as possible difficulties encountered during the execution of the project. Use no more than 250 words

[9] Describe any plan you have to disseminate and publish the results resulting from work carried out under the Transnational Access activity in JERICO -S3: scientific articles, books - or part of them -, patents, as well as reports and communication to scientific conferences, meetings and workshops. Highlight peer-reviewed publications. **Note that any publications resulting from work carried out under the JERICO -S3 TA activity must acknowledge the support of the European Commission – H2020 Framework Programme, JERICO -S3 under grant agreement No. 871153.**

5. Technical and Scientific preliminary Outcomes (2 pages max.)[10]

All the sensors were previously calibrated with the procedure described in Soulié et al. 2020 thus the data showed hereafter are data accounting this calibration. LAMP temperature sensor system showed that the desired target water temperatures simulated different heat-wave intensities of 18, 20 and 22°C above natural water temperature (16°C) were well obtained in the mesocosms and maintained stable until the end of the experiment (Figure 1). The slight decrease observed at regular intervals (every 6 hours) in the 22°C mesocosm and at lower level in the 20°C mesocosm were due to the automated sampling of the AQUABOX-device. The 16°C mesocosm (simulating natural temperatures) showed a more fluctuating temperatures than the heated ones even if these fluctuations were very low. This fluctuation that reveals day-night cycles with temperatures slightly higher (around 0.1°C) during day than during the night was due to the fact that the 16°C mesocosm was at room temperature and that that manual sampling activities during the days including the opening/closing door slightly influenced the maintenance of a constant 16°C temperature in the room. Salinity (figure 1B) showed constant values around 5.67 in all mesocosms.

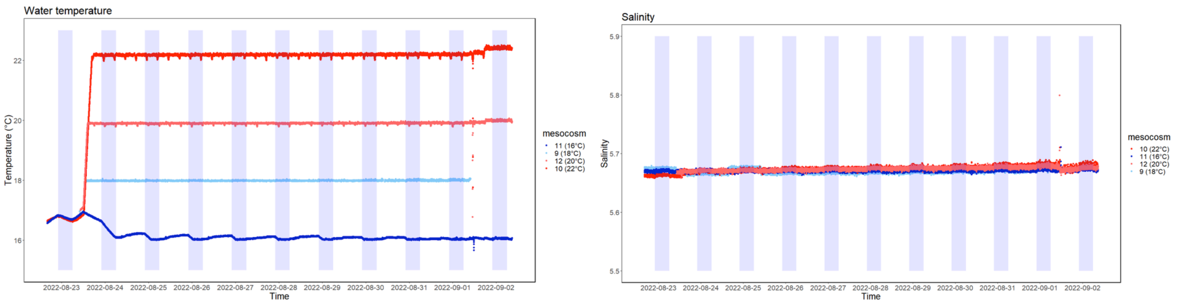

Figure 1 : LAMP-Sensor System water temperature (A) and salinity (B) measurements in the 16, 18, 20 and 22°C mesocosms during the simulated heat-wave experiment. Light blue bands indicate dark periods (simulating night), while white ones designate light periods (simulating day).

The oxygen concentration measured by the LAMP-SensorSystem showed that initial values before the increase of temperature were around 316 µmol L^{-1}. To note that in the 18°C and the 22°C heated mescosms the data of the first day of the experiment were missed due to a cable disconnection of the data storage system. The oxygen concentrations in the mesocosms follow the water temperature gradient with higher oxygen concentrations at 16°C and lower and lower in the 18, 20, 22 °C mesocosms (Figure 2, A). This is what is expected as temperature reduce the water oxygen concentration due to less gas solubility in warmer water compared to colder ones. Interestingly a clear marked day-night cycles of oxygen concentrations with values increasing during the day and decreasing during the night were observed in all mesocosms. This is due to the biological metabolism showing oxygen production by phytoplankton encompassing consumption during the day and only oxygen consumption by plankton during the night. To note also the decrease trend in oxygen concentrations along the experiment notably in the 20 and 22°C mesocosms, probably due to the plankton activity in these mesocosms leading to minimum values at the end of the experiment of about 10-15% less than those observed at the beginning of the experiment. The oxygen concentration daily cycles will be used to estimate oxygen net and gross production, and oxygen respiration (Soulié

[10] Describe in detail results and main findings of your experiment at the present stage.

et al. 2020) and thus evaluate the effect of the simulated heat-wave on the plankton oxygen metabolism.

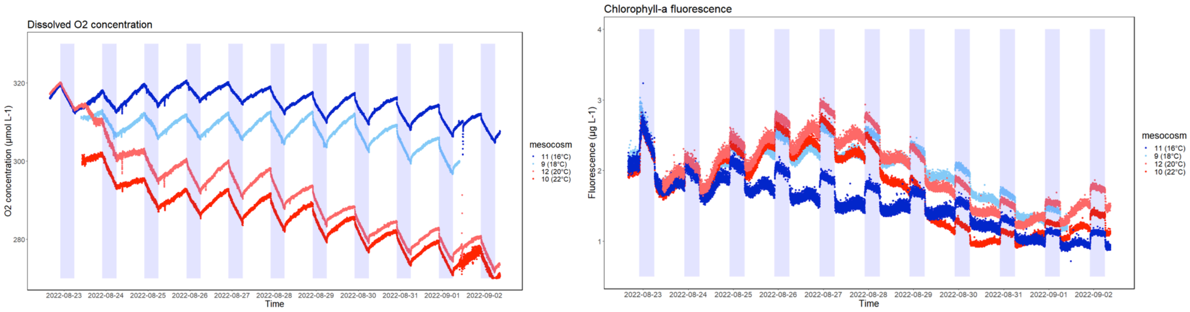

Figure 2 : LAMP-Sensor System oxygen (A) and fluorescence of chlorophyll a measurements (B) in the 16, 18, 20 and 22°C mesocosms during the simulated heat-wave experiment. Light blue bands are dark periods (simulating night), while white ones are light periods (simulating day).

The chl *a* measured using sensor fluorescence showed initially values around 2 µg L^{-1} in all mesocosms. As for the oxygen a day-night cycle was also observed with chl *a* production and losse during the days and only chl *a* losses during the nights. However, this daily cycle is partially masked by the non-photochemical quenching occurring during the light period that depress fluorescence. However, due to the extremely controlled system used in this experiment and the huge amount of data we will be able to precisely estimate this depression due to photochemical quenching and deriving the chl *a* concentration values during the day. This chl *a* daily cycle will allow to evaluate how heat-wave affect chl *a* production and losses (including those due to grazing, viral lysis and phytoplankton sedimentation). In this sense, chl *a* derived from fluorescence sensors clearly showed an increase in chl *a* in the heated mesocosms (18, 20 and 22°C) compared to the non-heated one (16°C) indicating the occurrence of a moderate phytoplankton bloom under heating. This bloom attained chl *a* maximum values around 3 µg L^{-1} four days after heating in the heated mesocosms, while chl *a* concentrations in the unheated mesocosm (16°C) showed a decreasing trend with values around or < 2 µg L^{-1}. To note that maxim chl *a* values were observed in the 20°C mesocosm, while the 18 and the 22°C showed lower values. This observation could potentially indicate that 20°C is an optimum temperature for this planktonic system. Chl *a* derived by fluorescence measurements showed a sudden decrease in the heated mesocosm indicating the phytoplankton bloom declined at the last days of the experiment and interestingly, this decrease was more sudden in the most heated mesocosm (22° C). At the end of the experiment, chl *a* concentrations in all the mesocosm attained similar values. As mentioned before, raw data of the Low-Cost-Sensor-System need more time to be treated and they will not be show in this report however, they will be presented later together with those of Lamp-Sensor-System on the same site. These sensor data will be completed by the accessory data on phytoplankton pigments and size-fractionated (< 2 µm and < 20 µm) particulate organic carbon, nitrogen, phosphorous and chlorophyll *a*. which are actually under analysis in the laboratory. The obtained chl *a* data will be used to validate chl *a* fluorescence measured by sensors. The pigments data will be used to evaluate the effect of the heat-wave on the major phytoplankton groups inferred using taxonomic pigments and it will help also to interpret the oxygen metabolism response and the phytoplankton biomass productions and losses under warming inferred using chl *a* fluorescence data. Finally, the size-fractioned particulate organic carbon, nitrogen phosphorous and chl *a* will allow to

evaluate the effect of heat waves on the partitioning in different size classes as increase of temperature can change this portioning with consequences on biogeochemical cycles.

[Location], [Date (dd/mm/yyyy)]

Location and date

Montpellier, 04/10/2022

Signature of principal investigator