Joint European Research Infrastructure network for Coastal Observatory – Novel European eXpertise for coastal observaTories - **JERICO-NEXT**	
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Lead beneficiary	Ifremer
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Submitted by	I. Puillat (Ifremer)
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History			
Revision	**Date**	**Modification**	**Author**
0.1	Sept-Nov. 2016	Gathering of JRAP contributions	Puillat I. and JRAPs leaders
1.0	17 Nov. 2016	Add on: summary, introduction, conclusion and comments	Puillat I.
1.1	21 Nov. 2016	Add on JRAP#1 missing part	F. Artigas and Puillat I.
1.2	30 Nov. 2016	JRAP6 update and Final version	B. Mourre & Puillat
2.0	6 Dec. 2016	Update JRAP 1 & 2 + approvals	A. Grémare, F; Artigas, I. Puillat

Approvals				
	Name	**Organisation**	**Date**	**Visa**
Coordinator	Farcy P	Ifremer	6 dec 2016	
WP4 Leaders	Puillat I.	Ifremer	6 dec. 2016	
WP4 co-leaders	Grémare A.	CNRS	6 dec 2016	

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1. Executive Summary

The WP4 of the JERICO-Next is a synthesis of the project built upon activities in other WPs, gathering the consortium around applied Joint Research Activity Projects (JRAPs) selected to put forward the added value of JERICO-NEXT. In order to reach this objective, WP4 keeps on track the JERICO-NEXT course of actions via synthesis and application activities based on interactions with other WPs. WP4 helps establishing some topical approaches for the scientific strategy in WP1 (task 1.2) and will give inputs to establish the network strategy after JERICO-NEXT (task 1.6). Indeed, six JRAPs will be implemented to address different key environmental questions and/or policy requirements such as those considered by the MSFD, and according to the 6 JERICO scientific areas:
1- JRAP-1 on pelagic biodiversity
2- JRAP-2 on benthic biodiversity
3- JRAP-3 on chemical contaminant occurrence and related biological responses
4- JRAP-4 on hydrography and transport
5- JRAP-5 on carbon fluxes and carbonate system
6- JRAP-6 on operational oceanography.

This document reports the progress of the JRAP activities after 1 year in the project. In the following pages, for each JRAP, we report main achievements with comparison to the initial plan, the next steps, the acquired data (link with WP5), the acquired communication material (to feed WP8), and some specific points regarding the science strategy. Indeed, the previous WP4 deliverable (D.4.1) was dedicated to present the science strategy that could be deployed in JRAPs (but not only) and was then reviewed by the members of the Science and Technical Advisory Board (STAC). A meeting with the STAC was then organised the 7 September 2016 to discuss this strategy. As a conclusion JRAP teams were asked to address some common questions and some JRAP-specific ones. This meeting is reported in “Report of WP4 meeting with the Scientific and Technical Advisory Committee (STAC) & Contributions to the JERICO-NEXT science strategy”, provided in annex of this document. In addition, this document also enhances some activities driven in coordination with other WPs such as the WP3.

The reported actions show that technical preparations were undertaken before deployment, some methodologies were reviewed, some field works are already done, some buoys and other systems are deployed and acquiring data, two WP3&4 joint workshops were organised. As a conclusion, JRAPs are well progressing with respect to their initial plans even if they are not developing along the same time line. Indeed some JRAPs already started their data acquisition, whereas some other will start this step later. Some important reported issues will be discussed during the next Steering committee Meeting to be held the 12-13 Dec. 2016. The upcoming important action in 2017 is to well coordinate the JRAPs data acquisition with the data management led in WP5, whereas 2018 will be more dedicated to work on the products delivered by JRAPs as JERICO-RI product prototypes..

2. Introduction

The WP4 of the JERICO-Next is a synthesis of the project built upon activities in other WPs, gathering the consortium around applied Joint Research Activity Projects (JRAPs) selected to put forward the added value of JERICO-NEXT. In order to reach this objective, WP4 keeps on track the JERICO-NEXT course of actions via synthesis and application activities based on interactions with other WPs. WP4 helps establishing some topical approaches for the scientific strategy in WP1 (task 1.2) and will give inputs to establish the network strategy after JERICO-NEXT (task 1.6). Indeed, six JRAPs will be implemented to address different key environmental questions and/or policy requirements such as those considered by the MSFD, and according to the 6 JERICO scientific areas:
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3. Main report

3.1. JRAP#1: Phytoplankton biodiversity and HAB (Biodiversity of phytoplankton, harmful algal blooms and eutrophication)

Involved institutes: SMHI, CEFAS, CNRS-LOV, CNRS-Univ Litt, CNRS-MIO, Deltares, Ifremer, NIVA, RWS, SYKE, VLIZ, and DAFF

Objective of the JRAP (short remind):
The main objectives of JRAP-1 are:
- To enhance the understanding of the dynamics of algal blooms by combining data on phytoplankton distribution, abundance and diversity with chemical and physical oceanographic data,
- To apply novel in situ automated or semi-automated methods to address phytoplankton diversity, abundance, biomass and photosynthesis parameters in marine coastal systems, with a focus on harmful algae and eutrophication,
- To assess their potential for complementing traditional methods, which are based on discrete water sampling and labour intensive laboratory microscope work,
- To formulate inputs for science strategy related to the JERICO-RI and recommendations for its further development (roadmap for the future).

3.1.1. Main achievements and delays

3.1.1.1. Achievements

Initial time line and expected work	Actual time line and achieved work, problems, good surprises and opportunity met
Kattegat-Skagerak area M12-14 Objective: To carry out a study of phytoplankton biodiversity and harmful algal blooms at the Tångesund observatory in the Skagerrak Partners: SMHI, (subcontractors WHOI and Scanfjord), NIVA, Ifremer and IRIS will analyse some samples from the study. RWS-NIOZ contributed with FRRF measurements during one cruise. Non-JERICO partners: the University of Gothenburg, Sweden and Alfred Wegener Institute (Bremerhaven, Germany)	M8-M14: A study of phytoplankton biodiversity, harmful algae and physical and chemical oceanographic conditions was carried out near a mussel farm on the Swedish west coast. In addition, three cruises in the off shore Skagerrak were made. An FRRF was used during one of the crusies (RWS-NIOZ) Oceanographic instrumentation (ADCPs and CTD-rigs) were deployed in several locations in the area. Data from a FerryBox system on the route Oslo-Kiel complement the data from the Tångesund observatory. Modelling of physical processes will complement the observations. An oceanographic buoy was deployed by SMHI in the Tångesund fjord in April 2016 (M8). In August 2016 an imaging flow cytometer (Imaging FlowCytobot) was deployed by SMHI in cooperation with WHOI and Scanfjord in Tångesund as part of a depth profiling system. Setting up the system required a larger effort from technical personnel than expected. Teething problems were encountered; they include problems with internet communication (4G cell phone connection), power supply and profiling systems (winches). After intense work by technical personnel and scientists the problems were resolved. In addition to the automated measurements water samples were collected every week to provide reference data. Water

	samples for analyses in the laboratory were also collected. The study ended in the middle of October 2016. During the study varying wind conditions resulted in upwelling and downwelling conditions. The phytoplankton community varied on the timescale of days. A bloom of the harmful alga *Lingulodinium polyedrum* was recorded. Also other HAB-species were observed.
English channel – North Sea (CNRS, IFREMER, CEFAS, VLIZ, RWS, DELTARES) M8-M13 *Methods used:* – Fluorometry (Spectral Fast Repetition Rate) – Pulse Amplitude Modulated fluorometry (Phyto-PAM) – Pulse-shape recording Flow Cytometry + Image in flow analysis – N Sea Study (VLIZ & RWS) – Spring/Summer bloom – N Sea & E. Channel Study (CEFAS ENDEAVOUR) – Spring/Summer/Autumn – E. Channel study (IFREMER+CNRS) – Spring/Summer/Autumn bloom – Preparations for studies in 2017	**Southern North Sea-eastern Channel combined cruises** **Objectives:** To understand the phytoplankton spatial distribution and community/population successions during the productive season from the eastern Channel to the southern North Sea bight. To test the accuracy of different automated and semi-automated devises to detect and discriminate amongst phytoplankton functional groups, focusing on HAB We started planning the common implementations of automated optic sensors for phytoplankton monitoring in some of the regular monitoring cruises performed by the JERICO partners in a meeting in Woerden (NL) in November (M3), then we implemented some of the sensors in cruises with the participation of at least 2 JERICO partners. **Cruises**: • 11 – 15 April RV Zirfaea ○ FCM (RWS) ▪ Fixed Samples (also VLIZ FCM) ▪ Underway samples ○ FRRF (NIOZ, RWS) • 24-25-26 May RV Simon Stevin ○ FCM (RWS, VLIZ) ▪ Fixed Samples ▪ Underway samples ○ FRRF (VLIZ) ○ Fluoroprobe (CNRS LOG) ○ Phytopam (CNRS LOG) • 13 – 16 June RV Zirfaea ○ FCM (RWS) ▪ Underway samples ○ FRRF (NIOZ) ○ PhytoPAM (CNRS LOG) ○ Fluoroprobe (CNRS LOG) • 21 – 28 June RV Endeavour ○ FCM (RWS, CEFAS) ▪ Underway samples The cruises were successful and some small technical problems were raised and resolved. A common LifeWatch and JERICO-Next workshop was carried out amongst participants in Oostende (BE, August 2016, M12) organized

	by VLIZ and attended by RWS, CNRS-LOG to present the first raw data and to discuss on further analysis Data is still being processed and analysed.
Mediterranean sea: M1-M18 (CNRS-MIO) Improvement of combined phytoplankton and hydrological data observation from a fully sub mesoscale analysis system thanks to a continuous flowthrough of sea water and a succession of sensors. Adaptation for the Ferrybox system (meso scale resolution due to the speed of the ship)	**M1-M11**: OSCAHR cruise (PI A. Doglioli and G Grégori) in the Mediterranean. 10 days sampling, testing of the Cytosense and the pCO2 pocket ferrybox sensors. Resolution of 2km and 30 min sampling for the Cytosense. PCO2 did not work for this cruise. **M15**: CHROME project (PI M Thyssen). First crossing of the Western Mediterranean Sea onboard the "Le Carthage" ferry from the CTN with on its board a Cytosense coupled to a pCO2 sensor (SubCtech OCeanPack) and a pH sensor. Data for one crossing was validated. Ship technical maintenance and route modification forced the removal of the pCO2 recorder and the Cytosense. Next opportunity to install the machine is now in October 2016. As the Mediterranean Sea is characterized by oligotrophic to mesotrophic conditions small cells such as *Prochlorococcus* and *Synechococcus* are widespread and found in abundance. Unfortunately, due to their small size and dim fluorescence, most of them are out of reach of automated *in situ* Cytobuoy flow cytometers. In collaboration with Cytobuoy company, some modifications have been successfully applied to a Cytosense instrument in order to better resolve the *Synechoccocus* and *Prochlorococcus*. In the frame of the OSCAHR cruise in the NW Mediteranean (PI : A. Doglioli & G. Grégori) we had the opportunity to combine together several instruments and sensors on a dedicated sea surface continuum sampling water line (pumped *in situ*, in sub-surface) to record at high resolution several biological (abundances of pico and nanophytoplankton by flow cytometry, chlorophyll *a* concentration by fluorimetry) and non biological variables (temperature, conductivity/salinity, pH, nutrients). The goal is to use such a strategy to better characterize the influence of a sub-mesoscale structure on the planktonic community. This experience allowed for the first time in the Mediterranean, to implement on a Ferry (the Carthage) a Cytosense coupled to a Ferrybox belonging to the Tunisian INSTM institute (Amidex- CHROME Project, PI: M. Thysssen). For the first time ultraphytoplankton has been monitored at high resolution (every hour) on a transect between Marseille and Tunis, across the Western Meditrranean Sea
Baltic Sea (SYKE, SMHI)	The JRAP1 activities in the Baltic Sea commences in year 2017

JERICO Plankton workshop I (CNRS-LOG, CNRS-MIO, CNRS-LOV, IFREMER, Cefas, Vliz, RWS, NIOZ, HZG, SYKE, SMHI, NIVA, HCMR, WHOI, U Mons, DAFF, NIVA, Algatech) (joint WP3.1, WP2.4.2 and WP4.1) Month 10	**International Workshop on Automated Phytoplankton Observation** The International Workshop on current advances in the application of (semi-)automated techniques for studying phytoplankton dynamics in coastal and marine waters, organized by the Laboratory of Oceanology and Geosciences (UMR 8187 CNRS-ULCO-UL1) took place from May 31 to June 2, 2016, in Wimereux. It gathered together scientists from 15 partners or contracted partners and SMEs of the JERICO-Next consortium in Europe, as well as some international external experts. Plenary presentations of innovative optical techniques and their application in observing systems were followed by practical discussions on technical and analytical improvements for *in situ* and *in vivo* monitoring of phytoplankton abundance, biomass, diversity and photosynthetic parameters. These discussions helped preparing Joint Research Actions on the implementation of innovative automated techniques in pelagic biodiversity - plankton, Harmful Algal Blooms and eutrophication studies, in connexion with actions on Coastal Carbon fluxes.
JERICO Plankton workshop II (SMHI, CNRS-LOG, CNRS-MIO, IFREMER, VLIZ, U Gent, RWS, NIOZ, HZG, SYKE, NIVA) (joint WP3.1 and WP4.1) M13	**The second International Workshop on Automated Phytoplankton Observationwas held at SMHI in Gothenburg (Sweden) by September 27-30, 2016.** Altogether 18 persons participated. The focus was on practical aspects of observing phytoplankton using advanced instrumentation. Participants brought instruments to the practical workshop. A presentation and demonstration of the use of each sensor was carried out by participants in order to make all attendees to benefit from the details and discussions that followed presentations. The instruments were used to analyse water collected at the Tångesund observatory where SMHI operates an *in situ* imaging flow cytometer together with other oceanographic instruments. Workshop participants used *in situ* instruments at Tångesund during an excursion as part of the workshop. In addition, water was collected at Tångesund and analysed at the laboratory at SMHI by the different sensors, together with phytoplankton monoculture samples. *Instruments used and demonstrated (companies and partners involved)* • Imaging Flow Cytometer: Imaging Flow Cytobot (McLane, WHOI-SMHI) • Pulse shape-recording Flow Cytometer with imaging capabilities: CytoSense (two instruments, CytoBuoy, RWS

	and CNRS-LOG) • Plankton imager: FastCAM (IFREMER) • Fast Repetition Rate Fluorometer: - FRRF-FASTOcean (Chelsea Instruments, RWS) • Multi-spectral Fluorometer (Phyto-PAM, Walz, CNRS-LOG) Multi Exciter (JFA Advantec, SYKE) Fluoroprobe (bbe Moldaenke, CNRS-LOG) • Spectrophotometer – PSI-CAM (HZG) In addition samples were analysed using microscopy (SMHI, NIVA)
Kattegat-Skagerak area M12-14 Objective: To carry out a study of phytoplankton biodiversity and harmful algal blooms at the Tångesund observatory in the Skagerrak Partners: SMHI, (subcontractors WHOI and Scanfjord), NIVA, Ifremer and IRIS will analyse some samples from the study. RWS-NIOZ contributed with FRRF measurements during one cruise. Non-JERICO partners: the University of Gothenburg, Sweden and Alfred Wegener Institute (Bremerhaven, Germany)	**M8-M14:** A study of phytoplankton biodiversity, harmful algae and physical and chemical oceanographic conditions was carried out near a mussel farm on the Swedish west coast. In addition, three cruises in the off shore Skagerrak were made. An FRRF was used during one of the crusies (RWS-NIOZ) Oceanographic instrumentation (ADCPs and CTD-rigs) were deployed in several locations in the area. Data from a FerryBox system on the route Oslo-Kiel complement the data from the Tångesund observatory. Modelling of physical processes will complement the observations. An oceanographic buoy was deployed by SMHI in the Tångesund fjord in April 2016 (M8). In August 2016 an imaging flow cytometer (Imaging FlowCytobot) was deployed by SMHI in cooperation with WHOI and Scanfjord in Tångesund as part of a depth profiling system. Setting up the system required a larger effort from technical personnel than expected. Teething problems were encountered; they include problems with internet communication (4G cell phone connection), power supply and profiling systems (winches). After intense work by technical personnel and scientists the problems were resolved. In addition to the automated measurements water samples were collected every week to provide reference data. Water samples for analyses in the laboratory were also collected. The study ended in the middle of October 2016. During the study varying wind conditions resulted in upwelling and downwelling conditions. The phytoplankton community varied on the timescale of days. A bloom of the harmful alga *Lingulodinium polyedrum* was recorded. Also other HAB-species were observed.

3.1.1.2. Acquired data and archiving made

Acquired data and archiving made, where, how? (Ref to the excel file “data inventory table.xls”).

Acquired Data type	Archiving place	Status: raw data, processed,

(parameters)		Quality checked, needs to make the data flowing to the standardised channel?
CTD-data (salinity, temperature, depth)	SMHI, Swedish Oceanographic Data Centre	Processed but not fully quality controlled
CTD-data (salinity, temperature, depth)	CNRS-LOG	Processed but not fully quality controlled
CTD-data (salinity, temperature, depth)	Ifremer	Processed but not fully quality controlled
CTD-data (salinity, temperature, depth)	RWS	Processed but not fully quality controlled
CTD-data (salinity, temperature, depth)	VLIZ	Processed but not fully quality controlled
Chlorophyll data	SMHI, Swedish Oceanographic Data Centre	Raw data
Oceanographic buoy - automated measurements, salinity, temperature, etc.	SMHI, Swedish Oceanographic Data Centre	Raw data
Phytoplankton data based on microscopy	SMHI, Swedish Oceanographic Data Centre	Samples are being analysed
Phytoplankton data based on imaging flow cytometry	SMHI, Swedish Oceanographic Data Centre	Raw data
Ferrybox data from the route Oslo-Kiel	NIVA	Processed but not fully quality checked
Phytoplankton data based on Flow Cytometry	VLIZ	Raw data
Data on photosynthetic parameters (Fast Repetition Rate Fluorometry)	VLIZ	Raw data
Chlorophyll fluorescence, Ferrybox data from the route Cuxhaven-Immingham	HZG	Processed but not fully quality checked
Chlorophyll fluorescence, stationary Ferrybox, Cuxhaven	HZG	Processed but not fully quality checked
Phytoplankton data based on flow cytometry	CNRS-LOG	Raw data
Phytoplankton data based on multi spectral fluorometry	CNRS-LOG	Raw data
Data on photosynthetic parameters (PAM - Pulse Amplitude Modulated-Fluorometry)	CNRS-LOG	Raw data
Ferrybox data: Phycoerythin fluorescence,	SYKE	Raw data
Phytoplankton data: phycoerythrin containing species	SYKE	Raw data
Phytoplankton data based on	RWS	Raw data

Flow Cytometry		
Data on photosynthetic parameters (Fast Repetition Rate Fluorometry)	RWS	Raw data
Carbon fixation, C-13 method	RWS	Raw data
Phytoplankton data based on Flow Cytometry	CNRS-MIO	Raw data
Data on photosynthetic parameters (Fast Repetition Rate Fluorometry)	CNRS-BOREA	Raw data
Phytoplankton data based on multi spectral fluorometry	Ifremer	Raw data
Phytoplankton data based on Flow Cytometry	Cefas	Raw data

3.1.1.3. Communication materiel

The list below includes material collected until September 2016.

Type (photos, video, other)	Topic (3 lines max)	How to get it? Copyright etc. URL?
Images and video	Tångesund study, Skagerrak	Contact SMHI
Images	Cruises in the North Sea	Contact RWS
Images	JERICO Plankton workshop 1	Contact CNRS-LOG
Images	JERICO Plankton workshop 2	Contact SMHI,RWS and CNRS-LOG

3.1.2. Next steps (Sept. 2016-Aug. 2018)

when	what
M13-M36: (Sept. 2016- Aug. 2018)	**1) Baltic Sea** Year 2017 will be the main sampling year in the Baltic Sea. Measurements and sampling will be carried out by SYKE and SMHI with a contribution from CNRS-LOV. The spring bloom and summer cyanobacteria bloom will be in focus. **SYKE** Platforms: Utö Island ocean observatory in the Archipelago Sea. Ferrybox Helsinki-Stockholm Activities: Continuous measurements using different fluorometers, Multiexciter, OSCAR PsiCam, FRRF etc. Continuous measurements are planned for the whole growing season. In addition, 3 to 5 campaigns (one or two weeks) will be carried out in Utö during phytoplankton events.

	Variability between the seasons will be investigated using sensors for phycoerythrin (PE, specific to some algal groups) and phycocyanin (PC, specific to some cyanobacteria). How can the different instruments characterise the changes in diversity and biomass, separation of pico-cyanobacteria and filamentous cyanobacteria during summer, optimal discrimination? Supporting information from microscopy and possibly also from imaging flow cytometry (IFCB) will be made available. **SMHI** Platforms: Ferrybox system: Lübeck-Oulu-Kemi-Lübeck Oceanographic buoy Huvudskär E. (NW Baltic Proper) Research vessel Aranda Activities: Continuous measurements of PC and chl fluorescence using the Ferrybox. Water sampling and microscope analysis Measurements of fluorescence parameters using the oceanographic buoy. Use of underwater video profiler (UVP5) during research cruise in July 2017 from a R.V. Aranda. The focus is to study vertical distribution of cyanobacteria **2) Kattegat-Skagerrak Region** The study at Tångesund in 2016 was a major effort. In 2017 samples and data will be analysed to produce deliverables and scientific articles. Continued work includes the measurements made using Ferrybox Oslo-Kiel (NIVA) with several optical sensors. SMHI plan to replace a wave buoy located at Väderöarna in the Skagerrak with a more advanced oceanographic buoy with optical sensors. **3) North Sea - E. Channel** Scientific/policy questions: • Making a map of the distribution at sub-mesoscale of phytoplankton abundance/biomass/diversity (mainly functional) in the North Sea and eastern Channel • To better understand the phytoplankton community changes and development of the spring bloom at high temporal resolution • To contribute to the surveillance of the status of North Sea and Channel (Marine Strategy Framework Directive) and proposing measurements for exploration of new indicators of Good Environmental Status (GES) North Sea-Channel opportunities to work onboard Research Vessels: Endeavour (Cefas), Simon Stevin (VLIZ), Zirfaea (RWS), Côtes de la Manche (CNRS). • Combined cruises to follow/track the bloom (*Phaeocystis* & diatoms) from the Bay of Seine towards the southern North Sea, characterizing functional groups/biodiversity/ physiology bloom (state/activity/..). • Auomated data associated with reference data as well as

	completed with other physico-chemical parameters. Calibration with other sensors. E. Channel opportunities to monitor phytoplankton dynamics, at high temporal resolution, on fixed/mooring stations: Marel Carnot - Fixed station Boulogne sur Mer (E. Channel), to be implemented late 2017 - early 2018 (IFREMER-CNRS LOG) : study at high frequency of changes in abundance/biomass/ SMILE Buoy - Bay of Seine- E. Channel (CNRS Borea-IFREMER) : study at high frequency of changes in biomass / photosynthetic parameters under direct estuarine influence. North Sea opportunity for regular spatial assessment of phytoplankton distribution at meso-scale : Ferry Box in the Cuxhaven (UK) - Zeebrugge (BE) - Haldan (NO) line, where JRAP#5 will install sensors for pCO2, pH and total fluorescence (and will perform microscopy counts): possibility to join sensors of JRAP 1 will be explored **4) Mediterranean Sea** -Observation of the phytoplankton autumnal and winter distribution (focusing mainly on the relative importance of pico- and nanoplankton) in the Western Mediterranean Sea: Installation of the Cytosense onboard the ferry le Carthage. This strategy will be complemented by some new generations of sensors capable to bring more information about the structure and the dynamics of the community (FRRF, PAM, Cytosense, O2/ar, pCO2). Such an approach will be first implemented at the Marine station of the Mediterranean Institute of Oceanography (in Endoume station) where a sampling pump will bring the seawater to a lab where the sensors will be implemented and tested. Once this will be done, then the system will be implemented onboard on various cruises. - Work on the Database for phytoplankton developpement thanks to a close coordination with the SeaDataCloud consortium. -Minicosm study at the MIO: primary production from several sensors (if funded, SYKE FRRF), Oxygen/argon sensor, flow cytometer. Preparation for the *In situ* observation site expected at the Marine Station of Endoume.
M31: JERICO Plankton workshop III (joint WP3.1 and WP4.1) - May 2018	A third International Workshop on Automated Phytoplankton Observation is planned to be arranged in Marseille in May 2018. The focus will be on reporting results achieved in WP3.1 and WP4.1 and to compile the JRAP1 contribution to the final report from the JRAP's (D4.5)

3.1.3. Answers to the STAC after D4.1 report

Question 1: **Please clarify how the JRAP activity links to other ongoing collaborative works/projects, indicate an approximate % age of contribution**.

*Project names, project type: (H2020, etc..), ~% contribution to the JRA***P:** **Baltic Sea (SYKE, SMHI)** JRAP#1 build on ferrybox infrastructure operated and maintained by project Algaline (SYKE and SMHI, Baltic Sea co-operation project , in operation >20years, SYKE coordination) and Utö infrastructure operated and

maintained mainly by FMI and partly by SYKE (institutional funding). All these infrastructures in Finland are part of national marine research infrastructure FINMARI, which coordinates all Finnish marine observations and is partly supported by Academy of Finland. SMHI (Sweden) operate the FerryBox line Oulu-Lübeck together with SYKE since 2010. SMHI also operates the Huvudskär buoy in the Baltic Proper as part of the Swedish infrastructure.

Kattegat-Skagerak (SMHI, NIVA)

JRAP#1 activities build on the Tångesund observatory operated by SMHI with subcontractors WHOI and Scanfjord. The oceanographic buoy in Tångesud is part of a Swedish National buoy newtwork partly funded by the Swedish Research Council. SMHI also operates an oceanographic buoy in the Skagerak. The ferrybox infrastructure (Oslo-Kiel) is operated and maintained by NIVA.

North Sea – English Channel

JRAP#1 activities with automated optical sensors in the E. Channel and North Sea were started, build upon former projects as the DYMAPHY (EU INTERREG IVA "2 Seas", 2010-2014), the CHARM III (Interreg IVA "France-Channel-England", 2009-2012) and PROTOOL (FP7 – 2009-2012), which started to explore, test and inter compare the existing automated phytoplankton optical sensors, combined to reference methods.
They are at present supported by current projects as the Alg@nline ferry box project (FMI-SYKE-SMHI), the Life Watch EU project coordinated within VLIZ (Belgium) and Swedish Lifewatch (SMHI), the EU EMODNET Database facility (VLIZ), as well as National/local projects (Smart Buoys – Cefas, RWS current monitoring programmes, CPER MARCO-CNRS/Ifremer, SMILE-CNRS/IFREMER

Mediterranean Sea, CNRS-MIO and CNRS-LOV

JRAP#1 activities build on the Ferrybox infrastructure operated and maintained by the CNRS-MIO together with Tunisian partners, in the frame of A*Midex CHROME-CNRS project.

Question 2: **Please elaborate a list of products derived from the acquired data and/or the analysis method to be used.** (ex. Data assimilation based on xxxx to produce yyy, statistical modeling to forecast XXXa or derive YYY, maps of integrative information , etc…)

Main product: Technical strategy and recommendations towards reliable measurements of phytoplankton dynamics at high spatial and/or temporal resolution, performed by a combination of phytoplankton optical sensors in different European coastal areas, focusing on diverse phytoplankton regimes and communities, responsible for a wide variety of phytoplankton outbursts (mainly but not only, Harmful Algal Bloom).

This strategy and recommendations will benefit from the results of both the literature review provided by WP2.4.2 on optical sensors, WP3.1 on technical and analytical improvements.
The particularity of this JRAP consists in combining different optical sensors based on three approaches (image acquisition/analysis, single-cell analysis and bulk multispectral analysis) for addressing phytoplankton dynamics at a monitoring rate that fits the most species growth rates, on order to be able to get deep in the understanding of the factors triggering the onset, maximum growth and biomass, population successions and collapse pf phytoplankton blooms, of outmost importance for understanding and defining the status, trends and regime shifts due to anthropogenic or global change pressures.

The results will be spatialised and the overall range of spatio-temporal variability in the succession, triggering and ending characteristics of phytoplankton and inner dynamics of phytoplankton communities will be characterised in contrasted European coastal systems, improving (when possible) the understanding of the environmental controls of this variability.

At last, we will combine the biological results with (when available) results of air-sea C-fluxes and carbonate system components results gathered within JRAP#5, in order to better differenciate between biological vs.

solubility carbon pump in different European coastal seas.

Question 3: Science integration in the Bay of Biscay and Med. Sea.
Your advice on and interest in working during 2 years (maybe 3) to write a common paper (or 2, or maybe something more important?) to tackle:

- 1-2 "scientific questions" (to be defined) for the bay of Biscay?
- 1-2 "scientific questions" (to be defined) for the Mediterranean Sea?

Here above referred "Scientific questions" that should be cross cutting and integrative with biology, physics, chemistry.
This means to agree on the scientific focus, make the bibliographic reviews, analysing data and jointly conclude on the results. This is actually what should be the main outcome of the WP4 together with the inputs to the overall JERICO-RI strategy.
Do you and/or some your JRAP team agree? Y/N, if yes please explain what contributions your team could be involved in; if no, please explain why (max 1page).

We discussed together about these propositions during the last Automated Plankton Observation workshop in Gothenburg.

Some of the partners involved within JRAP#1 might be interested in :

- a review and data analysis on the connection between environmental parameters and phytoplankton changes in diversity and abundance/biomass leading to phytoplankton blooms
- joining one of the JRAP#4 (HF Radar and hydrodynamics) field measurements in summer 2017 in the Bay of Biscay, by adapting the JRAP#1 strategy and approaches to hydrodynamic approaches (favouring not only the coupling of physics and biology but also by recommending further inter disciplinary studies
- coupling their current field studies within JRAP#1 together with other JRAPs field studies/techniques (as JRAP#5 and JRAP#6 approaches) in the Mediterranean

Nevertheless, all partners concluded that these efforts concerning Science Integration could also be performed including Nordic regions (Baltic, Straits and Fjords, Channel-North Sea) where many JRAP partners/countries have activities.

Details of Science Integration initiatives:

Baltic Sea

In the Baltic Sea, collaboration between JRAP#1 & JRAP#5 is very strong (same actors, partly same infrastructures).

1. We aim at writing a JRAP1/5 paper on how the different bio-optic proxys for phytoplankton taxonomy/production may be combined with carbonate system dynamics, in analyzing the effectivity of biological C-pump vs. solubility pump. (cooperation between FMI, SYKE, SMHI and other possible collaborators, partly through TNA possibilities)
2. We look for another potential topic combining JRAP#1/5 and JRA#P6

Mediterranean Sea, Aegean Sea

A JRAP#1 & JRAP#5 link is under creation (HCMR, SYKE, CNRS) to test limits of automated tools for phytoplankton coastal observation in the oligotrophic Cretan Sea at the location of JRAP#5 activities (FB, HCB). Contacts have been made and TNA possibilities are explored to test several instruments lower detection limits.

Straits, Fjords and Norwegian Shelf

We intend to combine data from JRAP1/JRAP5 to examine the relative roles of the biological and solubility pumps, especially addressing seasonal and spatial scale. The JRAP activities will also be used for assessing major contributions to coastal acidification (ocean acidification in coastal regions), especially with regards to freshwater input via rivers and fjords. Together with HZG, we plan to look at

carbonate system variability in the North Sea, with collaboration between NIVA/FMI/SYKE/SMHI on inorganic C and total alkalinity fluxes from the Baltic into the North Sea.
We aim to produce JRAP1/5 papers on the interannual variability of the coastal and shelf carbonate system, the influence of marginal inputs and sensitivity to ocean acidification.

North Sea-Channel-Bay of Biscay

A collaboration will be strengthened between JRAP#1, 5 and 4 in order to combine at least one integrated field study combining hydrodynamics, chemistry of carbonate and phytoplankton automated optical sensors, benefitting from the FerryBox platforms and/or JRAP#4 dedicated cruises and measurements (collaboration between HZG, VLIZ, CNRS, AZTI).

3.1.4. Updates with regards to the scientific strategy of your JRAP

No consequent changes were currently experienced during the first year of the project, with regards to the strategy expressed in D4.1.
Most partners developed joint field studies concerning the monitoring of phytoplankton dynamics and blooms (including HABs) in the sites and periods planned for the year 2015-2016. The collaboration was effective at least amongst a pair of partners, subcontractors and non-European laboratories when the expertise was not present in Europe.
For some sites and periods, the year 2015-2016 was dedicated to prepare the actions that will be carried out in 2016-2017 and to make contacts with some of the JERICO-Next partners to complete the actions by incorporating new sensors to the field activities.

3.1.5. Any Comment

JRAP#1 leaders and partners have found difficult to deal with the deadlines requested for reporting about the workshops, as well as on advancement deliverables more than twice a year. These requests are time consuming, when compared to the time allocated to the discussion on scientific approaches and on the analysis of the first results gathered together. They hope there will be enough time to meet and discuss on these matters further in the project, in order to meet the final deadlines of each JRAP.

24 Nov. 2016: Answer from the WP4 leader also scientific coordinator of the project (I. Puillat, Ifremer):
This will be discussed during the next Steering committee meeting to be held the 12-13 Dec. 2016, in Issy Les Moulineaux, near Paris

3.2. JRAP#2: Monitoring changes in benthic biodiversity

PI: Antoine Grémare
Involved institutes: CNRS/HCMR/IFREMER

Objective of the JRAP):
The overall aims of JRAP-2 are: (1) to carry out several sequences of observations in view of practically assessing the interaction between disturbance(s), benthic diversity and functions, and (2) by doing so to contribute to define an optimal strategy to assess the interactions between these three parameters/ processes. More specifically, considering the remineralisation of Particulate Organic Matter (POM) settling at the sea-floor as an indicator of the functioning of the sediment-water interface, JRAP-2 will deploy a series of measurements of (1) benthic (both micro and macro-) diversity, and (2) the functioning of the water-sediment interface in different study areas facing different sources of disturbance.

3.2.1. Main achievements and delays

3.2.1.1. Achievements

Initial time line and expected work	Actual time line and achieved work, problems, good surprises and opportunity met
M1-M6: -Two sampling cruises for maerl biodiversity and habitat structure, fishing pressure in the Bay of Brest -Preparative work was planned to organise the first sampling actions (cruises) that will take place in October 2016 in both the West-Gironde mud-patch and the Cretan Sea. This preparative work was defined in order to define the sampling strategy.	M1-M6: main achievements, - The two sampling cruises for benthic biodiversity and habitat characteristics have been undertaken at the following dates: - 6 & 7 September 2015 - 5 & 6 January 2016 During both cruises, 8 stations distributed on a fishing pressure gradient have been sampled for macrofauna (grab sampling), Megafauna (quadrat pictures), sedimentology, maerl vitality and complexity. Fishing pressure gradient was obtained through calculations based on AIS data from fishing vessels in the area (data from 2012 to 2016). January sampling strategy was adapted using the latest fishing data (October to December 2016). -Sampling strategy and general schedule defined for the two cruises. -For the West-Gironde mud-patch, a total of 10 sampling stations (from 35 to 65 meters deep) were selected in order to cover two parallel transect lines (NE-SW) crossing the whole mud-patch. -For the Cretan Sea, a total of 5 sampling stations (from 10 to 200 meters deep) were selected along a transect line starting from the sewage outfall until a

	control station where no effect of the sewage outfall should be detected
M6-M12: -Two sampling cruises for maerl biodiversity and habitat structure, fishing pressure in the bay of Brest - West-Gironde mud-patch and Cretan Sea. - Cruise preparation - Resolution of material issues (updates and preparation of specific instruments) in view of the first cruises - intercalibration of sampling and analytical procedures across study sites (workshop planned in Bordeaux M12)	M6-M12: - One sampling cruise for benthic biodiversity and habitat characteristics has been undertaken - 25 & 26 June 2015 - 27 & 28 October 2016 During this cruise, 8 stations distributed on a fishing pressure gradient have been sampled for macrofauna (grab sampling), megafauna (quadrat pictures), sedimentology, maerl vitality and complexity. Fishing pressure gradient was obtained through calculations based on AIS data from fishing vessels s in the area (data from 2012 to march 2016). The sampling strategy was adapted using the latest fishing data (October to March 2016). Next sampling cruise is scheduled for the 27 and 28th of October -West-Gironde mud-patch and Cretan Sea – West-Gironde mud-patch cruise: detailed schedule (including detailed task assignments for all participants) has been established for a cruise taking place between the 22/10/2016 and the 02/11/2016 on the R/V *Côtes de la Manche* – Preparation of the instruments that will be deployed in the West-Gironde mud patch, including multicorer, benthic chambers equipped with sensors, oxygen micro profiler. It should be underlined that the initial plan (in the project proposal) also included the deployment of eddy-correlation system. The deployment of such instrument will however be postponed until the second cruise (scheduled in October 2017) due to technical issues. – The scheduled workshop for harmonization of sampling and analytical procedures across study sites has been cancelled. However, JRAP #2 partners agreed with common guidelines in order to harmonize sampling procedures, particularly regarding sampling biological materials for microbial metabarcoding. – Cretan Sea cruise: detailed schedule is being established for a 2-day cruise that will take place in between 10/10/2016 and 17/10/2016

	on R/V Philia

3.2.1.2. Acquired data and archiving made

Acquired data and archiving made, where, how? (Ref to the excel file “data inventory table.xls”).

Acquired Data type (parameters)	Archiving place	Status: raw data, processed, Quality checked, needs to make the data flowing to the standardised channel?
Ex: Hydrology (T, S, dens)	Sismer centre	processed

3.2.1.3. Communication materiel

Type (photos, video, other)	Topic (3 lines max)	How to get it? Copyright etc. URL?

3.2.2. Next steps (Sept. 2016 - Aug. 2018)

when	what
M13-M18: (Sept. 2016-Feb. 2017)	Objectives: – First West-Gironde mud-patch and first Heraklion Bay cruises (M14) – Bay of Brest dredging survey sampling (M13; 16). Two sampling cruises are scheduled (October and early January) – Preparation for joint sampling/experiment aiming at sampling for both biodiversity and functions in the bay of Brest in M20 (April 2017) – Preparation for cruises taking place in M22 (June 2017) in the Cretan Sea and in M24 (August 2017) in the West-Gironde mud-patch. – Data extraction and analyses from (1) first cruises in the West-Gironde mud-patch and in the Cretan Sea and (2) seasonal survey of dredging in the bay of Brest. – Developments of the eddy correlation system

M19-M24: (Mar. 2017-Aug. 2017)	M19-M24: Objectives: – Second West-Gironde mud-patch (M24) and second Cretan Sea (M22) cruises – Bay of Brest dredging survey samplings (M19; M23) – Bay of Brest joint sampling/experiments (sampling for both biodiversity and functioning) in M19. This joint effort will encompass the assessment of the effect of both (1) dredging intensity and (2) invasive species (*Crepidula fornicata*) density on biodiversity and functioning of the benthic compartment in the Bay of Brest along two respective disturbance gradients. – Data extraction and analyses from (1) second cruises in the West-Gironde mud-patch and in the Cretan Sea, (2) joint samplings/experiments in the Bay of Brest, and (3)seasonal survey of dredging in the Bay of Brest. – Preparation for cruises taking place in M29 and M32 (January and April 2018) in the Cretan sea and in M30 and M33 (February and May 2018) in the West-Gironde mud-patch.
M25-M36	Objectives: – Last West-Gironde mud-patch (M30 and M33) and Cretan Sea (M29 and M32) cruises – Bay of Brest dredging survey sampling (M25) – Data extraction and analyses from (1) cruises in the West-Gironde mud-patch and in the Cretan Sea, (2) seasonal survey of dredging in the bay of Brest. – Overall data analyses in view of cross-systems and cross-disturbance type comparisons.

3.2.3. Answers to the STAC after D4.1 report

Question 1: **Please clarify how the JRAP activity links to other ongoing collaborative works/projects, indicate an approximate % age of contribution**.
Project names, project type: (H2020, etc..), contribution to the JRAP:
LifeWatchGreece, ESFRI: 5% contribution to JRAP#2, through the MedOBIS data repository (for the Cretan Sea area) possibility of integrating data from previous studies in the same site.

It is also worth noticing that parts (e.g. WGMP and parts of Bay of Brest actions) of JRAP2 will be achieved In tight connection with national projects (e.g. ANR AMORAD -25% contribution to JRAP2) and BENTHOVAL (10% contribution to JRAP), and AAMP IMPECAP (50% contribution to JRAP). We do believe that such a nesting may prove a key point in building a pan European coastal observatory.

Question 2: **Please elaborate a list of products derived from the acquired data and/or the analysis method to be used.** (Ex. Data assimilation based on xxxx to produce yyy, statistical modelling to forecast XXXa or derive YYY, maps of integrative information, etc…)

Data on benthic biodiversity could be used to estimate the functional diversity of the study areas, in respect to

their sources of disturbance. Based on the measurements of the physicochemical parameters, statistical modelling could be employed to predict responses of the benthic biodiversity under different scenarios. Both analyses can be integrated through indicators which can subsequently be used for the assessment of the ecological status of the sampling stations in all regions of the JRAP#2 implementation.

Data derived from Sediment Profile Imaging can also be used to derive ecological quality status of benthic stations in relation with the nature and the intensity of disturbances.

Corresponding outputs may consist in maps of ecological quality status of benthic habitats using different tools/approaches within tested areas.

Question 3: Science integration in the Bay of Biscay and Med. Sea.
Your advice on and interest in working during 2 years (maybe 3) to write a common paper (or 2, or maybe something more important?) to tackle:

- 1-2 "scientific questions" (to be defined) for the Bay of Biscay?
- 1-2 "scientific questions" (to be defined) for the Mediterranean Sea?

Here above referred "Scientific questions" that should be cross cutting and integrative with biology, physics, and chemistry. This means to agree on the scientific focus, make the bibliographic reviews, analysing data and jointly conclude on the results. This is actually what should be the main outcome of the WP4 together with the inputs to the overall JERICO-RI strategy.
Do you and/or some your JRAP team agree? Y/N, if yes please explain what contributions your team could be involved in; if no, please explain why (max 1page).

Basically, yes provided that the objectives are clear. For example, a recent review paper has been produced by the MERMEX group for the Mediterranean Sea (Marine ecosystems' responses to climatic and anthropogenic forcing in the Mediterranean, Progress in oceanography 91:97-166) and we clearly have to adjust our own objectives not to be redundant.

JRAP2 involved in the assessment of macro benthic diversity (both taxonomic and functional) and microbial diversity (using molecular tools). The latter will be tackled by the HCMR team for all study areas.

Possible scientific questions that could be addressed are:
1) Taxonomic vs functional diversity of macro and micro benthic organisms: two sides of the same story?
2) Microbial and macro benthic co-occurrence: do taxa co-occur more often than expected by chance? Which are the outcomes of this non-random co-occurrence?
3) What are the predictions for benthic biodiversity under increasing disturbance?

3.2.4. Updates with regards to the scientific strategy of your JRAP

Comparing to the initial scientific plan of the JRAP #2 as expressed in the document D4.1. and after the feedback given by the STAC, JRAP #2 partners realized on the interest of developing derived products.

Accordingly, they agreed on the formulation and the development of two kinds of products:
-The first one refers to proposal for developing appropriate sampling designs allowing for the assessment of the impact of different disturbance types on benthic communities and associated ecosystem functions. Such formulation will be formulated after analysing the results of the different study cases investigated within JRAP #2.
-The second one refers to the development and use of ecological quality status indices particularly derived from (1) benthic fauna (abundance and biomass) matrices, (2) qualitative and quantitative analyses of images of the sediment column (sediment imaging profiler) and (3) direct and indirect measures of disturbance intensity.

3.3. JRAP#3: Occurrence of chemical contaminants in coastal waters and biological responses

PI: Luca Nizzetto (NIVA)
Involved institutes: NIVA, HZG, CEFAS, IMR, IRIS

Objective of the JRAP:
1) To identify new contaminants in European coastal waters that are not yet addressed by regulation but which can pose a pressure to the coastal marine ecosystem.
2) To describe spatial distribution of chemical contaminants in European coastal waters exploiting integrated fixed and mobile monitoring infrastructures.
3) To investigate the patterns of the spatial distribution exploiting information from physical and chemical sensors available on the infrastructures.
4) To Analyze co-linearity between contaminant signals and biological signals (specifically tracking the presence of pollution feeding microorganisms in areas with high contamination exposure.
Specific objectives of the JRAP3 are:
-To deliver technical protocols and best practices for the monitoring of chemical pollutants using existing coastal infrastructures
-To optimize existing chemical sensor technology for use on fixed coastal monitoring infrastructures
- To provide guidelines for the implementation of contaminant monitoring using JERICO infrastructures (e.g. information on outcomes from adopting different spatial resolutions.

3.3.1. Main achievements and delays

3.3.1.1. Achievements

Initial time line and expected work	Actual time line and achieved work, problems, good surprises and opportunity met
M1-M5: Purchase and testing of materials for passive sampling deployment on fixed platforms;	**M1-M5**: Accomplished. We designed from scratch a new frame (or cage) for allowing deployment of passive samplers on marine mooring and a totally new protocol for the deployment-collection operation of passive samplers on fixed platforms. We have built two prototypes of the cage in anticorrosion materials (PTFE and high grade stainless steel). We optimized the design and produce a first lot of 15 units. Sampling materials for passive samplers were prepared and installed in the new cages) The cages were sent out to our JERICO partners awaiting for deployments. In few cases the deployment has already started before the planned time).
M7-M12: Initiate Sampling with FerryBox units	**M7-M12:** The sampling through the FerryBox units have already started. We have completed two missions in the Norwegian sea and planned another mission (foreseen in October for the Skagerrak and Kattegat). We estimated that 40% of the sampling activities with FerryBox is accomplished, at date.

3.3.1.2. Acquired date and archiving made

Acquired data and archiving made, where, how? (Ref to the excel file “data inventory table.xls”).

Acquired Data type (parameters)	Archiving place	Status: raw data, processed, Quality checked, needs to make the data flowing to the standardised channel?
Ex: Hydrology (T, S, dens)	Sismer centre	processed

3.3.1.3. Communication materiel

Type (photos, video, other)	Topic (3 lines max)	How to get it? Copyright etc. URL?

3.3.2. Next steps (Sept . 2016-Aug. 2018)

when	what
M13-M24: (Sept. 2016- Sept. 2017)	All sampling activity concluded. These include: - One high resolution campaign in the Baltic Sea-Skagerrak-Kattegat on FerryBox (planned for October-November 2016). The campaign will include consistent chemical and biological sampling for biomolecular markers. Ant sampling of Polycyclic Aromatic Hydrocarbons in Water. - Deployment of passive samplers in all the selected moorings.
M13-M24: (Sept. 2016- Sept. 2017)	Chemical analysis
M24-M36	Data analysis
M24-M44	information sharing with other JRAP and JERICO WP
M36-M44	Synthesis, Dissemination.

3.3.3. Answers to the STAC after D4.1 report

General questions

Question 1: **JRAP activity links to other ongoing collaborative works/projects**

Activities of JRAP#3 are linked to the EU Norman Network of reference laboratory (http://www.norman-network.net/). This is an initiative stemmed from an EU FP7 project that seek to facilitate the exchange of information on emerging environmental contaminants in Europe and encourages the validation and harmonisation of common measurement methods and monitoring tools so that the requirements of risk assessors and risk managers can be better met. The Norman Network is a main tool for informing the development of EU regulation on chemical pollution. Specifically the Water framework directive and the Marine

strategy framework directive. One scope is to gather information on monitoring results and compile lists of detected pollutants from different environmental compartment. Data of contaminants of emerging concerns in marine and coastal waters are still fragmentary in the context of European monitoring activities, since infrastructures to support marine monitoring are limited and gathering data in this case is expensive. Jerico-next is a golden opportunity to cover this gap. Specifically, JRAP 3 will serve to populate much of the missing information on marine coastal water pollution which are necessary for the implementation of the Marine strategy framework directive. We have already presented Jerico activities to Norman workshops and we were explicitly asked to share our data to support Noram activities and aims.

Concerning the case study listed below, JRAP will be active in the following regions:
Bay of Biscay: This is a "supersite" for JRAP 3. In collaboration with JRAP4 we are deploying passive samplers with high spatial resolution to deliver data on chemical tracers that can be used for modelling purposes.
German Bight: Monitoring with Ferry boxes for contaminants of emerging concern. This may provide data for cross comparison with information on micro plastic (See below)

Question 2: **A list of products derived from the acquired data and/or the analysis method to be used**

JRAP 3 will contribute to this list with a map of chemical pollutant distribution for the Kattegat and Skagerrak (derived from high resolution spatiotemporal analysis of a range of contaminants). Based on correlation analysis we will assess whether the distribution of some pollutants can be described by a physical proxy (e.g. temperature, salinity, etc., turbidity) or a combination of them. If this will be achieved we will be able to generate a high resolution map for this region. This would be a relevant products, since Kattegat and Skagerrak receive the outflow from the Baltic (one of the most polluted (from a chemical point of view) sea in the world) and deliver this plume it to the North sea and Norwegian sea.

At least 2 scientific publications are expected to emerge from JRAP#3 activities.

Question 3: **Science integration in the Bay of Biscay and Med. Sea.**

The Bay of Biscay is a "super site" also for JRAP3. Here we deployed passive samplers for pollutants with a spatial resolution, useful for model calibration and assessment. (In collaboration with JRAP4). We can support a second deployment round in this location. To cover temporal variability aspects.
JRAP 3 is active in the German bight with Ferry Box monitoring. We aim at deploying also 2 passive samplers of two fixed platforms. These data will be available for any modelling purpose.

3.3.4. Updates with regards to the scientific strategy of your JRAP

We confirm the support to JRAP4 and include deployment at higher resolution of passive samplers in the Bay of Biscay.

3.3.5. Any Comment

The strategy of this JRAP has considerably changed compared to the one presented in the JERICO-Next proposal. This has been the result of continuous inputs from JERICO management and STAC committee. We are now entering in a phase where additional changes will be difficult to deal with. We however believe that, following the comments from the STAC JRAP3 present a quality piece of work and match JERICO strategy. This makes us happy.

3.4. JRAP#4: 4-D characterisation of trans-boundary hydrography and transport

PI: Anna Rubio (AZTI)
Involved institutes: AZTI, Ifremer, CNR-ISMAR, CNRS, CMCC, HZG

Objective of the JRAP:
JRAP4 aims to demonstrate the potential of coastal observatories and the JERICO Research Infrastructure for the understanding and monitoring of the 4D shelf/slope circulation, with applications in line with several MSFD descriptors. The work will concentrate in three pilot areas (SE Bay of Biscay, NW Mediterranean and German Bight) and rely on the use of information from Observing Systems (HF radar, moored high-frequency thermistor chains, drifting buoys) and high-resolution numerical model experiments (OSSES).

3.4.1. Main achievements and delays

3.4.1.1. Achievements

Initial time line and expected work	Actual time line and achieved work, problems, good surprises and opportunity met
M1-M9 PHASE 4.1 PREPARATION **T4.1.1 State of the art concerning hydrodynamics and methods** OBJECTIVES/SUBTASKS: Review using literature/past work at each study area to identify the key points to be considered for 4D estimates ; Review on methodologies for 4D transport estimations and forecasts (link with TASK 3.2.3 led by CNR-ISMAR)	ACTUAL TIME LINE: unchanged ACHIEVED WORK: -Review of key points completed for D4.1 -Review of methodologies completed for D4.1 Other specific achievements: -M10, AZTI: Completion of work on the application of HF radar to infer surface transports and Short Term Prediction in the SE Bay of Biscay. Related reference: Solabarrieta, L., Frolov, S., Cook, M., Paduan,J., Rubio, A., González,M., Mader, J., Charria, G. Skill assessment of HF radar-derived products for lagrangian simulations in the Bay of Biscay. J. Atmos. Oceanic Technol., 0, doi: 10.1175/JTECH-D-16-0045.1.
M1-M9 PHASE 4.1 PREPARATION **T4.1.2 Analysis of nature runs** Objectives: to assess numerical skills of regional high resolution operational forecasting system actually available in the Adriatic-Ionian basin (AIFS, http://oceanlab.cmcc.it/aifs/) with emphasis on coastal areas; b) to evaluate impact of HF-radar observations on AIFS for the W Adriatic and NW Mediterranean (CMCC).	ACTUAL TIME LINE: Task delayed since nature runs are not yet ready. - M12, CMCC and University of Bologna started an internal collaboration for setting up a re-locatable system in the NW Mediterranean, in order to start new numerical experiments for OSSE. Some delays in activities evolution are representing the major difficulty, due to change in WP3.7 leading. ACHIEVED WORK: CMCC did some significant progress on implementing HF-radar velocity data into AIFS-EnKFDA system that would be used to perform OSSEs in NW Mediterranean region for JRAP-4 activities on the assessment of HF-Radar observing strategies. In particular, Observation operators associated with the radar observation have been started, concerning the design of the numerical setup and implementation in the NW Mediterranean.

	Other specifics achievements: none
M1-M9 PHASE 4.1 PREPARATION **T4.1.3 Discussion of best sampling strategies** Objectives / subtasks: Analysis of the capacity of existing infrastructures to resolve the key processes, reference for demonstrating value-added provided by JERICO_NEXT developments; Definition on the planned sampling strategy and the strategy for OSSES to future definition /evaluation of the sampling strategy in order to reach accurate 4D estimates (and the ability to validate them); Joint identification of metrics/strategy to assess accuracy of 4D estimations and forecasts and of Lagrangian diagnostics (in relation with MSFD).	ACTUAL TIME LINE: M1 – M12 Ongoing discussion on strategy for OSSES in progress, waiting for OSSES and nature runs first results. M1 – M12 Ongoing discussion on of metrics/strategy to assess accuracy of 4D estimations and forecasts and of Lagrangian diagnostics (in relation with MSFD). ACHIEVED WORK: -M7 : Special session on JRAP4 held during the 1st JERICO-Next HF radar workshop in San Sebastian (09-11/03/2016) were JRAP4 science strategy was discussed towards the D4.1. (http://www.jerico-ri.eu/download/JericoNext-HFR-workshop-Minutes_vf.pdf) -M9: Definition of best sampling strategies by study area ready (without OSSES) for first version of D4.1. Other specific achievements: -M10, AZTI, IFREMER: (June 23-24) Poster presentation on the sampling strategy for the Bay of Biscay at ISOBAY XV, Bilbao. Session 1: Physical Oceanography. Towards 4D shelf/slope circulation and transport estimations in the SE Bay of Biscay, within the framework of JERICO-NEXT Joint Research Activity Projects (JRAPs). A. Rubio, A. Caballero, G. Charria, P. Lazure, P. de Mey, L. Marie, J. Mader and I. Puillat.
M1-M9 PHASE 4.1 PREPARATION **T4.1.4 Report JRAP-4 Science Strategy to D4.1**	ACTUAL TIME LINE: unchanged ACHIEVED WORK: M9- JRAP4 Science Strategy for first version of D4.1 was reported in May 2016. Other specific achievements: none
M10-M23 P 4.2 ON-SITE IMPLEMENTATION **T4.2.1 MASTODON**	ACTUAL TIME LINE: unchanged ACHIEVED WORK: Other specific achievements: -M8 and M11, IFREMER. The project for the Campagne Etoile in the SE Bay of Biscay (subject to external funds) was submitted in April 2016 and has been positively evaluated and marked as a priority. Preliminary dates are 3-4/07/2017 (leg1) and 24/07/2017 (leg2). Etoile campaign will be used for deploy mastodon moorings and perform complementary measurements in the HF radar footprint area.
M10-M23 P 4.2 ON-SITE IMPLEMENTATION **T4.2.2 HFR** Objective/subtasks: Implementation of new	ACTUAL TIME LINE: unchanged ACHIEVED WORK: The installation of 2 HF radar antennas in the NW Med area has been completed by

HF radar sites in the framework of the JERICO_NEXT infrastructure.	CNR-ISMAR. The system is composed of 2 SeaSonde antennas at 25 Mhz, installed in the Tino island and in Monterosso respectively, and covering the area of the 5Terre in the Eastern Ligurian Sea. The antennas have been calibrated. Other specific achievements: - M3,M5, CNR-ISMAR Presentation meetings with potential stakeholders: Regione Liguria, Genova, February 14 2016; Italian Navy, Lerici, November 10 2015
M10-M23 P 4.2 ON-SITE IMPLEMENTATION T4.2.3 Analyses of OSSES Objective/subtasks: Interaction with OSSE implementation. The set up and testing of HF radar assimilation using Kalman filtering is presently carried out by CMCC. ISMAR-CNR is collaborating with CMCC providing expertise on the characteristics of HF radar data and on the associated errors and uncertainties. CMR-ISMAR is also providing the HF radar data in the NW Mediterranean Sea and also the historical data in the Manfredonia Gulf (in synergy with WP3.7 and WP3.2)	ACTUAL TIME LINE: Task delayed since OSSEs are under development in the NW Med Sea area ACHIEVED WORK: - Other specific achievements: none
M10-M23 P 4.2 ON-SITE IMPLEMENTATION T4.2.4 Auxiliary instruments	ACTUAL TIME LINE: unchanged ACHIEVED WORK: - Other specific achievements: none Good surprises / opportunities: -M13, MIO will deploy (26-28/10/2016) an ADCP 75kHz during 1 year at the ALBATROSS (IR EMSO and SOERE MOOSE, NW Med) mooring, in the footprint area of their HFRs. This will represent a great opportunity to have data In the water column (surface from HF radar and satellite images) to measure the Northern Current and its mesoscale variability. -M1-2, MIO. The OSCAHR cruise was conducted from 29 October to 6 November 2015 in the NW Med. The first leg sampled the coastal waters near the Cote d'Azur, characterized by the presence of the along-shore Northern Current. During the second leg, an offshore region characterized by strong temperature and chlorophyll gradients has been sampled in the middle of the Gulf of Genoa. The scientific objectives of OSCAHR (Observing Submesoscale Coupling At High Resolution) were to characterize a submesoscale dynamical structure and study its influence on the distribution of biogenic elements and the structure and dynamics of the first trophic levels associated with it. The OSCAHR dataset additionally allows for validation of remote sensing measurements (altimetry, ocean color, reconstitution of planktonic assemblages). The cruise strategy utilizes an adaptive

	approach based on satellite, HF radar maps and numerical modeling data to identify dynamical features of interest. The methodology includes the use of very recent or new instruments that sample the surface layer at high spatial and temporal frequency. In particular, an MVP (Moving Vessel Profiler) has been deployed with CTD, Fluorescence and LOPC (Laser Optical Particle Counter) sensors. Furthermore, a new type of cytometer has been installed that allows for near-time, high through- put sampling of phytoplankton functional groups from micro-phytoplankton down to cyanobacteria (Prochlorococcus).
M10-M23 P 4.2 ON-SITE IMPLEMENTATION **T4.2.5 Data processing & analysis** Objective/subtasks: - Analysis of data from HF radar and other complementary platforms in the NW Med to acquire information on variability at various scales and its impact on transport estimates. MIO and CNR-ISMAR are presently analysing historical data from a TOSCA experiment (December 2011) including data from HF radar, gliders, drifters and satellite. -Analysis of HF radar data and satellite information to study mesoscale structures in the SE Bay of Biscay and their impact on shelf/slope transports	ACTUAL TIME LINE: unchanged ACHIEVED WORK: Other specific achievements: M12 – CNR-ISMAR, Presentation at project INCREASE Workshop, September 13-15 2016, Lerici (Italy) M10 – AZTI Presentation at the congress EOF2016 (Alicante, Spain, July 2016) entitled HF radar insight into rapidly evolving mesoscale structures in the SE Bay of Biscay. A. Rubio, A. Caballero, L. Solabarrieta, L. Ferrer and J. Mader.

3.4.1.2. Acquired data and archiving made

Acquired data and archiving made, where, how? (Ref to the excel file “data inventory table.xls”).

Acquired Data type (parameters)	Archiving place	Status: raw data, processed, Quality checked, needs to make the data flowing to the standardised channel?
Hydrology (current velocity, wave parameters)	HFR raw and processed (radial) data are archived in each of the sites in two mirrored external HDD. A general backup is made at the central CNR-ISMAR Server RadialCombine, where radial data are also combined into total velocity maps. Both radial and total data are stored locally in NetCDF format and a copy is uploaded to a THREDDS server running on a different	Archived data are: - quality controlled radial velocity data - quality controlled total velocity data - Spectra (raw data)

	machine which provides data access and visualization via the catalog: http://ritmare.artov.isac.cnr.it/thredds/ritmare/CoastalRadarOS/HF_RADAR/Tyrrhenian_Ligurian_Sea/catalog.html	
Hydrology (current velocity, wave parameters)	HF radar data for the SE Bay of Biscay system are stored locally (spectra, radials, totals, waves). Total data converted to netcdf and put available in a thredds server connected ot Emodnet (http://oceandata.azti.es/thredds/catalog/data/RADAR_OO/catalog.html)	Spectra and wave are raw data Radials and totals are quality controlled using basic procedures Gap-filled totals using OMA are produced operationally and upload to a threads test server.

3.4.1.3. Communication materiel

Type (photos, video, other)	Topic (3 lines max)	How to get it? Copyright etc. URL?
Photos	Photos of HF radar sites and antennas	email

3.4.2. Next steps (Sept . 2016-Aug. 2018)

They are indicated only if different from the initial planning or any other precision is needed

when	what
M14	Scientific results of Optimal OSE/OSSE System in the NW Mediterranean will be consolidated by M14. Thanks to the new data available in the Ligurian Sea, transport diagnostics will be set up for the NW Mediterranean and preliminary results will be provided by M14. CMCC teamwork agrees to start to think on a more robust design of the data assimilation systems towards operations, in order to capitalize the JERICO-Next future results for improving operational oceanography, ocean forecasting and numerical modelling. Discussions will start inside WP3.
M22	Campagne Etoile in the SE Bay of Biscay (subject to external funds) was submitted in April 2016 and has been positively evaluated and marked as a priority. Preliminary dates are 3-4/07/2017 (leg1) and 24/07/2017 (leg2). Etoile campaign will be used for deploy mastodon moorings and perform complementary measurements in the HF radar footprint area.

3.4.3. Answers to the STAC after D4.1 report

Question 1: Please clarify how the JRAP activity links to other ongoing collaborative works/projects. Project names, project type: (H2020, etc..)

Bay of Biscay

The project LIFE LEMA - Intelligent marine Litter removal and Management for local Authorities (LIFE15 ENV/ES/000252) was finally approved in June 2016, and is starting in September 2016.The project aims at defining a holistic management service to guide local authorities in selecting the most sustainable approach to

address floating marine litter (FML) and to prevent and reduce the impact FML causes to the environment and society. The service will be implemented in 2 transnational regions in the SE Bay of Biscay (Gipuzkoa and Pyreneess-Atlantiques). One of the LIFE LEMA tasks will focus on the applications of modelling tools (in coordination with JERICO-NEXT WP4 Task JRAP 6) and transport characterization from HFRs and other in situ platforms (in coordination with JERICO-NEXT WP4 Task JRAP 4), to specific purposes related with FML. The way to use the information on ocean dynamics for FML trough three approaches (offshore collection, management of FML onshore, and source identification) will be the specific challenge of LIFE LEMA. LIFE LEMA project is, thus, especially well adapted for demonstrating the impact of the proposed innovative solutions of management assisted by Operational Oceanography tools.

The project COCTO (Coastal Ocean Continuum in surface Topography Observations; PIs: N. Ayoub, P. De Mey) funded by TOSCA/ROSES in the frame of SWOT altimetry mission - 2015-2018. This project concentrates on the transition ("continuum") between estuaries and the deep ocean, with a central focus on shelves. It has 3 objectives: (1) advance our understanding of fine-scale dynamical processes within the estuary-mouth-plume-shelf-break-ocean continuum; (2) identify the signature of these processes in current and future measurements, in particular Sea-Surface height (SSH) and other surface measurements; (3) characterize the potential impact of future SWOT measurements, together with complementary in situ measurements, on the estimation of those processes. We will study two regions with geographical similarities (presence of an estuary, wide shelf, macro-tidal dynamics) yet sufficiently different (mainly tropical vs. mid-latitude site) to provide a wide spectrum of physical processes and to open new perspectives for SWOT applications: the Bay of Biscay (including the Gironde estuary) in the North East Atlantic and the Gulf of Tonkin (including the Red River estuary) in the South China Sea. The approach is mainly based on high-resolution numerical simulations, with which we will (1) characterize the relevant dynamical processes, (2) analyse surface signatures of those processes, (2) perform data assimilative impact studies of simulated SWOT observations. Observations (in situ and satellite) will also be explored to better understand those small-scale processes. As one of the regions of interest is the South-Eastern part of the Bay of Biscay, diagnostics developed in this project will be potentially used in the frame of JERICO-NEXT for comparisons between numerical experiments and in situ observations.

NW Med

The IMPACT project (Maritime Cross Border Cooperation Project Italy-France) is presently considered for funding starting by the end of 2016. IMPACT deals with the challenge of managing Marine Protected Areas (MPAs) in coastal regions next to industrial ports, focusing on the North Western Mediterranean Sea. The objective is to define cross border plans to protect MPAs while keeping into account port development in the general framework of Blue Growth. IMPACT will provide a dedicated GIS system with the following information: a) transport by ocean currents between ports and MPAs, based on HF radar and drifter measurements; b) ecological retention properties of MPAs, based on ecological sampling and numerical models: c) contaminant distribution based on historical and dedicated measurements. The project is strictly linked with JERICO-NEXT JRAP4 in terms of transport products and ecological consequences.

The RITMARE Flagship Project extends until the end of 2016, It is the leading national marine research project in Italy and it includes the setup of an Observation System for the Marine Environment (WP5). In this framework, a network of coastal radars is in the process of being implemented, fostering data interoperability and scientific collaboration. In particular, a network of HF radars has been set up in the Tyrrhenian and Ligurian Sea, in coordination with JERICO-NEXt.

Collaboration with the COPERNICUS MARINE ENVIRONMENT MONITORING SERVICE for the Mediterranean Sea is foreseen through the JRAP partner CMCC in the framework of the European Service for Marine Service, operational since May 2015. The Consortium, led by CMCC, is composed by the Italian National Institute of Geophysics and Vulcanology (INGV), the Hellenic Centre for Marine Research (HCRM) and the Istituto Nazionale di Oceanografia e Geofisica Sperimentale (OGS): they are responsible of the Mediterranean Monitoring and Forecasting Centre (Med-MFC). Med-MFC provides regular and systematic information about the physical state of the ocean and marine ecosystems for the Mediterranean Sea, starting from the pre-operational

system developed during the MyOcean projects. The Med-MFC products include analysis, 10-days forecast, specific and targeted products and reanalysis. Products describe waves, currents, temperature, salinity, sea level and pelagic biogeochemistry. Further information are available at http://marine.copernicus.eu

German Bight
A possible cooperation could be developed with the project "Macroplastics Pollution in the Southern North Sea – Sources, Pathways and Abatement Strategies" funded by Lower Saxonia and coordinated by the University of Oldenburg. An important component of this project is the analysis of macro plastic drift at the surface, which fits into the activities planned in JERICO_NEXT.

Question 2: Please elaborate a list of products derived from the acquired data and/or the analysis method to be used.

1- Maps of surface currents and integrated transport
As stated in JRAP-4 section, main efforts will be put in quantifying transport by ocean currents and its potential impact on the distribution of floating matter (plankton - jellyfish or other pelagic organisms, marine litter, pollutants, etc.). In addition to the transport estimations, specific actions within the different study areas will be devoted on producing information and maps on integrated transport that can be used as a basis for several applications, including those of interest of other JRAPs. In the German Bight the plan is to derive transport estimates based on a combination of numerical model, HF radar data and tide gauge observations.

2- Specific products for numerical modelling validations and data assimilation (in coordination with JRAP6)
In the SE BoB the specific cross-cuttings with JRAP-6 will involve joint analysis of data and simulations for model assessment, specific products will be elaborated for this task (e.g. monthly means of surface currents, spectral analysis of surface currents, data and plots of integrated and surface transports with time…). In the **NW Mediterranean Sea**, CNR will be providing HF radar data for numerical model validation, set up of an assimilation system and implementation of an OSSE system. Led by CMCC, the cross cutting action with WP3.7 and JRAP6 consists in the development of an observation operator for assimilation of HF radar radial velocities. A data assimilation system is set up for assimilating HF radar data in the Gulf of Manfredonia area to improve modelling in coastal areas and perform an OSSE in the Adriatic and NW Mediterranean area.

3-Finally, in the SE Bay of Biscay There will be also the possibility to propose integrated products from in situ observations in the region including cruise data in 2017

Question 3: Science integration

The most directly related JRAP is the JRAP6. Although there are identified physical-biological approaches in all of the study areas, there is no any obvious overlap with other JRAP specific topics or data. A common opinion is that it would be nice to consolidate the JERICO-Next knowledge through multidisciplinary publications with other JRAPs colleagues, but only if we can find the historical data for a real cross-cutting integrative exercises. We should think about the scientific questions based on the available data and have the opportunity to discuss more specifically on this, for instance in a dedicated meeting.

3.5. JRAP#5: Coastal carbon fluxes and biogeochemical cycling

PI: Lauri Laakso, FMI; Jukka Seppälä, SYKE
Involved institutes: FMI, SYKE, NIVA, SMHI, HZG, HCMR, CNR, CNR

Objective of the JRAP:
JRAP#5 will exemplify how JERICO-NEXT can contribute to address the role and responses of the European Coastal Ocean and Marginal Seas in the global C-cycle, and to provide recommendations for a European integrated C-cycle monitoring. JRAP#5 will assess the sensitivity of biological and physical controls of air-sea C-fluxes. JRAP#5 will analyse the variability of sea-air C-fluxes and biogeochemical C-cycles, and will provide a mechanistic understanding on how marine biological and physical processes affect the C-cycle.

3.5.1. Main achievements and delays

3.5.1.1. Achievements

Initial time line and expected work	Actual time line and achieved work, problems, good surprises and opportunity met
Task 1 Inventory of methodologies and instrumentation (M6-M9) Objective: Collect detailed information of existing instruments and methodology. Collect information for each main type of instrument (pCO_2, pH, alkalinity, chlorophyll, O_2), their status and maintenance and the typical ranges of analysts. This information provides first-hand information on the diversity of sites and methodologies involved. After this primary information has been pooled (spring 2016) we still have ample time to react if immediate issues in comparability of methodologies arise.	**M1-M12: main achievements** The questionnaire was send in March 2016 to JRAP#5 partners, requesting general information of the study sites, instrument types (pCO2, alkalinity, pH, Chlorophyll/O2), their status, instrument methodology, typical measurand variability at the site, calibration procedures applied, maintenance frequency and methodology and problems & challenges encountered. The questionnaire was finalised by May 2016, with information from all JRAP#5 partners.
Task 2 Inter-comparison of methodologies (M14 -M17) Objective: Within Jerico-next e.g. pCO_2 is measured with at least 6 different methods and instruments, the same diversity of instruments applies also to alkalinity and pH measurements. This diversity may lead to observation results which are not comparable between the sites. The aim of the task is to organise scientific inter-comparison exercise (note, such exerciser has not been described in the original Description of Actions, but the need for such exercise was raised during later phases of planning JRAP#5.	**Main achievements** It was planned that the intercomparisons exercise should take place in Oslo and organized by Lauri Laakso (FMI) and Jukka Seppälä (SYKE) with support from Kai Sørensen and Andrew King from NIVA. Preparations started in February 2016 with a joint meeting at Oslo calibration facility, where technical details and approach of workshop was planned. Until now, we have not yet found enough funding sources for intercomparison including all JRAP#5 participants and alternatives are looked for in M12-14. If funding cannot be organised, the exercise will be postponed or

	maybe even cancelled. We hope to carry out intercomparison exercise after the intensive period, utilizing the potentially unspent TNA funding.

3.5.1.2. Acquired date and archiving made

Acquired data and archiving made, where, how? (Ref to the excel file “data inventory table.xls”).

Acquired Data type (parameters)	Archiving place	Status: raw data, processed, Quality checked, needs to make the data flowing to the standardised channel?
Data collection not yet started in JRAP#5.	SOCAT database for pCO2-data	Processed data after the intensive period

3.5.1.3. Communication materiel

Type (photos, video, other)	Topic (3 lines max)	How to get it? Copyright etc. URL?

3.5.2. Next steps (Sept. 2016 - Aug. 2018)

when	what
Task 2 Inter-comparison of methodologies (M14 -M17) (Oct. 2016- Jan. 2017)	Within Jerico-next e.g. pCO2 is measured with at least 6 different methods and instruments, the same diversity of instruments applies also to alkalinity and pH measurements. This diversity may lead to observation results which are not comparable between the sites The aim of the task is to organise scientific inter-comparison exercise (note, such exerciser has not been described in the original Description of Actions, but the need for such exercise was raised during later phases of planning JRAP#5 Until now, we have not yet found enough funding sources for intercomparison including all JRAP#5 participants and alternatives are looked for in M12-14. If funding cannot be organised, the exercise will be postponed or maybe even cancelled. We hope to carry out intercomparison exercise after the intensive period, utilizing the potentially unspent TNA funding.

M18-M30: Intensive measurement period (Febr 2017-March 2018)	Objective: The main research period of this JRAP is from spring 2017 to spring 2018, in which we will collect combined carbon and relevant biological data throughout European Seas and analyze the data especially for spatial and temporal variability, and links between the biology, and physical and chemical state of the sea. Intensive measurements are done from spring 2017 to spring 2018 at all sites At each marginal sea several platforms are used.

3.5.3. Answers to the STAC after D4.1 report

Question 1: **Please clarify how the JRAP activity links to other ongoing collaborative works/projects**

Baltic Sea (FMI, SYKE, SMHI)

JRAP#5 build on ferrybox infrastructure operated and maintained by project Algaline (SYKE and SMHI, Baltic Sea co-operation project, in operation >20years, SYKE coordination) and Utö infrastructure operated and maintained mainly by FMI and partly by SYKE (institutional funding). Novel methods to measure biological part of C-fluxes relies partly on developments made in project"Integrated experimental platform development "(SYKE, Academy of Finland 2013-17). All these infrastructures in Finland are part of national marine research infrastructure FINMARI, which coordinates all Finnish marine observations and is partly supported by Academy of Finland.

Work done in streamlining data flows (WP4-WP5 link) will guide the future development of biological/chemical data streaming in Baltic Sea observatories.

Work will guide the selection of operational instrumentation, measurement sites and frequencies as used in Baltic sea monitoring.

Results will be communicated to ICOS and will guide the development of coastal carbon observation systems.

Mediterranean Sea, Adriatic Sea (CNR)

The PALOMA research infrastructure (instrumented elastic beacon) is currently operated and maintained mainly by institutional CNR funding and the Italian Flagship Project RITMARE. Data acquired bot with automated instruments and monthly cruises represent the longest time series in the Adriatic Sea to study and monitor CO_2 sequestration and the ocean acidification (oa) process. It is part of the international network to monitor oa (GOA-ON) as well as of the Italian oa monitoring program (Marine Strategy) and contributes to the Italian project on oa (Acid It). It is a proposed site for the ICOS marine network.

Mediterranean Sea, Aegean Sea (HCMR)

The POSEIDON Ferrybox (PFB) operated (by HCMR) in the past on the route Athens-Heraklion, is currently reactivated (installed to a new ship). The system includes a pH sensor and plans to include also a pCO2 sensor are made.

The EU project FixO3 (open ocean fixed observatories) supports the POSEIDON-E1M3A buoy which

recently has been equipped with a pH sensor.
The HCMR's Project (institutional funding) of monitoring by R/V the Cretan Sea (at the E1M3A buoy location), which runs at monthly frequency since 2010, will be extended to include also sampling next to the Heraklion coastal buoy (HCB) recently deployed. In both locations discrete sampling of carbonate system parameters will be made
An ongoing grant from the European Economic Area (EEA) plans to support a pH sensor that may be deployed on the HCB buoy. The combination of the above data collected from offshore strongly oligotrophic waters with low anthropogenic impact to rather more coastal waters will allow the study of the carbon system exchange rates.

Norwegian Shelf (NIVA)

JRAP#5 activities are in cooperation with FerryBox infrastructure on two ships along the Norwegian coastline and in the North Sea (Skagerrak) that is operated and maintained by NIVA. The activities are also dependent on a NIVA-operated cutting edge carbonate chemistry analytical system for high quality determination of total dissolved inorganic C, total alkalinity, CO_2, and pH. The development of sensors for measuring carbonate system variables is being supported by NIVA Strategic Initiative program on Ocean Acidification and an EU H2020 project Integrated Arctic Observation System.
The results from JRAP#5 activities will go into cooperating project involved with the FerryBox infrastructure, including Norwegian Environmental Agency coastal acidification monitoring work, the Fram Centre, a Norwegian Research Council coastal acidification and management project (ACIDCOAST), and the abovementioned EU H2020 Arctic observation project.

Question 2: **Please elaborate a list of products derived from the acquired data and/or the analysis method to be used.**

Main product: Technical strategy and recommendations towards reliable measurements of air-sea carbon fluxes in different European coastal areas.

Based on the results obtained in JRAP5, we formulate general recommendations how to get reliable information on air-sea C-fluxes in different areas. The strategy build on products of 1) Evaluation of reliability of pCO2, pH data obtained with different equipment/measuring configurations, 2) Observed overall range and spatiotemporal variability in carbonate system components in different European coastal seas and 3) Importance of biological vs. solubility carbon pump in different European coastal seas.

Question 3: **Science integration**

Baltic Sea:

In Baltic Sea collaboration between JRAP1 & JRAP5 is very strong (same actors, partly same infrastructures).

3. We aim in writing a JRAP1/5 paper on how the different bio-optic proxys for phytoplankton taxonomy/production may be combined with carbonate system dynamics, in analyzing the effectivity of biological C-pump vs. solubility pump. (cooperation with FMI, SYKE, SMHI)
4. We look for another potential topic combining JRAP1/5 and JRAP6

Mediterranean Sea, Adriatic Sea (CNR)

Extreme meteorological events (heat waves, floods, cold winds outbreaks,) are becoming more and more frequent, as predicted by global change studies. Coastal areas respond quickly to meteorological forcings and moored instruments are essential to gain data on short time scales also under bad weather conditions. The data acquired in the JRAP5 will allow studying the response, in terms of carbon fluxes, of different coastal sites to meteorological forcings, allowing an estimate of how climate modifications

would affect air-sea CO_2 fluxes in different sub-regions of the Mediterranean Basin.

Mediterranean Sea, Aegean Sea (HCMR)

A JRAP#1 & JRAP#5 link is under creation to test limits of automated tools for phytoplankton coastal observation in the oligotrophic Cretan Sea at the location of JRAP#5 activities (FB, HCB). Contacts have been made and TNA possibilities are explored to test several instruments lower detection limits.
The JRAP#2 & JRAP#5 link is strong since benthic biodiversity is studied in the same area as JRAP#5 activities

Link with JRAP6 & JRAP5 since the carbonate system data collected may be used to setup model predictions for solubility pump

Norwegian Shelf (NIVA)

We intend to use carbonate system data from JRAP1 to examine the relative roles of the biological and solubility pumps, especially addressing seasonal and spatial scale. The JRAP activities will also be used for assessing major contributions to coastal acidification (ocean acidification in coastal regions), especially with regards to freshwater input via rivers and fjords. Together with HZG, we plan to look at carbonate system variability in the North Sea, with input from FMI/SYKE/SMHI on inorganic C and total alkalinity fluxes from the Baltic into the North Sea.
We aim to produce JRAP1/5 papers on the inter annual variability of the coastal and shelf carbonate system, the influence of marginal inputs and sensitivity to ocean acidification.

3.5.4. Updates with regards to the scientific strategy of your JRAP

As a response to STAC question, we have formulated in more detail the focused science questions, for whole JRAP#5 and separately for each area.

The general question JRAP#5 answers is, how to organise future network for reliable and consistent C-flux measurements in European seas, which differ largely in their characteristics (e.g. carbonate chemistry and biological pump). This requires that we answer sub-questions: 1) how reliable and comparable is the data collected with different measuring configurations, 2) what are the overall ranges and variabilities in carbonate system components in different areas and what are the required measurement frequencies to cover all details, and 3) based on collected data (which is not having 100% coverage for all variables in all areas) how important is biological carbon pump relative to solubility pump.

The focused specific science questions for each area :
Baltic Sea: How are the carbonate system dynamics and phytoplankton productivity linked in the atrophied waters?
Med Sea, Adriatic Sea: How does the meteorological forcings affect carbon fluxes
Med Sea, Aegean Sea: In the oligotrophic area, are we able to see any indications of biological pump, using contemporary automated methods for phytoplankton detection?
Norwegian Shelf: What are the relative roles of biological and solubility pumps, especially at different seasonal and spatial scales?

3.6. JRAP#6: Operational oceanography and coastal forecasting

PI: Baptiste Mourre
Involved institutes: SOCIB, AZTI, IH, HCMR, CMCC, CNR, FMI, IMR

Objective of the JRAP:
JRAP#6 aims to show the importance of JERICO-NEXT observations for the assessment of operational regional models implemented in the coastal ocean, leading to recommendations for coastal forecasting system improvements, both in terms of models and observations. These objectives will be achieved through a coordinated evaluation of numerical models in seven European coastal areas affected by different physical processes, complemented by model sensitivity tests and data assimilation experiments including Observing System impact studies (OSEs and OSSEs).

3.6.1. Main achievements and delays

3.6.1.1. Achievements

Initial time line and expected work	Actual time line and achieved work, problems, good surprises and opportunity met
M1-M8 **JRAP6 preparation, coordination and strategy** – Define strategy – Define data, models and working plans for the eight partners – Define JRAP6 organization, timeline and reporting	**M1-M8** **JRAP6 preparation, coordination and strategy** – Common strategy defined – Data, models, periods of study and working plans defined – Time line and organization agreed among partners – Strategy iterated with WP4-WP1 leaders according to STAC feedbacks
M9-M18 **Subtask 1.1 - Model assessment using JERICO observations** **Ibiza Channel** – Setup of numerical simulations in the Western Mediterranean Sea – Data acquisition and compilation (HF radar, gliders and mooring in Ibiza Channel) – Developments of tools to compare with model outputs	**M9-M13** **Subtask 1.1 - Model assessment using JERICO observations** **Ibiza Channel** – Setup of numerical simulations: 2-km resolution WMOP operational predictions and long-term free run with the same parameters. High resolution atmospheric forcing from the Spanish Meteorological Agency. – Compilation and first analysis of HF radar data (2013-2016), development of tools to compare with model outputs: EOFs, spectrum, Hovmuller diagrams. – Compilation and first analysis of glider data

	(2011-2016): transport time series across the Ibiza Channel – Compilation and first analysis of mooring data (2009-2016): time series of T, S, UV at fixed locations
Adriatic Sea – Model setup in the Adriatic Sea – Data assimilation setup – Data acquisition – Development of model skill scores	**Adriatic Sea** – Model setup**:** AIFS (Adriatic-Ionian Forecasting System) based on NEMO at 1/45° horizontal resolution and 121 z-levels with partial steps; – Data acquisition: HF-radar data in the W Adriatic (CNR La Spezia), fishing vessels data in the Northern Adriatic (collaboration with CNR Trieste) – CMCC is presently working on assessing AIFS skill scores
Atlantic Iberian margin – Data collection by the MONICAN system – Model setup: LAM-HOPS nested in HYCOM – Evaluation of atmospheric forcing conditions – Skill assessment of reg-HYCOM in area of influence of Nazare Canyon – Skill assessment of LAM-HOPS coupled to reg-HYCOM, without assimilation.	**Atlantic Iberian margin** – Data collection: • Data was collected from MONICAN1 (1800m) buoy from Sep2015 to Sep2016 • Data was collected from MONICAN2 (90m) buoy from Sep2015 to March2016. • Data was collected from Nazare and Peniche tidal stations from Sep2015 to Sep2016. • Data was collected from Ferrel coastal meteo station from Sep2015 to Sep2016. • *Not accomplished:* Due to technical problems MONICAN2 buoy was not in operation from March2016 to the present. Planned to be redeployed in October/November2016. – Revised strategy: Evaluation of models without assimilation was enlarged to also include simulations for the periods June-July2007 and March-April2011 for which consistent data sets exist and were already planned to be explored in the following objective (Models with assimilation). This required to consider results from the regional NEMO model (provided by COPERNICUS CMEMS) for the two selected periods – Model implementation: • LAM-HOPS was implemented and configurations for 2007 and 2011 simulations

	are being tested. • Coupling of this model to the regional models (reg-NEMO and reg-HYCOM) is ongoing. CMEMS) for the two selected periods – Atmospheric Forcing evaluation: 3 periods were selected for this evaluation: • March-April2011 (early upwelling conditions) Meteorological measurements are available from the 2 MONICAN buoys, the Ferrel coastal station and from ship measurements. Forcing fields from ERA-Interim and Aladin were retrieved for the comparisons. Ongoing work. • March-October2012 (summer conditions), measurements from 2 MONICAN buoys and Ferrel station. ECMWF fields retrieved for assessment. Ongoing work • October2015-May2016 (winter conditions), measurements from 2 MONICAN buoys and Ferrel station. ECMWF fields were retrieved for assessment. Ongoing work. - Processing of previously collected data sets to be used in model skill assessment (points 3 and 4 of initial plan) a) Survey 13 June to 03 July 2007 • Ongoing processing of data collected onboard (450 CTDs/VMADCP). • Processed data collected on 3 current meter moorings • Retrieved and processed atmospheric forcing fields (ERA-Interim) for global period. • Retrieved and processed available SST data for global period (JPL-MUR) b) Survey 29March-16April 2011 • Processed data collected on board (161 CTDs), ongoing processing LADCP/VMADCP data • Ongoing processing data collected on two multipara metric buoys (MONICAN1 and MONICAN2) • Processed data collected at two current meter moorings • Retrieved and processed available SST data for global period (NAVO Globe) • Retrieved and processed atmospheric forcing fields (Aladin, ERA-Interim) for global period. - Access to regional model results a) Retrieved NEMO regular grid daily averaged

	fields for period June-July 2007 from COPERNICUS CMEMS. Development of routines for handling and pre-processing model fields. b) Retrieved test files from reg-HYCOM. Development of routines for handling and pre-processing model fields.
Aegean Sea – Setup of simulations in the Aegean Sea – Data collection – Introduction of wave-current interaction terms to the Aegean Sea hydrodynamic model – Preparation of glider deployments	**Aegean Sea** – Assessment of the Aegean Sea hydrodynamic model with and without data assimilation by performing annual (during 2013) experiments. Emphasis was given to the SST forecast error and its future reduction – Observations used: Satellite SSH and SST (bulk temperature); In situ data: Argo T/S profiles within the Aegean, the Ionian and the Libyan Sea; POSEIDON buoys data. – Introduction of the wave dissipated energy term (estimated by the WAM model) into the turbulence closure scheme of the Aegean Sea model. Initial tests performed for year 2013. The wave dissipated energy is calculated by a WAM (Cycle 4.5.4) model implementation for the Aegean Sea. – Acquisition and installation of all the necessary equipment for the support of the operation of the glider observing module. Preparation of the two glider units in order to be ready for the deployments.
South Bay of Biscay – Setup of simulations in the Bay of Biscay, coupling ROMS, NEMO and WRF – Inclusion of river forcing	**South Bay of Biscay** – Using Matlab, we prepared the coupling between ROMS and the outputs from NEMO and WRF. The study area covers the Basque Country area with a resolution of 670 m (43.2° N – 48° N, 6° W – 0.9° W) and 32 sigma levels in depth. Hourly WRF outputs (atmospheric forcing) and daily NEMO outputs were used for ROMS. The NEMO data used in ROMS for the boundary conditions consist of daily outputs for temperature, salinity and velocities (3D),

	and sea level height (2D). The eight main harmonic components of the tide are included from the OSU TOPEX/Poseidon Global Inverse Solution (TPXO). – At present, we incorporate in ROMS the mean freshwater discharges from the Nervión, Oria, Bidasoa, and Adour Rivers. With the aforementioned information, we obtain 96-h forecasts. These forecasts are still under analysis and they are not open to the public. – Problems: Using daily information from NEMO, it is possible that there is a residual due to the eight harmonic components of the tides, i.e. these components are not totally removed from the data. Therefore, the incorporation of these components using TPXO could generate instabilities in the numerical result. This aspect must be revised carefully.
Norwegian Sea – Information not received **Baltic Sea** Preparation of the in-situ measurement campaign to be carried out in spring 2017 – spring 2018, as part of JRAP#5	**Norwegian Sea** – Information not received **Baltic Sea** First steps towards the preparation of the intensive measurement period (definition of study sites, instrument types and methodologies, see JRAP#5).
Subtask 1.2 - Data-assimilative model assessment and Observing System Experiments (OSEs) – Preparation of OSEs: period of study, assimilated validation measurements – First steps of development of data assimilation systems	**Subtask 1.2 - Data-assimilative model assessment and Observing System Experiments (OSEs)** **Ibiza Channel** – Definition of test period for HF radar OSE according to the availability of independent validation measurements in the study area (mooring current meter and drifters) **Adriatic Sea** – Data assimilation setup: AIFS-EnKFSA, application of a standard 3D Ensemble Kalman Filter on DART (www.image.ucar.edu/DAReS/DART/) – Progress was made on implementing HF-

Subtask 2.1 - Recommendations for modelling strategy improvements – Perform model sensitivity tests	radar velocity data into AIFS-EnKFDA system that would be used to perform OSEs in the south Adriatic region – The development of HF radar observation operators has been started – Some delays in activities evolution are representing the major difficulty, due to changes in WP3.7 leadership **Subtask 2.1 - Recommendations for modelling strategy improvements** **South Bay of Biscay** – A sensitivity test was made with ROMS to analyze the effect of high river discharges due to strong storms and rain. For this test, we used the real freshwater discharges registered on January 15-18, 2013. The effect of the river plumes on the sea surface circulation is noticeable and also the strong gradient of salinity. From this result, we conclude that it is necessary to include in the modeling a prediction of the river discharges instead of mean values.

3.6.1.2. Acquired date and archiving made

Acquired data and archiving made, where, how? (Ref to the excel file “data inventory table.xls”).

Acquired Data type (parameters)	Archiving place	Status: raw data, processed, Quality checked, needs to make the data flowing to the standardised channel?
T,S (glider Ibiza Channel) UV (HF radar Ibiza Channel) T, S, UV (mooring Ibiza Channel)	SOCIB SOCIB SOCIB	Processed L0 L1 L2 Processed L0 L1 Processed L0 L1
MONICAN system observations • MONICAN1 buoy (1800m) *Periods:* - Out2015-May2016 - May2016-Sep2016 *Parameters:* - Meteo(Wind,Patm,Tair,Hmd)	• IH database	Period1: QC Period2: Real Time data: QC Archived data: Raw

- Waves - T (6 depths), Currents(ADCP) • MONICAN2 buoy (80m) *Periods:* - Out2015-Mar2016 *Parameters:* - Meteo(Wind,Patm,Tair,Hmd) - Waves - T (2 depths), Currents(ADCP) • Ferrel coastal meteo station *Periods:* Sep2015-Aug2016 *Parameters:*Wind,Patm,Tair,Hmd • Nazare tide gauge *Periods:* Sep2015-Aug2016 *Parameters:* Sea surface height • Peniche tide gauge *Periods:* Sep2015-Aug2016 *Parameters:* Sea surface height **Opportunity ship observations** • 3 CTD casts near MONICAN1 (May2016) - P,T,C,S,Turb (pmax=1927dbar, 808dbar, 53dbar)	• IH database • IH database • IH database • IH database	QC Raw Processed Processed Raw
HF radar data from the Basque operational system.	AZTI	These data have the standard format.

3.6.1.3. Communication materiel

Type (photos, video, other)	Topic (3 lines max)	How to get it? Copyright etc. URL?

3.6.2. Nextsteps (Sept . 2016-Aug. 2018)

when	what
M13-M18	Subtask 1.1 - Model assessment using JERICO observations **Ibiza Channel**

	– Complete WMOP model assessment using HF radar, glider and mooring data in the Ibiza Channel – Provide synthesis to JRAP6 subtask 1.1 report **Adriatic Sea** – Complete AIFS model assessment in the S Adriatic Sea – Provide synthesis to JRAP6 subtask 1.1 report **Atlantic Iberian margin** – Complete atmospheric forcing skill assessment (M14) – Complete processing data for June-July2007 period (M14) – Model simulations and skill assessment for June-July2007 period with regNEMO+LAM_HOPS (M14-M15) – Complete processing data for Mar-Apr2011 period (M15) – Model simulations and skill assessment for March-April2011 period with regNEMO+LAM_HOPS (M15-M16) – Complete processing data collected during period of 2016 selected for skill assessment (M16). – Model simulations and skill assessment for period in 2016 period with regHYCOM+LAM-HOPS(M16-M17) (Tentatively period in Oct/Nov2016 for which opportunity ship measurements can be conducted) – Provide synthesis to JRAP6 subtask 1.1 report **South Bay of Biscay** – The coupling between ROMS and NEMO must be revised, especially the possible problem with the tides. Therefore, it is necessary to contact with the organization providing the NEMO data, i.e. Puertos del Estado. – The incorporation of river discharges must be analysed in order to obtain an appropriate data for ROMS, closer to the real discharges. – ROMS will be run daily, generating hourly outputs of the main variables (temperature, salinity and velocity fields). – The dispersal model included in ROMS will be activated and also the coupling off-line with the Sediment, Oil spill, and Fish Tracking model (SOFT), a Lagrangian particle-tracking model. – The operational system will be revised, in function of the results obtained in the M13-M18 period. – Comparisons with available data from surface drifters, HF radar, and CTDs will be performed and analysed. – Provide synthesis to JRAP6 subtask 1.1 report **Aegean Sea** – Complete Aegean Sea model assessment

	– Provide synthesis to JRAP6 subtask 1.1 report **Norwegian Sea** – Information not received
M18 (March 2017) **M38 (November 2018)**	**Subtask 1.1 report** **Baltic Sea** – Incorporate WAM wave model assessment results in terms of wave-induced turbulence and its impact on algae blooms in the Baltic Sea in subtask 1.1 report
M13-M30	**Subtask 1.2 - Data-assimilative model assessment and Observing System Experiments (OSEs)** **Ibiza Channel** – Development and test of HF radar data assimilation – Performance and evaluation of HF radar OSE experiment **Adriatic Sea** – Consolidation of HF radar data assimilation setup and associated observation operators – Performance and evaluation of HF radar OSE experiment in the South Adriatic region **Atlantic Iberian margin** – Simulations and skill assessment for period June-July2007 with assimilation of collected data in LAM-HOPS – Simulations and skill assessment for period March-Apr2011 with assimilation of collected data in LAM-HOPS – Simulations and skill assessment for selected period in 2016 with assimilation of collected data in LAM-HOPS – Processing of HF radar data collected in Nazare Canyon area during period July-December2011 for model assimilation – Development of strategy for assimilation of HF radar data in LAM_HOPS – OSEs to assess the impact of buoy data and HF radar measurements **Aegean Sea** – The introduction of the glider observation module in the Aegean is currently an ongoing activity with the pilot missions to be scheduled for the autumn of 2016. The operational use of the glider units is expected to begin in the first months of 2017 – The collected data from glider missions will be

M30 (March 2018)	undergone through the quality control procedures that are recommended by the EGO community and the EuroGOOSDataMeq working group. – OSE to assess the impact of glider and FerryBox data **Subtask 1.2 report**
M13-M38 M38 (November 2018)	**Subtask 2.1 - Recommendations for modelling strategy improvements** **Ibiza Channel** – Analysis of sensitivity tests about model parameters (momentum diffusion and large scale model in particular) – Provide recommendations about modelling strategy **Adriatic Sea** – Analysis of model sensitivity tests – Provide recommendations about modelling strategy **Atlantic Iberian margin** – Analysis of model sensitivity tests (in particular on model code and resolution) – Provide recommendations about modelling strategy **South Bay of Biscay** – Analysis of model sensitivity tests – Provide recommendations about modelling strategy **Aegean Sea** – Study the contribution of air-sea interactions to the Aegean Sea model performance by introducing air parameters from an alternative to POSEIDON atmospheric model (WRF implementation at 1/20 resolution over the Mediterranean Sea) for year 2014. – Sensitivity runs to decrease model SST bias **Norwegian Sea** – Information not received **Baltic Sea** – Analysis of WAM model sensitivity tests – Provide recommendations about modelling strategy **Subtask 2.1 report**

M13-M40	**Subtask 2.2 - Observing System Simulation Experiments (OSSEs) and recommendations for coastal observing systems** **Ibiza Channel** – Setup of OSSE experiment: definition of nature run and model perturbations – Generation of virtual HF radar observations in the Western part of Ibiza Channel – Assessment of the impact of such observations **Adriatic Sea** – due to recent improvements on AIFS-EnFKDA model setup, CMCC will provide a more detailed test performances of assimilation based on a nature run in the W Adriatic using the free run produced by the unstructured model SANIFS – CMCC plans to proceed with new experiments for OSSE in the W Adriatic using SANIFS – CMCC teamwork agrees to start to think on a more robust design of the data assimilation systems towards operations, in order to capitalize the JERICO-Next future results for improving operational oceanography, ocean forecasting and numerical modelling. **Atlantic Iberian margin** – OSSE to evaluate the added value of T-S profiles over a larger area
M40 (January 2019)	**Subtask 2.2 report**

4. Conclusions

The reported actions show that technical preparations were undertaken before deployment, some methodologies were reviewed, some field works are already done, some buoys and other systems are deployed and acquiring data, two WP3&4 joint workshops were organised. As a conclusion, JRAPs are well progressing with respect to their initial plans even if they are not developing along the same time line. Indeed some JRAPs already started their data acquisition, whereas some other will start this step later. Some important reported issues will be discussed during the next Steering Committee Meeting to be held the 12-13 Dec. 2016. The upcoming important action in 2017 is to well coordinate the JRAPs data acquisition with the data management led in WP5, whereas 2018 will be more dedicated to work on the products delivered by JRAPs as JERICO-RI product prototypes.

5. Annex: "Report of WP4 meeting with the Scientific and Technical Advisory Committee (STAC) & Contributions to the JERICO-NEXT science strategy"

Report of WP4 meeting with the Scientific and Technical Advisory Committee (STAC),
&
Contributions to the JERICO-NEXT science strategy

8th September 2016, Bordeaux, CNRS

Milestone MS3 (WP1&4)

Grant Agreement n° 654410
Project Acronym: JERICO-NEXT
Project Title: Joint European Research Infrastructure network for Coastal Observatory - Novel European eXpertise for coastal observaTories

Coordination: P. Farcy, IFREMER, JERICO@ifremer.fr

Authors: Puillat I., Durand D., Grémare A.
Involved Institutions: Ifremer, Covartec, CNRS
Date: 20/09/2016

The JERICO-NEXT project is funded by the European Commission's H2020 Framework Programme under grant agreement No. 654410
Project coordinator: Ifremer, France.

Table of contents

1. Document description

Document information	
Document Name	Report of JERICO-NEXT Science Strategy meeting #1
Document ID	
Revision	0.2
Revision Date	20/09/16
Authors	Puillat I. , Durand D., Grémare A.
Security	

History			
Revision	Date	Modification	Author
0.1	15/09/16	First draft	Puillat I.
0.2	15-25/09/2016	corrections and comments from JRAP leaders	A. Rubio, B. Mourre,

Diffusion list				
Consortium beneficiaries	X			
Third parties				
Associated Partners				
other				

2. Executive summary

After the governance Strategy meeting held the day before, the purpose of this meeting was to build upon deliverable D4.1 reviewed by the STAC towards the deliverable D 1.2 (due Month M44, at the end of the project). Which is dedicated to propose a science strategy to monitor the European coastal seas.

Deliverable D4.1 was a first step to establish a JERICO science strategy according to the 6 JERICO-NEXT scientific topics, starting with a sampling strategy to be deployed in the 6 JRAPs. These deployments and their technical preparation will help getting returns of experiences. By waiting we already need to improve the strategy with the benefit of the STAC advices and our frequent brainstorming. This was the objective of our meeting in Bordeaux: to build upon these advices with a fruitful brainstorming. Each JRAP was presented with some focus on 3 specific questions that were discussed and the STAC members gave some recommendations.

As a synthesis, the concluding discussion addressed the following questions:

1. Link to societal challenges
    a. do we need a better defined societal strategy for JERICO-RI?
    b. What society needs, wants, expects?
    c. Users, products

2. Definition of European regions in the context of JERICO-RI? (scales local, regional to pan European) for science strategy, governance, threats etc… need to federate neighbours around a common vision to be supported by regional multi-national partnership to deal with coastal environment challenges.

It was agreed that JERICO can have a regional coordination in addition to the environmental/science specificity. There is a need to check where the synergy is: shared societal benefit at regional level for instance.

The most probable possibility to management of the coastal areas is based on regional system which can be compatible with a pan-European management. It was underlined that with regards to the users, it is necessary to check that users are identified at that regional level taking in account the OSPAR regions and similar user initiatives and commissions.

3. Statement of decisions

Decision #	*JRAP#*	*Content*	*Who*	*when*
JRAP#1.1	1	Send JRAP2 slides to Felipe as example	*Ingrid Puillat*	Done
JRAP#1.2	1	Populate the template with the 3 questions as already requested	*Felipe Artigas and Bengt Karlson*	By one week after the meeting
JRAP#1.3	1	Prepare a description of the science questions that JRAP1 will address according to the STAC remarks: General questions common to the 5 areas, and areas specificities. This should content a short review: what are the environmental conditions that are triggering, maintaining and declining the blooms? What are the conditions specific to each of the 5 areas? What is known? What is not understood? Max 5 pages are requested (3 are enough).	*Felipe Artigas and Bengt Karlson*	By mid October 2016
JRAP#3.1	3	I. Puillat will ask to L. Nizzetto to clarify the need of monitoring these contaminants: a state of the art with regard to the pollution state in each monitored area. It can be a review of the concentration met of the variability. Draft by one month. This will help to write the D1.2. A final version for 7th December.	*Ingrid Puillat*	By mid Oct. 2016
JRAP#4.1	4	List the potential users of JRAP4 products per area	*Anna Rubio*	March 2017 (Helsinki GA)
JRAP#5.1	5	Yann Bozec should be contacted by the coordination team	*Coordination team*	Done
JRAP#5.2	5	Focus on science question per area and more general one(s)		By mid Oct. 2016
JRAP#6.1	6	Write 10 lines on the link with biology	*Baptiste Mourre*	Done
JRAP#6.2	6	List the potential users of JRAP6 products per area	*Baptiste Mourre*	Done

4. Attendees

Partner	Name	Organization
STAC members	Alicia Lavin Montero Janet Newton Roger Proctor Peter Herman	IEO University of Washington IMOS & university of Tasmania DELTARES
WP leaders	Stefania Sparnocchia Michelle Devlin Ingrid Puillat Dominique Durand George Petihakis Leonidas Perivoliotis Laurent Delauney	CNR-ISMAR CEFAS Ifremer Covartec HCMR HCMR Ifremer
JRAP leaders & co-leaders	Felipe Artigas (JRAP#1) Bengt Karlson (JRAP#1, **VC**[*]) Antoine Grémare (JRAP #2) Luca Nizzetto (JRAP#3,**VC**) Anna Rubio (JRAP#4) Jukka Seppala (JRAP#5)	CNRS-LOG SMHI CNRS-EPOC NIVA AZTI SYKE
Coordination team	Sylvie Pichereau Patrick Farcy Anne Schmidt	Ifremer Ifremer Ifremer

[*]VC: Video Conference

Excused

Partner	Name	Organization
STAC members	Laura Beranzoli Isabel Sousa Pinto Richard Lampitt Eric Delory	INGV & EMSO University of Porto & EMBOS NERC & Fix03 PLOCAN & NEXOS

5. Purpose of the workshop, agenda

5.1. Purpose

After the governance Strategy meeting held the day before, the purpose of this meeting was to build upon deliverable D4.1 reviewed by the STAC towards the deliverable D 1.2 (due Month M44, at the end of the project). Which is dedicated to propose a science strategy to monitor the European coastal seas.

Deliverable D4.1 was a first step to establish a JERICO science strategy according to the 6 JERICO-NEXT scientific topics, starting with a sampling strategy to be deployed in the 6 JRAPs. These deployments and their technical preparation will help getting returns of experiences. By waiting we already need to improve the strategy with the benefit of the STAC advices and our frequent brainstorming. This was the objective of our meeting in Bordeaux: to build upon these advices with a fruitful brainstorming.
The Science Strategy meeting#1 held in Bordeaux the 8 Sept; 2016 at the University of Bordeaux, hosted by EPOC. This was reminded in the Introduction made by I. Puillat.

To prepare this meeting a synthesis of the STAC review was presented to the JRAPs in early August (reference document in annex 1), and a template for 3 questions was sent. The 3 questions where:

Question 1: please clarify how the JRAP activity links to other ongoing collaborative works/projects, indicate an approximate % age of contribution.

Question 2: please elaborate a list of products derived from the acquired data and/or the analysis method to be used. (ex. Data assimilation based on xxxx to produce yyy, statistical modeling to forecast XXX or derive YYY, maps of integrative information, etc…)

Question 3: Science integration in the Bay of Biscay and Med. Sea.
Your advice on and interest in working during 2 years (maybe 3) to write a common paper (or 2, or maybe something more important?) to tackle:

- *1-2 scientific questions (to be defined) for the Bay of Biscay?*
- *1-2 scientific questions (to be defined) for the Mediterranean Sea?*

Here above refereed scientific questions that should be cross cutting and integrative with biology, physics, chemistry. This means to agree on the scientific focus, make the bibliographic reviews, analysing data and jointly conclude on the results. This is actually what should be the main outcome of the WP4 together with the inputs to the overall JERICO-RI strategy.

This was the basis for the 6 JRAPs presentations during the meeting and for the discussions.

♦ ***Reference document:*** Synthesis of the STAC feedback after review of D4.1 (WP4), in Annex 1.

5.2. Agenda

Thursday, 8 September 2016			
9h00 – 11h00	Strategy meeting (Session.2): **The JERICO Science strategy** - Introduction: reminder of the process, achievements and bottlenecks. Possible solutions (15 min) - Science Strategy of the 6 JERICO-NEXT scientific topics : - Topic/JRAP 4: 30 min including discussions - Topic/JRAP 3: 30 min including discussions - Topic/JRAP 6:30 min including discussions	D. Durand / A. Grémare/ I. Puillat A. Rubio L. Nizzetto I. Puillat or?	Deliverable D4.1 Consolidated expertise report
11h00 Coffee break -			
11h15 – 12h45	Strategy meeting (Session 2): **The JERICO Science strategy** - Science Strategy of the 6 JERICO-NEXT scientific topics : - Topic/JRAP 1: 30 min including discussions - Topic/JRAP 2: 30 min including discussions - Topic/JRAP 5:30 min including discussions	 F. Artigas A. Grémare J. Seppala	
12h45 Lunch Break			
14h00 – 16h00	Strategy meeting (Session 2): **The JERICO Science strategy** Discussion on the JERICO Science strategy: proposals for a better science integration	***All***	
End of the second day meeting			

6. Report after the workshop

Slides are presented in Annex 2 of this document

6.1. Introduction (by Ingrid Puillat)

Round table: attendee's introduction

She reminded the purpose of the event and the target: Deliverable D1.2 – M18 – Fed by WP4 and other tasks in WP1

Next Step – Workshop MS44 in Helsinki, march 2017. Scientific meeting for WP4.

Change in the presentation order : JRAP6 4 3 in the morning

6.2. JRAP6:

B. Moure presented JRAP6.

He underlined there is no biogeochemical models implemented in any of the study areas- but the main point is the work towards data assimilation using the JERICO-Next Facilities. Some words about the LEMA LIFE project, as a project in connection with JRAP6 tools were given.

Feedback from the STAC:

A. Lavin: Alicia asked about the new antenna in the Landes? Do you have some biogemical measurements?

R. Proctor: there are biogeochemical modelling results at the European level (CMEMS) even if no such model is considered in JRAP6. The main reason is that there is presently no downscaling of these solutions to coastal scales as with hydrodynamic models. It might be interesting to compare the outputs of our high-resolution models with the coarser CMEMS models implemented over larger areas. You should be able to show the need of small scale biogeochemical observations. Would you be able to produce standardized indicators of models accuracy for all the regions?

B. Mourre: the comprehensive study of the impact of model downscaling is certainly interesting but is not part of the JRAP objectives. However, sensitivity studies planned in subtask 2.1 of JRAP6 should provide insights into the impact of the large scale model used as initial and boundary conditions, and the model spatio-temporal resolution.

J. Newton: what your effort will be to compare the model ouputs with local observations? how will the data model-comparisons will be performed? is the approach to validate the model going to be the same in all the areas?

B. Mourre: JRAP6 is focusing on a detailed assessment of the existing state-of-the-art physical models, rather than developing new complex models including biogeochemistry. The JRAP partners have agreed on a common objective and will perform the model assessment according to the specificities of the observing platforms and the ocean processes at play in their region. There will then be an effort to synthesize the results obtained in all areas to bring common recommendations. However, we will not get rid of the specificities of the different coastal situations considered in this JRAP

D. Durand: today we will work on the definition of the products, of the strategy

J. Newton: Do you have specific user group that will use the coastal forecast? Are there specific groups that are looking forward to the forecasts/products?

B. Mourre: there are obvious users of this work : National agencies, there are users that I am trusting but I thought that this aspect was not part of the project.

I. Puillat corrected this statement and reminded the existence of the user panel in WP8 and asked Baptiste to list the potential users that would be interested in JRAP6 outputs.

A. Rubio: Maybe we can propose SASEMAR as new user !! talk to Julien.

J. Newton: Was an international collaboration with teams in US and AUS (for instance) foreseen to advance on the biogeochemical aspect?

B. Mourre: This is not planned in the project.

D. Durand highlighted the biological-physical integration planned in the Baltic Sea, as well as the direct link with CMEMS.

Actions: B. Mourre:

1. Write 10 lines on the link with biology (see here above questions)

Done in delayed mode as follow:

"JRAP6 focuses on the assessment of physical models (hydrodynamics and waves), mainly due to the relative immature development of biogeochemical operational systems in the European coastal waters. JRAP6 focuses on a detailed assessment of the existing models (physical models), rather than developing new complex models including biogeochemistry. JRAP6 results are expected to have ecological implications given the very strong influence of hydrodynamics on biogeochemical processes. In particular, the model assessment will be focused on aspects directly related to society needs and MSFD implementation: surface circulation and physical processes involving vertical velocities or surface mixing with an impact on ecosystems. The outputs of the physical models will be mainly compared to physical measurements. In some cases, biogeochemical measurements will also be considered to provide insight into the validation of physical outputs. In particular, phytoplankton observations collected in the Baltic Sea will be used to evaluate the impact of the wave-induced turbulence on algae blooms. Biological data will also be considered as part of the analysis of the ocean circulation in the Nazare Canyon area off Portugal to evaluate the representation of upwelling and slope circulation processes."

2. List the potential users of JRAP6 products per area

- Coastal forecasting system developers (for system improvements)
- Coastal observatory managers (for sampling optimization)
- Coastal forecasting systems users: national maritime search-and-rescue and security agencies, coastal zone management authorities, touristic and recreational sectors, maritime transport, marine scientists (physicists, biologists, chemists).

6.3. JRAP4

Presentation highlights (A. Rrubio) :

Several ongoing projects with connections to the main JRAP4 work lines are cited. In the SE Bay of Biscay: LIFE-LEMA project on marine litter, starting in September 2016, will take opportunity of the JERICO infrastructure and of the developed tools. Similarly, in the German Bight a project related to marine litter is cited. In the NW Med, the project IMPACT is presently considered for funding starting by the end of 2016. This project will deal with the challenge of managing Marine Protected Areas (MPAs) on the North Western Mediterranean Sea and is linked with JERICO-NEXT JRAP4 in terms of transport products and ecological consequences.

In terms of products two main groups are identified:

1- Maps of surface currents and integrated transport that could be used as a basis for several applications, including those of interest of other JRAPs.

2- Specific products for numerical modelling validations (in coordination with JRAP6) and in connection with data assimilation exercises in **WP3.7** (HF radar data for numerical model validation, set up of an assimilation system and implementation of an OSSE system in the NW Mediterranean).

The most directly related JRAP is the JRAP6. Although there are identified physical-biological approaches in all of the study areas, there is no any obvious overlap with other JRAP specific topics or data.

Feedback from the STAC:

A. Lavin: asked about the new antenna in the SE BoB –

A. Rubio: This antenna is going to be deployed in the framework of task 3.2.2. Louis Marie (Ifremer) is working on this in collaboration with Pierre Flament- Normally this will be a 4.4. MHz antenna, similar to the ones in the Spanish coast (so we expect about 150 km range and 3 km resolution). It will improve the existent data in view of model validations exercises but also on cross-validation of current data provided by the HFRs.

A. Lavin: what is the measurement on the depth? Which data are going to be used in the water column to reach 4D estimations?

A. Rubio: HF radars= measurement only on the 1st meter. So this is a challenge. We will use models and a combination of existing/past data and also new data: mastodon moorings and planned campaigns.

R. Proctor: What is the contribution of JRAP4 in the German Bight?

A. Rubio: In the GB there are no new deployments and the work will concentrate on the characterization of 4D transport with common methodologies that in the rest of JRAPS. The challenge will be to be able to define joint protocols for all the study area which are characterized by very different dynamics. We want to manage a Lagrangian experiment with new analysis techniques.

R. Proctor: At the time of the review, he was confused because a lot of methodologies were cited in the JRAP4, so what are we going to apply for transport characterization?

A. Rubio: in the D4.1 we gave a broad view of the state of the art and the methodologies available. The methodologies that we are going to use are not still defined; we hope to do so in the few months knowing that it will be not an easy task. There will be a meeting next week to decide what methods because it depends on what kind of process we have. The idea is to identify one or two key common methods for the different study areas.

D. Durand: about user driven products in addition to science driven products. In the German bight there is a user driven product?

A. Rubio: in the Life project: there are products for Bay of Biscay. Another users are the Marine security agencies, they are very interested by HF radar data (in US is already like in the Gibraltar strait, SASEMAR is already using HFRs data from Puertos del Estado).

D. Durand: you have local users and more global ones like Copernicus. For your JRAP it is important to identify the type of users.

Actions: A. Rubio

1. List the potential users of JRAP4 products per area (1st list by March 2017: Helsinki GA, then update along the project lifetime)

6.4. JRAP2

Presentation given by A. Grémare

Feedback from the STAC:

P. Herman: I missed the sense of the question/ and the answer… this was already commented in the STAC review. Something on the lack of general character of the results or applicability of the methodologies. But the difficulty is that the influence process on the local benthos is varying from one place to one place. So it is difficult to make a generalization of the observed process.

A. Grémare: this is not our objective at all. Because we are thinking the opposite. We trust more in an aggregation of the observation. To observe the system the most efficiently, we have to make many observations

Antoine and Peter: agreed is that the Scale is the issue

J Newton: Suggestion to look across the case studies presented.

A. Grémare: this is expected since the study areas are common and all data could be merged easily. We did not intend to extrapolate our local results to European one. Our strategy is based on the aggregation of local results

P. Herman: need to know what you learnt at European scale from your study. Suggests referring to other studies. Is it possible to envisage an index study that is less time consuming? Reproducible elsewhere?

A. Grémare: this is not possible during the lifetime of JERICONEXT

Jan Newton: difficult to make the results/products applicable to other study areas at least not only from 3 study areas, but as a pilot action will set the bases for extended experiences with wider impact. It can be useful to think on recommendations of how these methods can be applied on a more general way.

M. Devlin-CEFAS: Are you planning to use MSFD indicators?

A. Grémare: does not believe these indicators are truly useful, and suggests to user other indicators own-defined. We are proposing a new set of index with a methodology. We have to publish that but it won't be easy because new

D. Durand: summary: we include the benthic system starting from a blank sheet in JERICO. Will we be involved to define a set of basic parameter to be used to asses basic information on changes, significant changes? I understand your frustration: we are touching something, and we are not yet ready to define what can be derived at European level. What specific set up could be deployed at European level. JERICO is developing a basic

J. Newton: common studies. Countries have to invest and so need to engage local agencies and to maintain the investment. You have to start somewhere. And for that put the emphasis on the product. Product communalities: for instance disturbance processes that can be reproduced elsewhere and monitored… communalities: for instance related to climate change.

6.5. JRAP1

The JRAP1 was presented by Felipe Artigas, and Bengt Karlson attended via a video conference.

The title of the JRAP 1 was modified: phytoplankton instead of Plankton.

Short term studies of different types of algal blooms. Multiplatform approach (including remote sensing). He presents the study areas, the approach and the interactions with other WPs and JRAPs.

About coupling physics with biology the example of the mesoscale activity was given.

It was propose to collaborate with JRAP2 for benthic microalgae, with JRAP3 for chemical contaminants. With JRAPs4 the importance of the advection in the phytoplankton distribution was highlighted. A. Rubio (JRAP4 leader) expressed that it can be possible if a suitable cruise at sea is possible, in the negative case we should

work with historical data. Felipe explained there should be some HF radars in the JRAP1 area but they are not managed in JRAP4 nor in JRAP1

B. Karlson showed recently acquired data and wishes to link that to modeling results and to contaminants distribution. He added elements of JRAPs integration in Skagerrak study area where there are multiplatform observations (including moorings, ferry, flowcytobox (regular in-field campaigns)) and different data sets (they have some radars in the area)

Feedback from the STAC:

Main comments were about the need to focus on feasible objectives, concentrate on the questions that can actually be answered with the data that area going to be gathered, as expressed here after

P. Hermann: impressed by the capability to bring all the instruments together, but what question will be solved? Why all this instruments for? What would you miss if you remove one instrument? In some other words, the question is what question would you answer with one instrument instead of another one? The different techniques used are interesting, focus on what they provide in addition to the classical ones. At least concentrate on one main scientific question to be formulated in the different areas, maybe not in the same specific way.

J. Newton: booms, then eutrophication then contaminants/chemical/ Nutrient then we don't see what and how… if you focus on the biodiversity the question needs to be focused on: species/processes/methods. It is already focused on technics, but not explained what process will be studied etc…

D. Durand: How far are we from a more automated monitoring?

F. Artigas: These monitoring tools are complementary to the classical monitoring (in-situ samples one a month/twice a month), these new technologies are useful to have real time data but the in-situ data will be still needed.

D Durand: need to make clear what these new techniques are bringing.

J. Newton: 5 study areas. Formulate science question in each, with temporal resolution etc., given the dynamics and the characteristics, it can be common questions then to be derived per region.

I. Puillat: These questions are needed to be formulated more clearly in the D4.1.

F. Artigas: like in JRAP2, a way to schematize the problematic under JRAP1 could be maybe using the same schema that Antoine has developed for JRAP 2. We will make a similar explanation.

F. Artigas: Close connection with project that develop indicator on pelagic biodiversity.

J. Newton: have you met international group for time series on phytoplankton: IGMETS.net?

F. Artigas: not yet, we will

Actions

I. Puillat: to send JRAP2 slides to Felipe as example.

F. Artigas and B. Karlson: to populate the template with the 3 questions as already requested.

F. Artigas and B. Karlson: to prepare a description of the science questions that JRAP 1 will address, according to the STAC remarks: General questions common to the 5 areas, and areas specificities. This should content a short review: what are the environmental conditions that are triggering, maintaining and declining the blooms? What are the conditions specific to each of the 5 areas? What is known? What is not understood? Max 5 pages are requested (3 are enough).

6.6. JRAP5

Presentation given by J. Seppala

Feedback from the STAC:

Science integration JRAP1-JRAP5; See science integration example in NW Mediterranean (Aegean sea, Ligurian sea) – look about possible collaborations in NW Med.

A. Lavin: Asked about SE Bay of Biscay and the ferry box data.

J. Seppala: Did not manage to get answers from the SE Bay of Biscay partners in CNRS (Y. Bozec to be contacted by the coordination)

J. Newtown: Her review comments were very straight; she thought the work is well founded and planned.

R. Proctor: 'We have 5 stations in Australian, we should share'

P. Herman: better convinced that JRAP1 and JRAP5 will jointly work, but will you work station by station, because questions are local? What is local what is more general? Made a point on the lack of data at certain stations for the planned purposes; He suggested to drop the stations where fluxes cannot be estimated properly.

J. Seppala: The intention is to answer at least some of the questions in every station, and concentrate in some few stations (or something like that).

P. Herman: Again comes the question on whether exists the possibility to define scientific questions applicable not only locally, but to a larger area.

Actions

Focus science question per area and more general one(s)

6.7. JRAP3

Presentation made by I. Puillat on behalf of L. Nizzetto

Presentation of the NORMAN network – link with EU initiatives

JRAP 5 is active in the Biscay Bay (super site for transport)

Feedback from the STAC:

A. Lavin: Every country has to follow the Ospar convention, the contaminant monitoring from FP and FB is very useful. The MSFD is hardly demanding of this information. What is being done in the BoB?

A. Rubio: 6 or 8 passive samplers have been sent to AZTI, they will be deployed in a next cruise. We are waiting for the opportunity to deploy them.

P. Herman: What is the interest on measuring these new contaminants if we do know nothing on their toxicity?

D. Durand: Yes we know very little. But should we wait to measure them until we know if they are toxic or not? Or should we measure them from now even if they are present in very low concentrations. Sometime it can be speculation but some of them are already known to be toxic. There can be a tradeoff between waiting for the warning and investing a little to anticipate this kind of problem instead of facing it too late.

M. Devlin (CEFAS): The interest of measuring these contaminants is that they can be an indication of what is changing on land that makes emerging contaminant at sea, and to monitor long term changes.

P. Herman: Again the behavior of these contaminants is very similar to those we know and if they are in very low contamination what is the point? Which concentration level can we set as critical if we do not know what their effects are?

M. Devlin: there are studies on the potential damage of low concentration of contaminants and if the response is that they have no effect or not high concentrations is good too.

A. Grémare and R. Proctor: also pointed to the difficulty of crossing passive tracer (integrated data) with physics.

J. Newton: looking through the JRAP, there is a strategy bigger than the passive samplers. It is more on the behavior of different types of contaminants (hydrophobic, hydrophilic).

Finally it is agreed that the STAC will address through Ingrid their questions to Luca.

Action I. Puillat and L. Nizzetto

I. Puillat will ask to L. nizetto to clarify the need of monitoring these contaminants: a state of the art with regard to the pollution state in each monitored area. It can be a review of the concentration met of the variability. Draft by one month. This will help to write the D1.2. A final version for 7th December.

7. Conclusions

A synthesis was presented by Dominique Durand, according to 3 items:

1. Link to societal challenges
    a. do we need a better defined societal strategy for JERICO-RI
    b. What society needs, wants, expects
    c. Users, products
2. Keys to sustainability for JERICO-NEXT
    a. Focusing on the science to maximize the value for society
    b. Urgency of the questions: priorities are needed
    c. High concern /long term impacts and consequences
3. Definition of European regions in the context of JERICO-RI? (scales local, regional to pan European) for science strategy, governance, threats etc… need to federate neighbours around a common vision to be supported by regional multi-national partnership to deal with coastal environment challenges

- **Discussion about Item #3 and item #1:**

R. Proctor: Difficult to define regional systems at least in Australia.

A. Grémare: But in Europe we have closed seas, so this is can be an element for definition.

J. Newton: you can have a regional coordination in addition to the environmental/science specificity. Need to check where the synergy is: shared societal benefit at regional level for instance (e.g. good connections between countries or groups can be one criterion).

P. Herman: How the management of the coastal areas is going to evolve? 3 possibilities: 1) everything goes down to a national level, or 2) "regional sea commissions" are set which can make sense since we share similar problems, and 3) a pan-European management is set.

The most probable for him is the option 2) and that could be a reasonable option for JERICO-Next knowing that 2 and 3 are not incompatible). For instance, riverine countries of the Baltic Seas, maybe around oceanic sub-basins/basins.

P. Herman: with regards to the users, it is necessary to check that users are identified at that regional level taking in account the OSPAR regions and similar user initiatives and commissions.

A. Rubio: region= like IBIROOS or MOONGOOS or smaller?

P. Herman: like the BOOS (Baltic ROOS).

- **Other discussion and final words**

Discussion on Common Exploitation BOOSTER (CEB): Exploitation strategy and business plan development.

NEXT meeting with the STAC: information about business plan to be included.

R. Proctor: societal benefit : to be investigated, very interesting for us

J. Newton: happy to see that comment from the task are useful;

P. Herman: there is a very solid base for this project, with a will to make something useful

8. Annexes and references

8.1. Annex 1 Synthesis of the STAC feedback after review of D4.1 (WP4)

Purpose

We received the review of 5 members of the STAC, one review is still missing but we can already give a fruitful feedback that we synthesize hereafter. Attached to this document you can find the review reports gathered per question asked.

Planning

In the last pages of this document you will find a short template to answer to the STAC review. It would be appropriate to get your answer back by the 29 August in order to discuss its content with the JRAPs participants and be ready for the meeting with the STAC on Sept 8th in Bordeaux (Ingrid won't be available the 5-7 sept).

We also consider of importance to have direct interactions with the JRAP leaders (through video conference) asap, in order to discuss the review and the necessary follow-up etc.

So please inform us of your availability on the following doodle page, by the August 15th.

http://doodle.com/poll/xdp43w9ww6myqrwd

Synthesis of the most important comments common the 6 JRAPs

NB: see the review document for JRAP specific reports

1- Cooperation with other EU initiatives should be highlighted and the state of the art should express results and knowledge acquired in other regions Internationally.

2- Outcomes of the JRAPs: Products and new knowledge. This information is not yet enough described. This is related to the following comments. It is important to show the added value of our integrative work across marine research fields and of the integrated use of different platforms types. For that, the expected knowledge must be explicated and data analysis methods must be better described for some JRAPS: will we produce maps, sections, products DERIVED from several data types (in and across research fields) like statistics, correlations, mathematical model (for prediction or other), new understanding of integrated processes, etc…

3- Science integration: This is mainly a work to be better addressed within and between JRAP 1 2 and 5, but contributions from JRAP 3 4 and 6 may be enhanced. Typically it is necessary to show specific analysis and the corresponding products that will be made to tackle this issue, taking into account, for instance, Nutrient availability, Hypoxia events, relation with zooplankton etc… It is again suggested to work in a specific region with all JRAPs in collaboration. The Bay of Biscay is suggested. We know that it is technically and financially not possible to organize a common deployment. So we suggest to investigate the possibility to make a joint analysis: of the data (pre-existing data + JERICO NEXT JRAP data), of the sciences questions related to 2 regions: the Bay of Biscay (mesotrophic area ?)and the Mediterranean (oligotrophic) or the Baltic Sea (Eutrotrophic area). See our demands in the next section.

4- Upscaling from Local to regional

For each JRAP, there should be an investigation on the methodology to extrapolate the results of local researches to regional ones: what is the possible upscaling? What are the limits? Is it possible to go beyond these limits later? How?

Follow-ups relevant for the 6 JRAPs:

Question 1: please clarify how the JRAP activity links to other ongoing collaborative works/projects, indicate an approximate % age of contribution.
Question 2: please elaborate a list of products derived from the acquired data and/or the analysis method to be used. (ex. Data assimilation based on xxxx to produce yyy, statistical modeling to forecast XXXa or derive YYY, maps of integrative information, etc…)
Question 3: Science integration in the Bay of Biscay and Med. Sea.
Your advice on and interest in working during 2 years (maybe 3) to write a common paper (or 2, or maybe something more important?) to tackle:

- 1-2 scientific questions (to be defined) for the bay of Biscay?
- 1-2 scientific questions (to be defined) for the Mediterranean Sea?

Here above refereed scientific questions that should be cross cutting and integrative with biology, physics, chemistry.
This means to agree on the scientific focus, make the bibliographic reviews, analysing data and jointly conclude on the results.
This is actually what should be the main outcome of the WP4 together with the inputs to the overall JERICO-RI strategy.

Please answer in the dedicated template in the following page.

Template to answer to the STAC review

To send back at the latest date the 29 Aug. 2016

JRAP #: X

Name of the responsible person of this answer: ……

Question 1: **Please clarify how the JRAP activity links to other ongoing collaborative works/projects, indicate an approximate % age of contribution**.

*Project names, project type: (H2020, etc..), ~% contribution to the JRA***P:**

Question 2: **Please elaborate a list of products derived from the acquired data and/or the analysis method to be used.** (ex. Data assimilation based on xxxx to produce yyy, statistical modeling to forecast XXXa or derive YYY, maps of integrative information , etc…)

Question 3: Science integration in the Bay of Biscay and Med. Sea.

Your advice on and interest in working during 2 years (maybe 3) to write a common paper (or 2, or maybe something more important?) to tackle:

- 1-2 "scientific questions" (to be defined) for the bay of Biscay?
- 1-2 "scientific questions" (to be defined) for the Mediterranean Sea?

Here above referred "Scientific questions" that should be cross cutting and integrative with biology, physics, chemistry.

This means to agree on the scientific focus, make the bibliographic reviews, analysing data and jointly conclude on the results. This is actually what should be the main outcome of the WP4 together with the inputs to the overall JERICO-RI strategy.

Do you and/or some your JRAP team agree? Y/N, if yes please explain what contributions your team could be involved in; if no, please explain why (max 1page).

8.2. Annex 2: Presented slides

The JERICO Science Strategy WP4 and WP1 progress

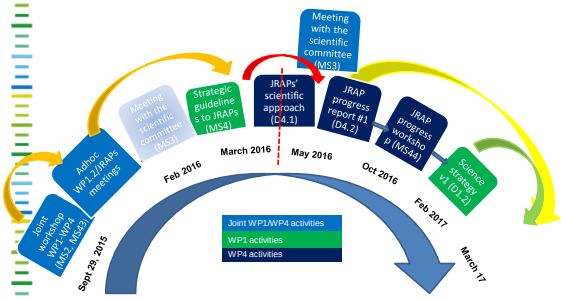
Bordeaux, 7 sept. 2016

I. Puillat (Ifremer)
D. Durand (Covartec)
A. Grémare (CNRS-EPOC)
jerico@ifremer.fr

WP4 Main objectives & organisation

- Coordination: I. Puillat, Deputy coordinator: A. Grémare (CNRS)
- Expected effort: 162 Men months
- 6 JRAPs in line with the 6 JERICO scientific areas:
  - JRAP-1 on pelagic biodiversity (B. Karlson, SMHI)
  - JRAP-2 on benthic biodiversity (A. Grémare, CNRS)
  - JRAP-3 on chemical contaminant occurrence and related biological responses (L. Nizzetto, NIVA)
  - JRAP-4 on hydrography and transport (A. Rubio, AZTI)
  - JRAP-5 on carbon fluxes and carbonate system (L. Laakso, FMI)
  - JRAP-6 on operational oceanography (B. Mourre , SOCIB)

Coordinated action plan WP1/WP4



- MS6 First feedback from the JRAPs (**M36**)
- D1.2 - Science strategy v2 (**M44**)

Process set up after the KO meeting

KO meeting	• STAC: more integration • Presentation of deadlines
Oct. 2015-Jan 2016	• First Survey: integration vs funding • Strategy: first description, brainstorming, commonalities in place and time (ppt) • Data survey (WP5)
Jan-May 2016	• Debriefing of the surveys • Template of D4.1 and 3 versions of D4.1 and intermediate brainstorming • Presentation during the Joint WP4 & 1 workshop 15 March in London
Jun-Sept. 2016	• D4.1 sent to the STAC for review and review reports sent to the JRAPs after synthesis
Now-March 2017	• Debriefing and brainstorming with the STAC to build upon D4.1 with objective to contribute to the D1.2

D4.1 – Approaches to monitor European coastal seas

- A comprehensive document
  - Each JRAP described as a science project
  - Emphasis on
    - Scientific questions, knowledge gaps and expected outcomes
    - Sampling strategy
    - Integration physical, geochemical, biological parameters
    - Innovation and impact
    - Interaction between JRAPs
    - Link to WP1 (science strategy and roadmap for the future) and WP3 (JRA technology)

Now: the Target

- Debriefing and brainstorming with the STAC to build upon D4.1 with objective to contribute to the D1.2 : « Science strategy ».
- Answer to the STAC review: Common issues and JRAP specific questions.

D1.2: A report on the science strategy required to answer the targeted scientific questions, policy requirements, and societal challenges within JERICO-NEXT. (**Draft version at M18**, final version M44).

WP4 Next Step

✓ **March 2017**: WP4 workshop #1 (MS44): Helsinki (General Assembly)

JRAP-6
Operational oceanography and coastal forecasting

Coordination: Baptiste Mourre email: bmourre@socib.es

Contributors: J. Vitorino, T. Vukicevic, S. Ciliberti, L. Ferrer, J. Mader, L. Laakso, G. Korres, L. Perivoliotis, H. Wehde, M. Juza, J. Tintoré

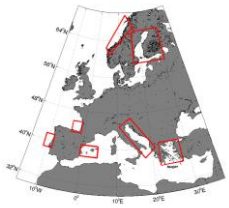
Strategy meeting / Bordeaux / France / September 8, 2016

Main objective

Show the importance of JERICO-NEXT observations for the **assessment** of operational regional models implemented in the coastal ocean, leading to **recommendations for coastal forecasting system improvements**, both in terms of models and observations.

Approach

Assessment of hydrodynamic models without/with data assimilation, including some Observing System Experiments (OSEs) and Observing System Simulation Experiments (OSSEs).
Assessment of 1 wave model.



Links to other projects

EU projects that have connections with JRAP6:

- H2020-**AtlantOS** Atlantic Ocean Observing Systems
(optimizing and enhancing the integrated observing system for the Atlantic Ocean, regional OSSEs). Many Atlantic Ocean JERICO partners involved in AtlantOS (HZG,CNRS, IFREMER, EuroGOOS, IMR, CMCC, CSIC). 4-year project until June 2019.

- H2020-**MedOS** Mediterranean Sea Observing Systems
(integrated observing system for the Mediterranean Sea, regional OSSEs)
Many Mediterranean Sea JERICO partners involved in MedOS (HCMR, CMCC, OGS, SOCIB, CSIC, CNR, CNRS, IFREMER, EuroGOOS). Project to be submitted in Sept 2016.

- FP7-**SANGOMA** Stochastic Assimilation for the Next Generation Ocean Model Applications (developments in data assimilation for operational forecasting and monitoring systems). Pierre de Mey (CNRS-LEGOS) was the only JERICO partner (JRAP4) involved in SANGOMA. Project ended in November 2015.

- Also, connection with **Copernicus Marine Environment Service**: development of downstream applications, improvement of coastal analysis and forecasting systems.

JRAP6 products

- Synthesis on numerical model evaluation: quantification of model errors based on coastal observation platforms, assessment of the impact of assimilated measurements

- Recommendations on the modelling strategy in coastal areas

- Recommendations on optimal coastal observing systems sampling to improve coastal model forecast skills

Multidisciplinary science integration in specific areas

JRAP6 connections with other JRAPs:

- JRAP1 and JRAP5 in the Baltic Sea (algae blooms and phytoplankton variability)

- JRAP4 in the Bay of Biscay and NW Med Sea (analysis of hydrographic conditions and transports)

→ some common scientific question to be identified ?

Multidisciplinary science integration in specific areas

Difficulties:

- The work planned in JRAP6 is already quite ambitious. Opening a new working direction could be a risk for the proper development of the proposed tasks.

- Considering numerical models and coastal forecasting, an additional difficulty concerns the integration with biology/chemistry since none of the teams involved in JRAP6 is presently able to provide an operational biogeochemical model over the coastal areas.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 654410.

D4.1 – Innovation and strategic perspectives

- JRAP-1: testing a new approach based on flow cytometer to monitor HAB and phytoplankton biodiversity
  - Impact: more cost-effective monitoring approach and better warning capability
- JRAP-2: Developing the future benthic component of the JERICO-RI
  - Impact: enlarging the potential of the JERICO-RI and major contribution to integrating biotic and abiotic parameters
- JRAP-3: integration of pollutant observation in the JERICO-RI and biosensing approach to chemical pollution
  - Impact: strong innovation potential
- JRAP-4: Providing better assessment of coastal transport
  - Impact: increasing the JERICO-RI capability to provide basic data for coastal dynamics
- JRAP-5: Developing a coastal capability for measuring the carbon system in coastal areas
  - Impact: Potential to provide a Ccoastal component to ESFRI-ICOS
- JRAP-6: Analysis of the optimal contribution of in-situ coastal observation to forecasting systems
  - Impact: cost-effectiveness of coastal observing system

JRAPs in WP4

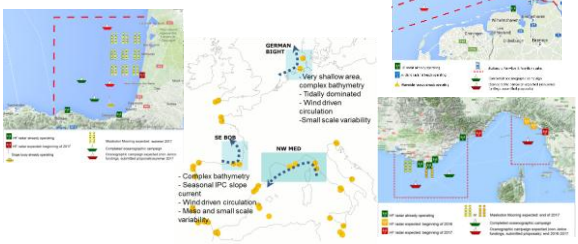
JRAP #	lead	Partners	Sites
1	B. Karlson, SMHI	SMHI, CEFAS, CNRS-LOV, CNRS-Univ Litt, CNRS-MIO, Deltares, Ifremer, NIVA, RWS, SYKE, VLIZ, and DAFF	Northern Baltic, Kattegat-Skagerrak, Eastern Channel and Southern North Sea, Bay of Biscay, Ligurian Sea, Benguela Current
2	A. Gremare, CNRS-EPOC	CNRS-EPOC, HCMR, Ifremer-Benthos, CNRS-UBO	Gironde estuary, Aegean Sea , Brest estuary
3	L. Nizzetto, NIVA	NIVA, HZG, IMR, IRIS, CEFAS	North Sea, Norwegian Sea (possibly Baltic and Biscay Bay)
4	A. Rubio, AZTI	AZTI, Ifremer, CNR-ISMAR, CNRS-MOI, CNRS-LEGOS, CMCC, HZG	SE Bay of Biscay, NW Med. sea, German Bight
5	L. Laakso, FMI	FMI, SYKE, NIVA, SMHI, HZG, HCMR, CNR , CNRS -SBR	Baltic Sea, Med Sea, Norwegian Shelf, Barents Sea, North Sea, West channel, Bay of Biscay
6	B. Mourre, SOCIB	SOCIB, IH, AZTI, CMCC, CNR, FMI, HCMR, IMR	Ibiza Channel, Adriatic Sea, South Bay of Biscay, Aegean Sea, Portuguese Nazare Canyon area, Baltic Sea, Norwegian Sea

Time line until Aug. 2017

Time Line	MS/D/WS	Actions	WPs	Validation criterias
Sept.15 (M1)	MS43	Presentation of JRAP projects during KO meeting. Presentation of WP4 activities and time schedules agreed with WPs and partners. Actions with WP1 & 8 planed.	WP4, WPs	Reported in a KO meeting report
Mar. 16 (M7)	MS4	Strategic guidelines for the implementations of the JRAPs.... OI London 15 march	WP1, WP4	Guidelines communicated to and endorsed by the
May 16 (M9)	D4.1	Present approaches to monitor European coastal seas (Covartec)	W W	
Sept. 16 (M13)	D4.2	Progress report #1 (Ifremer)	W	
Feb. 17 (M18)	MS44/ **WS#1**	**WP4 Workshop#1:** Presentation of JRAP progress, highlighting links with other WPs .	WP4, WPs	Reported in WP4 workshop#1
Aug. 17 (M24)	**D4.3**	**D4.3 Progress report #2 (Ifremer)**	**WP4**	

JRAP#4 : 4D characterization of trans-boundary shelf/slope hydrodynamics and transport

4D characterization of shelf/slope circulation and its time variability year-round in three trans-boundary areas, through the joint analysis of multiplatform data of surface currents and hydrology and applications in line with MFSD objectives.



Connections with other projects

SE BoB

LIFE LEMA - Intelligent marine Litter removal and Management for local Authorities (LIFE15 ENV/ES/000252) starting in September 2016. One of LIFE LEMA tasks will focus on the applications of transport characterization from HFRs and models (in coordination with JERICO-NEXT WP4 Task JRAP 6) to specific purposes related with FML

COCTO (Coastal Ocean Continuum in surface Topography Observations) funded by TOSCA/ROSES in the frame of SWOT altimetry mission - 2015-2018. Diagnostics developed in this project will be potentially used in the frame of JERICO-NEXT for comparisons between numerical experiments and *in situ* observations.

NW Med

IMPACT (Maritime Cross Border Cooperation Project Italy-France) is presently considered for funding starting by the end of 2016. IMPACT deals with the challenge of managing Marine Protected Areas (MPAs) on the North Western Mediterranean Sea. Linked with JERICO-NEXT JRAP4 in terms of transport products and ecological consequences.

RITMARE Flagship Project (until end 2016), It is the leading national marine research project in Italy and it includes the setup of an Observation System for the Marine Environment (WP5). In particular, a network of HF radars has been set up in the Tyrrhenian and Ligurian Sea, in coordination with JERICO-NEXT.

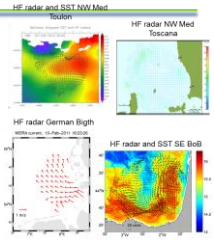
German Bight

"Macroplastics Pollution in the Southern North Sea – Sources, Pathways and Abatement Strategies" funded by Lower Saxonia and coordinated by the University of Oldenburg. An important component of this project is the analysis of macroplastic drift at the surface, which fits into the activities planned in JERICO_NEXT.

Products (prototypes of)

1- Maps of surface currents and integrated transport
As stated in JRAP-4 section, main efforts will be put in quantifying transport by ocean currents and its potential impact on the distribution of floating matter. In addition to the transport estimations, specific actions within the different study areas will be devoted on producing information and maps on integrated transport that can be used as a basis for several applications, including those of interest of other JRAPs.

2- Specific products for numerical modelling validations (in coordination with JRAP6)
In the SE BoB the specific cross-cuttings with JRAP-6 will involve joint analysis of data and simulations for model assessment, specific products will be elaborated for this task (e.g. monthly means of surface currents, spectral analysis of surface currents, data and plots of integrated and surface transports with time…)



3- In the NW Mediterranean Sea, cross cutting with WP3.7 will be performed providing HF radar data for numerical model validation, set up of an assimilation system and implementation of a OSSE system.

4- Transport statistics for German Bight. In the German Bight the plan is to derive transport estimates based on a combination of numerical model, HF radar data and tide gauge observations.

5- SE Bay of Biscay There will be also the possibility to propose integrated products from in situ observations in the region including cruise data in 2017

Science integration

- **As described in d4.1 JRAP-4 main efforts will be put in quantifying transport by ocean currents and its potential impact on the distribution of floating matter (plankton - jellyfish or other pelagic organisms, marine litter, pollutants, etc.).** In addition to the transport estimations, specific actions within the different study areas will be devoted on producing information and maps on integrated transport that can be used as a basis for several applications, including those of interest of other JRAPs. This will be the base for scientific multidisciplinary collaborations.
- In the case of JRAP6 possible crosscuttings were identified in NW Med and Bay of Biscay, for model validations and DA exercises.
- For the SE Bay of Biscay we think an effort towards joint physical-biological studies could be interesting, but only if we can find the historical data for a real cross-cutting integrative exercise. We should think about the scientific questions based on the available data… at least to think of scenarios for Lagrangian experiments based on HFR and model data.
- For the NW Mediterranean the possible applications (for CNR-ISMAR) include for instance transport of litter or jelly fish, as well as MPAs or fishery management, but there is no any obvious overlap with other JRAP topic or data.
- A possibility of crosscutting with JRAP3 was mentioned in the D4.1 for the German Bight. The drift of contaminants (e.g., oil) potentially released from ships in the German Bight could be investigated based on numerical models and HFR data. Because of the well-defined ship routes the most likely release locations are known. The potential of measurements from fixed platforms (e.g., at FINO-1 or FINO-3) and moving systems (e.g., Ferrybox) to identify this kind of pollution will be assessed. For this purpose, simulated observations from hypothetical pollution events will be investigated. Different scenarios regarding wind conditions and tidal phase at the time of the release will be considered. Pollutant dispersion (e.g., depending on wave conditions) will be considered in addition.

JRAP-2

Monitoring changes in benthic diversity

Presenter: Antoine Grémare email: antoine.gremare@u-bordeaux.fr

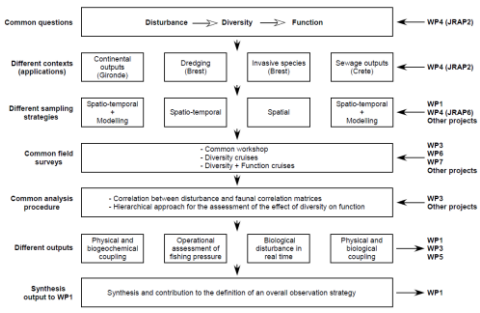
Contributor(s): B. Deflandre, S. Schmidt, G. Bernard, J. Grall, A. Carlier, C. Arvanitidis, C. Pavloudi

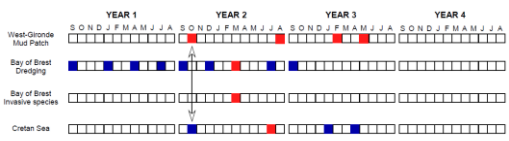
STAC-JRAP meeting / Bordeaux/ UK / September 18, 2016

Main objectives

- ✓ Assessing spatio-temporal changes in (macro- and micro-benthic) diversity under different sources of disturbance
- ✓ Assessing functional consequences resulting from spatio-temporal changes in benthic diversity
- ✓ Contributing to the definition of a strategy for the future monitoring of European coastal waters (inputs to WP1, Task 1.2)

General organization





- ✓ ***Two kinds of cruises (Diversity, Diversity + Functioning)***
- ✓ ***All cruises completed by the end of year 3***

Q1: Associated initiatives

- ✓ One of the main characteristics of the call was the coupling between obervation data of different kinds (e.g., physics and biology)
- ✓ Such a coupling is not casual and, for most potential disturbances, mostly makes sense at a small spatial scale
- ✓ JRAP2 has been conceptualized as a collection of case studies to assess/monitor the effects of several kinds of disturbance on benthic biodiversity and associated functional processes
- ✓ Interest of identifying associated initiatives not only at the European but also at the National and even Regional/Local levels

- ✓ Regional: MAGEST observation network (WGM), AIS data (BBD)
- ✓ National: ANR AMORAD (25% WGM), ANR BENTHOVAL (10%, JRAP2), AAMP IMPECAP (50% BBD)
- ✓ International: ESFRI LIFEWATCH-GREECE (through MEDOBIS, 5%, CSS)

Q2: Derived products

- ✓ Field experiences to improve the coupling of physical, biogeochemical and biological observations at small spatial scales
- ✓ Field experiences to coordonate observations carried out (or tools developped) within different contexts
- ✓ Adaptation of corresponding protocols to the nature of main potential disturbance(s)
- ✓ Test of technological developments (JERICO and JERICOnext, software and hardware)

- ✓ Computation of ecological quality status indices based on benthic macrofauna composition
- ✓ Computation of ecological quality status indices based on Sediment Profile Imagery
- ✓ Calibration of corresponding indices
- ✓ Definition of the sampling protocols (references…) requested for the computation of indices

Q3: Potentiality for upscaling

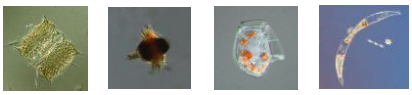
- ✓ JRAP 2 has been designed to gain experience on: (1) the coupling of observations of different kinds, and (2) the coordination of projects carried out at different levels
- ✓ In this sense, it will contribute to optimize observation protocols at small spatial scales
- ✓ D1.1 is aiming at cataloguing observation initiatives and environmental threats in the partner states of JERICONext
- ✓ Both initiatives (i.e., WP4 and D1.1) should allow for the elaboration of a sound observation strategy at the panEuropean scale (D.1.2)
- ✓ In this approach, upscaling is mostly consisting in the aggregation of local studies based on: (1) existing observations, and (2) identified lacks

- ✓ The identification of environmental questions may constitute a sound supplementary step, provided that:
  - It is based on a thorough analysis of the litterature available for the area
  - It takes count of already published syntheses (e.g., Marine ecosystems' responses to climatic and anthropogenic forcing in the Mediterranean, Progress in Oceanography 91:97-166)

Thank you for your attention...

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 654410.

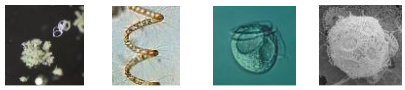
Implementation in Joint Research studies



JRAP1 : Pelagic biodiversity

Phytoplankton diversity, (harmful) algal blooms and eutrophication

Bengt Karlson, SMHI, bengt.karlson@smhi.se
Felipe Artigas, felipe.artigas@univ-littoral.fr



JRAP#1: objectives

JRAP #	lead	Partners	Sites
1	B. Karlson, SMHI	SMHI, CEFAS, CNRS-LOV, CNRS-Univ Litt,, CNRS-MIO, Deltares, Ifremer, NIVA, RWS, SYKE, VLIZ, and DAFF	Northern Baltic, Kattegat-Skagerrak, Eastern Channel and Southern North Sea, Bay of Biscay, Ligurian Sea, Benguela Current

- To get closer to resolving natural high spatial and temporal variability in the sea with regard to plankton and more specifically to phytoplankton
- To improve the understanding of the development of certain algal blooms by regular and targeted field studies
- To exemplify how JERICO-NEXT can help address MSFD requirements (D1-Marine biodiversity for the pelagic realm, D4 Food Webs, D5 Eutrophication)
- To use JERICO-NEXT observation platforms and other infrastructure

What are the problems?

- There are several thousand different phytoplankton species with different properties
- Phytoplankton have a patchy distribution in time and space
- The coupling between physics, chemistry and biology is not always well understood
- Biological interactions are often not well understood
- The currently used observation methods in monitoring programs do not resolve the natural variability

Partners

JRAP1 partners (some key persons identified)

- **SMHI**, Bengt Karlson and Malin Mohlin
  - Subcontractors Woods Hole Oceanographic Institute (Michael Brosnahan and Don Anderson) and Scanfjord AB
- **NIVA**, Wenche Eikrem and Kai Sørensen
- **SYKE**, Jukka Seppälä
- **RWS** – Machteld Rijkeboer
  - Subcontractors Jacco Kromkamp (NIOZ), Thomas Rutten b.v. and CytoBuoy b.v.
- **Deltares** - Anouk Blauw
- **VLIZ** – Klaas Deneudt
  - Sub-contractor Univ. of Gent - Wim Vyverman
- **CEFAS** – Veronique Creach
- **Ifremer** – Alain Lefebvre
- **CNRS**
  - Felipe Artigas (Univ Littoral) & Fabrice Lizon (Univ Lille) – CNRS LOG Wimereux
  - Pascal Claquin (Univ Caen) – CNRS BOREA Caen
  - Lars Stemman (Univ Paris VI) – CNRS OSU Villefranche sur Mer
  - Melilotus Thyssen and Gérald Grégori – CNRS M.I.O. Marseille
- **Collaborator in Republic of South Africa: DAFF** – Grant Pitcher

Scientific strategy

- Carry out short terms studies of different types of algal blooms
- Multi discipline approach
  - Biological, chemical and physical oceanography
- Multi platform approach
  - Research vessels
  - Buoys
  - FerryBox systems
  - Remote sensing (not part of JERICO NEXT)
- To combine novel methods with established ones
  - Automated water sampling and traditional water sampling
  - Automated in situ sensors for bio-optical parameters such as chl. fluorescence and multi-spectral fluorometry , FRRF/PAM fluorometry for photosynthetic pigments
  - Automated identification and enumeration of organisms
    - Pulse-shape recording Flow Cytometry (in situ and on ship)
    - Imaging Flow Cytometry (in situ and on ship)
    - High Troughput sequencing of 16S and 18S rDNA
  - Counting and identifying organism using the light and electron microscope

Strategy

- JRAP 1 on pelagic biodiversity will include short term studies of algal blooms in:
  - The eastern Mediterrannean
  - The English channel – North Sea
  - The Skagerrak-Kattegat
  - The Baltic Sea
- Interactions with other JRAPs and WP are essential for successful studies

Harmful algal bloom study at the Tångesund observatory.

- A study of plankton dynamics near a mussel farm at Tångesund on the Swedish Skagerrak coast will be carried out in August-October 2016. An instrumented oceanographic buoy was deployed already in April.
- One objective of the study is to investigate the coupling between physical processes and harmful algal blooms. The focus organisms are dinoflagellates belonging to the genus *Dinophysis*.
- These phytoplankton produce diarrhetic shellfish toxins that may accumulate in shellfish, posing a threat to human health. Other phytoplankton and also bacteria are being studied. The involved JERICO partners are SMHI with subcontractors Scanfjord and WHOI (USA), NIVA, IRIS and Ifremer. In addition scientist from the University of Gothenburg, Sweden, and the AWI (Germany) will be involved.
- In connection with the study at the fixed location three cruises with a research vessel are planned. In addition, data from the Ferrybox system on Colour Fantasy covering the route Oslo-Kiel will be used.

Study of phytoplankton algal blooms in the Baltic Sea

- In April the Huvudskär E instrumented buoy was deployed in the Northern Baltic proper. Ferrybox systems on ships TransPaper, Finnmaid and Silja Serenade are in operation.
- Bio-optical data are being collected continuously and automated water sampling is also carried out. Water samples are analysed in the laboratory, e.g. for phytoplankton composition.
- The Utö observatory in the Archipelago Sea is being set up.
- The focussed studies in the Baltic Sea will be carried out in 2017.

Study of phytoplankton in the western Mediterranean

- Phytoplankton functional diversity and spatio-temporal distribution at the meso-scale are studied in the frame of the A*MIDEX CHROME (Continuous High Resolution Observation of the Mediterranean, https://en-chrome.mio.univ-amu.fr/?page_id=42) project thanks to the combined installation of a Ferrybox system (belonging to the INSTM, Tunis) and a Cytosense flow cytometer on board the CTN's ferry "Le Carthage".
- The first trial was run end of April 2016 for one week and should run again before the end of 2016.
- By combining the phytoplankton datasets with oxygen, partial pressure of carbon dioxide and pH, the understanding of the phytoplankton functional diversity on biogeochemical processes at the basin scale will be improved.

Study of phytoplankton in the North Sea – English Channel area

- The phytoplankton will be studied using automated systems on research vessels, ferries, instrumented buoys (e.g. SMILE and Smartbuoys) and the MAREL Carnot instrumented Station.
- In 2016-2017 cruises with R/V Cefas Endeavour around the Bristish Isles, R/V Côtes de la Manche, R/V Borea and R/V Simon Stevin in the English Channel and Zirfaea in the North Sea along the Dutch Coast will be carried out.
- The Ferrybox system on the route Ouistreham-Porstmouth as well as a new FerryBox system on the Calais-Dover route would be implemented with some optical phytoplankton sensors in 2017.

N. Sea – E. Channel area

- Cruises of R/V Zirfaea (RWS):
- 11-14 April 2016: Phytoplankton study along the Dutch Coast and towards the Dogger Bank. Flowcytometry and FRRF in order to detect, follow and couple the phytoplankton composition and the productivity of the system. This involved the cooperation of RWS-NIOZ-VLIZ-University of Ghent
- 13-17 June 2016. Phytoplankton study along the Dutch Coast and towards the Dogger Bank. Flowcytometry, FytoPam and continuous Fluoroprobe in order to detect, follow and couple the phytoplankton composition and the productivity of the system. This involved the cooperation of RWS -CNRS -University of Lille
- Cruises of Cefas Endeavour (Cefas):
- 9-12 May 2016: Phytoplankton study on the East Coast of UK.
- The Cytosense Flowcytometer on line with the Ferrybox during a short cruise (3 days) between North of Norfolk and the Tames Estuary chasing a *Phaeocystis* bloom.
- 20-29 June 2016: Comparison of outputs from two Flowcytometers from RWS and Cefas. The two Flowcytometers will be on line with the Ferrybox during the Survey which aims to estimate the density of Nephrops in the North of the North Sea. The data from the two instruments will be compared to estimate their performances and will show that it is possible to combine phytoplankton measurement with other monitoring surveys.

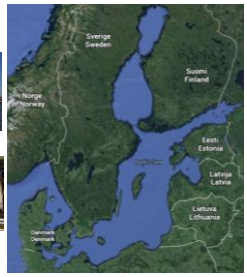
Plans for the Tångesund observatory

Baltic Sea

Research vessel, Utö observatory, FerryBoxes and buoys





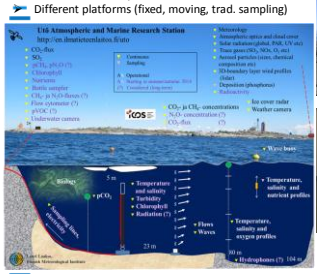






Baltic Sea

Research vessel, Utö observatory, FerryBoxes and buoys

- Different bio-chem-phys marine observations at one site
- Marine and atmospheric observations at one site
- Different platforms (fixed, moving, trad. sampling)



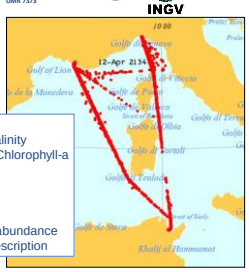

en.ilmatieteenlaitos.fi/uto

Western Med Sea projects

A*MIDEX CHROME (Continuous High Resolution Observation of the Mediterranean Sea). Expected start of the ferry box : December 2015-January 2016

Ferrybox management, contact: cherif.sammari@instm.rnrt.tn

Coupling with a cytometer, contact: melilotus.thyssen@mio.osupytheas.fr

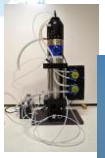




– Temperature
– Conductivity/salinity
– Fluorescence/Chlorophyll-a
– CDOM/FDOM
– pH
– pCO_2
– Oxygen
–Phytoplankton abundance and functional description

Cytobuoy cytometer with the Image in flow device

SMILE – Buoy – Bay of Seine English Channel

A new platform open for installation of new sensors




A Fast Repetition Rate Fluorometer ACT2 (Chelsea) Installation on the SMILE Buoy at the end of the year

Temperature
Conductivity
Oxygen
Turbidity
Chla (Fluorescence)
PAR

Mini – « Ferrybox »
Temperature
Conductivity
Oxygen
Turbidity
BBE Only Analyser

MAREL Carnot instrumented Station: High Frequency Monitoring in the eastern English Channel


Sampling frequency: 20 minutes for physico-chemical parameters and 12 hours for nutrients
Preprocessed database: 131 472 x 10 non-correlated parameters over 2005-2009
Ongoing System update.

Parameters:
Temperature, Salinity, Oxygen, Turbidity, pH, Fluorescence, PAR, Relative Humidity, Wind, Water level, Nitrate, Phosphate, Silicate


Contact: alain.lefebvre@ifremer.fr

Pocket Ferry Box (PFB) + AlgaeOnline Analyser (AOA) + CytoSense + PhytoPAM

A preliminary study towards a Ferry Box line across the Dover Strait


CytoSense (CytoBuoy©)

Ysi 6600 V2 data sonde (+ Flow Cell)

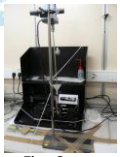
R.V. « Côtes de la Manche » (INSU-CNRS)

DYPHYMA Cruises – INTERREG "2 Seas" DYMAPHY Project

Sampling frequency: 1 min - 10 min continuous sampling mode / Spatial resolution approx. 0.5-1.5 km
AOA Database Fingerprints : Green, blue-green , brown and Mixed algae
Pulse-Shape recording Flow Cytometry + Image inflow system

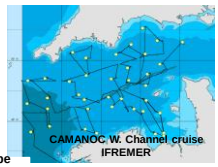
Contacts: alain.lefebvre@ifremer.fr and Felipe.Artigas@cnrs.fr

« Thalassa » R.V. (IFREMER)
IBTS-CAMANOC-CGFS Channel cruises


Flow Cam


Pocket Ferry Box + AOA bbe+ CytoSense


CTD + Bottles + Fluoroprobe




Filtration desk

VLIZ Flow Cytometer (FCM) and Fast Repetition Rate Fluorometer (FRRF)

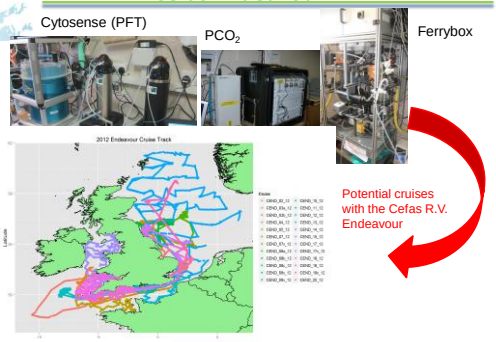
- On board Simon Stevin
- Connected to continuous water flow system
- Flow cytometry and FRRF

Facilities on line on the Cefas Endeavour

Cytosense (PFT)

PCO_2

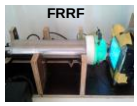
Ferrybox



Potential cruises with the Cefas R.V. Endeavour

Flowcytometry in routine monitoringof Dutch offshore, coastal and estuarine waters (RWS)

FRRF



Machteld Rijkeboer (RWS)
Arnold Veen (RWS)
Thomas Rutten (TRP)
Jacco Kromkamp (NIOZ – FRRF)

FerryBox FCM

JRAP#5 Coastal carbon fluxes and biogeochemical cycling
L. Laakso FMI, J. Seppälä SYKE,
NIVA, SMHI, HZG, HCMR, CNR, CNRS

Objective: understanding and quantifying the influence of biological activity on carbon release or uptake, relative to physical and chemical processes affecting sea-air carbon fluxes, throughout European coastal seas.

- one annual cycle at each location
- couple physical, chemical and biological measurements
- fixed and moving observatories, and high-frequency measurements -> information on the relevant scales observations need to be carried out.

JRAP will guide development of optimal observation network for C-flux studies,

Jerico NEXT Strategy meeting / Bordeaux / France / September 7-8 2016

Q1: How the JRAP5 activity links to other ongoing collaborative works/projects,

JRAP#5 builds on top of the ongoing activities in various platforms that are operated and maintained by institutional funding by partners. Some measurement activities in platforms as well as development of instrumentation and technologies, supporting JRAP#5, are externally funded (H2020 and national funding).

- Baltic: Alg@line ferrybox project, national initiatives (FINMARI)
- Adriatic Sea: Italian Flagship Project RITMARE, internat. network GOA-ON, national initiatives (Marine Strategy)
- Aegean Sea: FixO3 (H2020), grant from the European Economic Area (EEA), national initiatives
- Norwegian Shelf: Integrated Arctic Observation System (H2020), national initiatives (ACIDCOAST)

Work done in streamlining data flows (WP4-WP5 link) will guide the future development of biological/chemical data streaming and archiving (e.g. EModNet)
Work will guide the selection of operational instrumentation, measurement sites and frequencies as used in the future monitoring of air-sea C fluxes in European coastal areas.
Results will be communicated to ICOS and will guide the development of coastal carbon observation systems.

Q2: Products derived from the acquired data and/or the analysis method to be used

Main product: Technical strategy and recommendations towards reliable measurements of air-sea carbon fluxes in different European coastal areas.

Based on the results obtained in JRAP5, we formulate general recommendations how to get reliable information on air-sea C-fluxes in different areas. The strategy build on products:

1) Evaluation of reliability of carbonate system measurements including (pCO_2, pH, total DIC, total alkalinity, carbonate ion, ...) obtained with different equipment/measuring configurations,
2) Observed overall range and spatiotemporal variability in carbonate system components in different European coastal seas
3) Importance of biological vs. solubility carbon pump in different European coastal seas in cooperation with JRAP#1.

Q3: Science intergration

Baltic Sea (FMI, SYKE, SMHI):

Target: Biol.-Chem.-Phys.

In Baltic Sea collaboration between JRAP1 & JRAP5 is very strong (same actors, partly same infrastructures).

We aim in writing a JRAP1/5 paper on how the different bio-optic proxies for phytoplankton taxonomy/production may be combined with carbonate system dynamics, in analyzing the effectivity of biological C-pump vs. solubility pump. (cooperation with FMI, SYKE, SMHI)

Q3: Science intergration

Baltic Sea example

JRAP#5: Utö fixed observatory; ferrybox Silja Serenade; ferrybox Transpaper
- Continuous (all year around, 1sec.-1h interval) measurement of physics (T, sal, waves, wind), chemistry (pCO2, pH, O2, CDOM), biology (Chla, Turb., cyanob.)
- Utö observatory, additional campaigns : chemistry (DIC, Alk, nutrients), biology (primary prod., taxonomy)

4/17	5/17	6/17	7/17	8/17	9/17	10/17	11/17	12/17	1/18	2/18	3/18
4/17		6/17	7/17		9/17						?

JRAP#1: Utö fixed observatory
- Campaigns aligned with JRAP#5 campaigns
- Relation between fluorescence based and 14-C based primary production
- Relation between optical (spectral) taxonomy vs. microscopy

Common question: Can we use optical proxies in describing main events in taxonomy and production , and how can we utilize this information when interpreting C-flux measurements (JRAP#1 studies = if methods are mature/feasible, and if so JRAP#5 = use the data for biogeochemical study)

Q3: Science intergration

Mediterranean Sea, Adriatic Sea (CNR)

Target: Met.-BioGeoChem.

Extreme meteorological events (heat waves, floods, cold winds outbreaks, ...) are becoming more and more frequent, as predicted by global change studies. Coastal areas respond quickly to meteorological forcings and moored instruments are essential to gain data on short time scales also under bad weather conditions.

The data acquired in the JRAP5 will allow studying the response, in terms of carbon fluxes, of different coastal sites to meteorological forcings, allowing an estimate of how climate modifications would affect air-sea CO_2 fluxes in different sub-regions of the Mediterranean Basin.

Q3: Science intergration

Mediterranean Sea, Aegean Sea (HCMR)

Target: Biol.-Chem.-Phys.

A JRAP#1 & JRAP#5 link is under creation to test limits of automated tools for phytoplankton coastal observation in the oligotrophic Cretan Sea at the location of JRAP#5 activities (FB, HCB). Contacts have been made and TNA possibilities are explored to test several instruments lower detection limits.

The JRAP#2 & JRAP#5 link is strong since benthic biodiversity is studied in the same area as JRAP#5 activities

Link with JRAP6 & JRAP5 since the carbonate system data collected may be used to setup model predictions for solubility pump

Q3: Science intergration

Norwegian Shelf (NIVA, HZG)

Target: Biol.-Chem.-Phys. & Land-Sea

We intend to use carbonate system data and biological data from JRAP1 to examine the relative roles of the biological and solubility pumps, especially addressing seasonal and spatial scale. The JRAP activities will also be used for assessing major contributions to coastal acidification (ocean acidification in coastal regions), especially with regards to freshwater input via rivers and fjords. Together with HZG, we plan to look at carbonate system variability in the North Sea, with input from FMI/SYKE/SMHI on inorganic C and total alkalinity fluxes from the Baltic into the North Sea.

We aim to produce JRAP1/5 papers on the inter-annual variability of the coastal and shelf carbonate system, the influence of marginal inputs and sensitivity to ocean acidification.

JRAP-3
Occurrence of chemical contaminants in coastal waters and biological responses

Presenter: Luca Nizzetto email : Luca.nizzetto@niva.no

Contributor(s):Catherine Boccadoro, Elisa Ravagnan (IRIS) , Kate Collingridge (CEFAS), Henning Wehde (IMR), Wihelm Petersen (HZG),

WP1/WP4 JRAP meeting / London / UK / March 15, 2016

Main objectives

1) To identify new contaminants in coastal waters
2) To describe spatial distribution of chemical contaminants
3) Exploring the drivers controlling spatial distribution
4) Exploring co-linearities between contaminant concentrations and biological responses

Secondary objectives

1) To deliver technical protocols and best practices for the monitoring of chemical pollutants
2) To optimize existing chemical sensor technology for use CI
3) To provide guidelines for the implementation of contaminant monitoring strategies using JERICO infrastructures

Overview of Monitoring activities/infrastriucture in JRAP3

20/09/2016

Question 1. Integration with other EU initiatives

NORMAN
Network of reference laboratories, research centres and related organisations for monitoring of emerging environmental substances

- European scale intitiative stemmed from FP7 project.
- enhancing the exchange of information on emerging environmental substances
- encouraging the validation and harmonisation of common measurement methods and monitoring tools
- **Providing harmonized data to governance to support implementation and development of EU water framework directory and marine strategy framework directory**

20/09/2016

Question 1

-Jerico- Next JRAP activities are key to fill the objective gap in data on contaminants in marine and coastal waters

- JRAP 3 activities have already be presented in NORMAN meetings. Rising high interest.

- Data from JERICO can be integrated in a series of database compiled by NORMAN. This includes the list of contaminant of emerging concerns.

- a key JRAP 3 deliverable is information on new contaminants of emerging concern.

- Information on monitoring best practice and protocols delivered by JRAP3 will be chared with NORMAN. NORAMN will serve to disseminate JERICO-derived knowledge to the European arena of environmental chemists. Bridging a significant gap between two fields.

20/09/2016

Question 2

-JRAP 3 wil deliver a map of selected pollutant distribution of the Kattegat Skagerrak region.

- JRAP is conducting high resolution spatiotemporal observation on the distribution of emerging contaminants in this area using FerryBox based monitoring.
- We expect to obtain a high resolution map stemmed from correlation analysis between pollutant distribution and physical proxies (e.g. temperature, salinity, etc., turbidity, or a combination of them.

- Kattegat and Skagerrak receive the outflow from the Baltic (one of the most polluted (from a chemical point of view) sea in the world) and deliver this plume it to the North sea and Norwegian sea. **This map wil be a relevan products for environmental chemistry community.**

20/09/2016

Question 3

1. JRAP 3 is both active in the Biscay bay (super site for the deployment of passive samplers in JRAP3).
2. Deployment in the Bay of Biscay is consistent with the aim of assessing transport model
3. In the German Bight, JRAP 3 is active with 2 passive sampling deployment (to be deployed on HZG). And ferry box assisted sampling
4. Contamination data from the German Bight wil be navailable for any model assessment purpose.

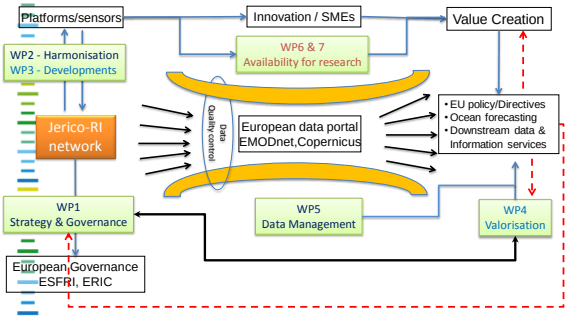
Topics to discuss with the STAC

Presenter: email

Contributor(s):

Meeting name / place / country / dates

The JERICO-NEXT Approach



Science strategy: Discussion with the STAC

1. Link to Societal challenges
   - Do we need a better defined **Societal Strategy for JERICO-RI**
   - what society needs, wants, expects
   - Users, products

2. Keys to sustainability for JERICO-NEXT
   - Focusing the science to maximize the value for society (for the nations/EU): Janet, Roger
   - Urgency of the questions (Peter Herman): set priorities !!
     - High concern / long-term impacts and consequences

3. What is the right definition of **European regions in the context of Jerico-RI**
   - Crucial input for both the science strategy and the governance strategy
   - Depending on the compartment, the env. Challenge, …?
   - Threats that is common for neighbouring countries
     - Area across border that should be protected?
   - Federating neighbouring nations on common challenges
     - Common vision
   - Regional multi-national partnership to deal with coastal environment challenges

Common Exploitation Booster (CEB)

- Exploitation strategy
- Business plan development

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