





JERICO-DS DELIVERABLE

Joint European Research Infrastructure of Coastal Observatories - Design Study

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EXECUTIVE SUMMARY

One goal of JERICO-DS WP1 consists of identifying the main scientific needs and societal problems that are most important for each nation. The idea is to provide preliminary indications of the national desired requirements and characteristics in the scientific design phase of the JERICO-RI. The subsequent analysis of these desiderata focuses on the common problems and needs, underlining which ones may be complementary among different nations. This process ensures the bidirectional approach, that is the continuous exchange and update of scientific strategies and needs, from the global to the national scale and vice versa. The same process intends to integrate the regional viewpoint, proper of the JERICO-S3 project, with the national viewpoint introduced by JERICO-DS.

This Deliverable D1.1 contributes to this general goal by:

- 1. listing societal needs within specific Scientific Topics and Integrated Themes;
- 2. identifying common societal needs based on their priority and implementation levels at the national level;
- 3. formulating preliminary suggestions to consider the national scale in the JERICO strategy.

D1.1 is a preliminary contribution of Deliverable D1.3 entitled "Final report for a long-term scientific plan: a mutually beneficial strategy to bridge national and EU landscape" which incorporates recommendations from D1.2 - "First elements to unify environmental RI efforts at national level: national scientific expectations across RIs (specific goals, expertise, data)" and represents the main outcome of the whole WP1.

The enumeration/classification of the societal needs within specific Scientific Topics and Integrated Themes brought to a list of six Scientific Topics and three Integrated Themes. The list was put forth considering the important connections with the KSCs of the JERICO community (Grémare et al., 2021) as well as with the MSFD descriptors and the UN Sustainable Development Goals. Inside each Topic and Themes several societal needs were also identified together with their scales (multinational/regional, national and local) to enforce the JERICO-DS bi-directional approach. The number of societal needs varies within each Topic/Theme from a maximum number of eight to a minimum of two.

The identification of common societal needs was based on their priority and implementation levels at the national level collected through a survey filled by National Representatives (NRs). Main results from the survey indicated that nations shared different high-priority needs. These include:

- non-indigeneous species,
- aquaculture,
- climate change,
- localised measures/protection from marine litter,
- riverine inputs,
- impact/effects of storms and floods;

which were indicated at least by 13 out of 14 nations. With the exception of oil spill dynamics and marine forecast, many relevant societal needs demanded more implementation for most of the nations, with the inclusion of those related to MSFD descriptors.





The formulation of preliminary suggestions to consider the national scale in the JERICO strategy was based on the development of specific Data-to-Products Thematic Services (D2PTS) to address the common high-priority national societal needs. This is thought to be strategic and directly linked to Pillar#1, "Fostering societal impact for a larger community of stakeholders" (Grémare et al., 2021). These services are envisioned in the directions taken by the four pilot-focused regional/thematic services identified in the JERICO-S3 WP7 and are also important to sort out the overlapping areas with established RIs.





1. Introduction

Scope and purpose of the deliverable

The general objective of the JERICO-DS WP1 is the establishment of the long-term scientific plan, including a description of socio-economic impacts at the national, European and global levels. This objective is pursued following three main directions/tasks:

- including national needs, assets and strategies (Task 1.1);
- drawing the boundaries of JERICO-RI in the national landscapes and contributing to global coastal observations (Task 1.2);
- defining the Key Performance indicators (KPIs) for scientific excellence (Task 1.3).

JERICO-RI is aimed at designing and building a sustained pan-European integrated research infrastructure dedicated to the observation of coastal marine systems. In the evaluation document for the last 2021 ESFRI Roadmap, given the large number of terrestrial and oceanographic RIs already in place, the coast has been labelled as a "forgotten frontier" and the JERICO effort as a "refreshing-to-see" RI being "fully focussed on the coast". JERICO-RI indeed fills the gap underlined in the Landscape Analysis of the Strategy Report on Research Infrastructures of the 2021 ESFRI Roadmap which, in the section entitled "Gaps, challenges and future needs" of the Marine Environmental subdomain, states:

"As the coastal ocean is currently a key component of the UN Decade for Sustainable Development and has become a high priority on the worldwide environmental political agenda, Europe needs dense enough, well instrumented sites and regions to study, observe and monitor water of the coastal shelf. The comprehensive analysis of the changes in the coastal ecosystems requires an integrated basin approach to understand the impact of different drivers and to find measures for coastal preservation, management and planning. The long-term observation is needed to address transversal scientific and societal challenges acting at various spatio-temporal scales, and to understand large-scale processes that can significantly impact coastal and littoral areas. This could only be achieved at the pan-European level."

The same gap is visually evident in the Figure 1 below, taken from the same Strategy Report but for the 2018 ESFRI Roadmap. Such a figure still represents a valid reference as no new entry has been registered from 2018 in the last Roadmap in the Environment Domain. In filling the volume of this recognized gap, it is clear from the evaluation document for the 2021 ESFRI Roadmap that JERICO-RI has to clarify "its interaction in overlapping areas (geographical and scientific disciplines) with established RI".

The scientific synergies with other marine and environmental RIs at the national level and the monitoring of the national strategic long-term plans regarding the respective national RI landscapes are the general goals of Task 1.2 and at the core of the Deliverable D1.2: "First elements to unify environmental RI efforts at national level: national scientific expectations across RIs (specific goals, expertise, data)".







Figure 1: Simplified diagram of the observation capabilities of ESFRI Landmarks and Projects respect to the hydrosphere components (Y axis) and to the environmental processes therein (X axis). Source: Strategy Report on Research Infrastructures of the 2018 ESFRI Roadmap.

The general goal of Task 1.3 is the identification of KPIs instrumental to the assessment of the scientific performance of JERICO-RI and interconnected with its strategic objectives and the scientific goals. This identification is at the core of the Milestone MS1.5 entitled "KPIs for an operational JERICO-RI to assess the scientific excellence and societal economic impacts".

The general goal of Task 1.1 consists of identifying the main scientific needs and societal problems that are most important for each nation. The idea is to provide preliminary indications of the national desired requirements and characteristics in the scientific design phase of the JERICO-RI. The subsequent analysis of these desiderata focuses on the common problems and needs, underlining which ones may be complementary among different nations. This process ensures the bidirectional approach, that is the continuous exchange and update of scientific strategies and needs, from the global to the national scale and vice versa. The same process intends to integrate the regional viewpoint, proper of the JERICO-S3 project, with the national viewpoint introduced by JERICO-DS.

This Deliverable D1.1 contributes to this general Task 1.1 goal by:

- 1. listing societal needs within specific Scientific Topics and Integrated Themes;
- 2. identifying common societal needs based on their priority and implementation levels at the national level;
- 3. formulating preliminary suggestions to consider the national scale in the JERICO strategy.

D1.1 is a preliminary contribution of Deliverable D1.3 which incorporates D1.2 recommendations and represents the main outcome of the whole WP1.





The evolution of the scientific strategy in the two concluded JERICO projects

JERICO-RI activities were supported by two finished and consecutive European projects (see left side of Figure 2): JERICO-FP7 (2011-2015) and JERICO-NEXT (2015-2019).

The focus of JERICO-FP7 was mainly on physical data putting together the existing and unconnected communities that were mainly relying on automated high-frequency observation systems like ferryboxes, gliders and fixed platforms.

HF radars and coastal cabled observatories were integrated as new systems in JERICO-NEXT while a first cost-benefit analysis was elaborated toward the sustainability criterion of the RI.



Figure 2: Simplified diagram showing the evolution and the relationships linking past and current JERICO projects.

Two distinct scientific features marked the transition from JERICO-FP7 to JERICO-NEXT: a) the inclusion of biological data and b) the first elaboration of a scientific strategy based on the following five main pillars (Figure 3):

- "Developing innovative technologies for coastal ocean observing and modelling" to consider the differences in Technology Readiness Levels (TRLs) among disciplines, and the need of developing multidisciplinary platforms for a holistic approach to coastal observations;
- 2. "Enhancing integrated coastal ocean monitoring" to strengthen the harmonisation and the comparison of observations taken by different operators;
- 3. "Interfacing with other ocean observing initiatives operating at different spatio-temporal scales" to enhance the cooperation with other European and global infrastructures/initiatives and local observation providers;







Figure 3: The five pillars on which the scientific strategy elaborated during JERICO-NEXT was based. Source: Grémare et al (2019).

- 4. "Fostering societal impact for a larger community of stakeholders" to widen the stakeholder community, deepening their involvement in the definition of the derived products of the research infrastructure;
- 5. "Establishing observing objectives, strategy and implementation at regional level" to support multidisciplinary pilot actions designed to tackle major scientific/societal questions at the regional level and put forth the individual units of the future pan-European Research Infrastructure.

The scientific strategy in the ongoing JERICO-S3 project

The on-going JERICO-S3 project (Figure 2, left side) is proposing a more integrative approach to better observe the coastal ecosystem, increasing scientific excellence and considering the role played by regional and local ecosystems. JERICO-S3 introduced a preliminary development of an e-infrastructure ("e-JERICO" or "JERICO Core") which supports scientists and users by offering access to dedicated services, available data, best practices and documentation.

JERICO-S3 has been redefining the scientific strategy established during JERICO-NEXT and identified the main elements for the ESFRI application submitted in September 2020 (Puillat et al. 2020).

During this process two important features were recognized, namely that:

- integration itself is not an independent pillar but rather a "bedrock" for the other pillars and for the whole JERICO scientific strategy;
- "regionalisation" is more a component of the implementation of the scientific strategy rather than a constituent of the strategy itself.





As a result, the JERICO-S3 strategy included "Enhancing integration of coastal observations" as the main objective (or "bedrock"), "Structuring observation at the regional level" for the implementation of a network of regional observing systems, while the number of pillars was decreased to three:

- 1. "Fostering societal impact for a larger community of stakeholders";
- 2. "Developing innovative technologies for coastal ocean observing and modelling";
- 3. "Interfacing with other ocean observing initiatives".

JERICO-S3 has a strong experimentation component which relies on its delineated strategy and is mainly constituted by the implementation of Pilot Super Sites (PSSs). Then, both PSSs and Integrated Regional Sites (IRSs), work towards establishing integrated observational and science strategies and serve as implementation of different actions, aimed at:

- testing how coastal observations could be best integrated, to tackle a wide range of scientific questions and environmental issues (i.e., the JERICO-S3 bedrock);
- interfacing with regional user communities (i.e., Pillar #1);
- hosting demonstration experiments for new technological developments (i.e., Pillar #2);
- interacting with other RIs or, more in general, with other observing initiatives in the region (i.e. Pillar #3).

Despite their differences (i.e., both in terms of current maturity level and way forward), both PSSs and IRSs serve as proofs of concept for regional integration and they both intend to provide sound inputs for the design of the future JERICO-RI.

Additional steps forward have been taken by Grémare et al. (2021) in the JERICO-S3 Deliverable 1.1 entitled "First analysis of the JERICO-S3 scientific monitoring and regional approaches. Early inputs toward sustainability" which has capitalised some of the efforts for the ESFRI application submitted in September 2020 (Puillat et al. 2020). Specifically in JERICO-S3 D1.1:

common JERICO-RI scientific challenges have been identified. More precisely, the

- Common JERICO-RI scientific challenges have been identified. More precisely, the indications on the challenges from both PSSs and IRSs have been grouped in Key Scientific Challenges (KSCs), Specific Scientific Challenges (SSCs) and Research Axes (RAs). A list of 3 KSCs and 10 SSCs has been established and validated while it has been decided to keep the list of RAs "alive", i.e. subjected to continuous updates through regular consultations of the JERICO-RI consortium;
- regional specificities regarding these challenges and the way they are addressed in both PSSs and IRSs have been preliminary analysed. In this respect, D1.1 results have suggested stronger interactions between JERICO-S3 WPs and the need to define centralised actions to overcome:
 - the current limitation in the addressment of KSCs and of some of the SSCs in both PSSs and IRSs;
 - the need for a better and clearer logic of the structuration of the foreseen research infrastructure to better guide IRS actions;
 - the importance of achieving tight interactions between PSSs and IRSs for the future infrastructure.
- recommendations on demonstrative actions regarding innovative technologies in the project have been provided. In a joint action with JERICO-S3 WP7, D1.1 provided the guidelines to develop a coastal sensor package dedicated to the comprehensive





observation of plankton dynamics. D1.1 has also collected propositions of scientific actions from both PSSs and IRSs as the scientific basis for the future demonstration survey.



Figure 4: General architecture of JERICO-RI with both scientific and development strategies showing the three Key Scientific Challenges and the three Pillars. Source: Puillat et al (2020).

The Key Scientific Challenges

The initial framework assembled during JERICO-S3 was at the base of the Science Case for the ESFRI application submitted in September 2020 (Puillat et al. 2020). In that occasion, the whole JERICO-RI strategy was split into a scientific and a development strategy based respectively on the three KSCs and Pillars identified in JERICO-S3 (see Figure 4). The development strategy of JERICO-RI was elaborated to tackle the three KSCs, which are:

- 1. Assessing and predicting changes of coastal marine systems under the combined influence of global and local drivers (KSC#1);
- 2. Assessing the impact of extreme events on those changes (KSC#2) ;
- 3. Unravelling the impacts of natural and anthropogenic drivers of climate change (KSC#3).

The strategy was linked to the purpose, mission and vision of the RI: it was aimed at strengthening and enlarging a solid and transparent European network in providing operational services for the continuous and sustainable delivery of high-quality environmental data and information products related to marine environment in European coastal seas. In the elaboration of the JERICO-RI strategy, a fundamental aspect is the integrative character of the coastal ocean observation. Enhancing the integration of the strategy. All together these three pillars are transferring the





integrative feature of the bedrock, supporting the establishing observing objectives, strategy and implementation both at the regional and at the pan-European levels.

The JERICO-DS contribution

The main objective of JERICO-DS (Figure 2, left side) is to engage nations in designing the research infrastructure. JERICO-DS is introducing the national viewpoint and involvement to co-construct JERICO-RI, from the scientific and technical design to the business plan and governance strategy. In all its WPs, JERICO-DS uses a bi-directional approach, i.e. between national RIs and the pan-European dimension, to coordinate national engagements towards legally bound commitments.

The general goal of JERICO-DS WP1 is to establish the long-term scientific strategy of the RI including the national level. In this direction, WP1 has already consolidated the general scientific mission and vision (see Milestone MS1.1) and counted/differentiated the interactions with institutions and funding bodies at the national level (see Milestone MS1.2). KPIs instrumental to the assessment of the scientific performance of JERICO-RI were also preliminarily identified (see Milestone MS1.5).

Preliminary attempts of interaction with other marine and environmental RIs at the national level were also described (see Deliverable D1.2).

The other WP1 activities are aimed to identify specific scientific questions and needs that are of interest at the national level. In other words, JERICO scientific challenges are considered in the context of the needs of each nation, focusing on the main specific scientific and societal problems that are most important for each nation. The prioritisation of the problems and related scientific questions provides a first indication regarding the requirements and desired characteristics of the national RIs, in terms of choice of variables, platforms and sensors.

This Deliverable D1.1 contributes to these activities with the specific goals listed in the first section "Scope and purpose of the deliverable". The methodology followed and the results obtained are described next.





The JERICO-DS and JERICO-S3 joint development

Several actions have been undertaken since the start of JERICO-DS project in other to ensure good communication between JERICO-DS and JERICO -S3 projects work packages dealing with the scientific strategy of JERICO-RI (mainly WP1s). The interactions between WPs have been ensured by several meetings online and two dedicated workshops, held during the JERICO-DS General Assembly (November 2021) and the JERICO-Days (June 2022).

The specific goal of the November 2021 workshop was three-fold:

- To increase the alignment of the scientific strategy between the two projects by a joint analysis of KSCs and SCs, main strategic elements and open questions.
- To discuss on the results of JERICO-DS survey and jointly define / refine next actions (see Figure 5).
- To share and discuss the main outcomes of JERICO-S3 D1.1 ("Early inputs towards sustainability") and jointly define / refine next actions, including the development of centralised actions.

The following June 2022 workshop joined WPs leads from both projects to discuss practical steps for improving coordination between JERICO-S3 and JERICO-DS efforts towards a better assessment of the ESFRI recommendations (from an observational network to become a RI). Specific discussions focused on:

- How to integrate the regional "perspective" from JERICO-S3 with the national "perspective" from JERICO-DS.
- How to improve "practical" coordination between JS3 WP1/2/9 + WP3/4 (regional perspective) and similar/complementary actions in JDS.
- How to include the need to converge towards building common recommendations for JERICO-RI strategy.







Figure 5: Example of work mural for the analysis of JERICO-DS and JERICO-S3 interaction.

2. Main report

Method: the WP1 survey

During the kickoff meeting held in November 2020 the whole JERICO-DS consortium reviewed and consolidated the Vision and Mission statements.

During the same meeting, WP1 leaders and co-leaders clearly expressed the need to work out on a WP1 survey to collect national scientific inputs, priorities and societal needs. The survey should have clearly stressed out the bidirectional approach, i.e. the continuous





exchange and update of scientific strategies and needs, from the global to the national scale and vice versa. In other words, on one hand, the survey needed to be open enough to let national stakeholders express national priorities beyond the previous scientific topics identified in the previous JERICO projects. On the other hand, national needs should have spawned from the milestones of the JERICO-RI scientific strategy, for example starting from the Key Scientific Challenges put forth for the ESFRI application submitted in September 2020. The survey should also be constructed in order to get a standardized and uniform feedback, important for easing the subsequent analysis.

WP1 leaders and co-leaders jointly discussed the content of the WP1 survey in many other meetings after the kickoff and arrived to the following decisions (named after as the rules of the five Ts):

- Targets of the survey: survey should reflect ideas and opinions of key high-level stakeholders, like Ministries or Ministry spokespersons, Funding Agencies and Bodies, Directors of main Institutes;
- Tell apart in the survey individual/specific topics vs integrated themes;
- Topics and themes should consider and address both the pan-European and the national scale of the societal needs;
- Topics and themes need to have a direct relation to the KSCs;
- Topics and themes should explore the links with the EU Marine Strategy Framework Directive and UN Sustainable Development Goals.

As a result the following six Scientific Topics and three Integrated Themes were identified for the survey (see Figure 6):

- Scientific Topics:
 - Biodiversity trends;
 - Hydrology and Transport;
 - Eutrophication;
 - Chemical Contaminants and Marine Litter;
 - Land/ocean continuum;
 - Coastal Carbon.
- Integrated Themes:
 - Ecosystem approach: integration of physics chemistry and biology observation as a system;
 - Coastal forecasting;
 - Impact of extreme events.







Figure 6: The six Scientific Topics and the three Integrated Themes identified during the WP1 activities for the survey.

For each Topic and Theme the different societal needs, their scales (multinational/regional, national and local) and relations to KSCs and MSFD descriptors were listed as well (see Figure 7). The list of Topics, Themes and societal needs was approved in the different Nation Meetings by the National Representatives (NRs). In the same meetings it was also decided that NRs were expected to fill the survey after having collected and gathered feedback from key high-level stakeholders. NRs needed to address these specific questions:

- Priority and implementation levels of societal needs: is this societal need of national interest? If yes, with which priority? What is its current implementation level?
- Missing societal needs: are we missing something important? Both in general terms (identification and definition of topics and themes) and/or for societal needs at the different scales;
- Source of the information: how are the NRs gathering the information to reply to the survey? Personal informed opinions? Meetings with national key stakeholders? National documents already in place?

The survey was finalised and sent to all NRs on May 15th 2021. All NR responses were received in February 2022 and their analysis represents the core of this Deliverable. Feedback about the sources of information and indicators of meetings with national agencies and funding bodies represents the core of the preliminary version of the Milestone MS1.2.

An online version of the WP1 survey can be found at the following link: <u>https://forms.gle/Pi3sWbRknqcF7T8q6</u> while Figure 8 shows two examples of its pages.

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		Specific/Individual Scientific Topics				
	Торіс	Scale of the societal needs	Relation to KSCs			
#1	Biodiversity trends	 Multinational: latitudinal migration, non-indigeneous species National: networking, legislational support, contribution/support to MSFD implementation (Descr#1) creation of national inventory, biological indicators Local: impact of local disturbances 	KSC#1			
#2	Hydrology and transport	 Multinational: climate change scenarios National: networking, legislational support, contribution/support to MSFD implementation (Descr#7) Maritime Spatial Planning, oil spills, fishery management Local: navigation, aquaculture 	KSC#1			
#3	Eutrophication	 Multinational: trans-national management of regional seas (Baltic and Adriatic seas) National: networking, legislational support, contribution/support to MSFD implementation (Descr#5) Local: impacts on fisheries, biodiversity, tourism, amenity 	KSC#3			
#4	Chemical contaminants and marine litter	 Multinational: support to international conventions/agreements National: networking, legislational support, contribution/support to MSFD implementation (Descr#8, #10) Local: localized impacts, localized measures for protection 	KSC#3			
#5	Land/ocean continuum (only from the marine point of view)	 Multinational: mass fluxes in the marine environment National: Local: riverine input (particles, nutrients, contaminants) in the marine environment, fishery management, influence of transport of nutrients and metals 	KSC#1			
#6	Coastal carbon	Multinational: coastal zone CO2 sequestration (carbon budget) for climatic reasons National: national carbon budget CO2 sequestration Local:	KSC#1			

		Integrated Scientific Themes				
	Theme	Scale of the societal needs	Relation to KSCs			
#1	Ecosystem approach: integration of physics chemistry and biology observation as a system	 Multinational: support/contribution to coordination, management of trans-national ecosystem approach National: networking on management Local: local management 	KSC#1			
#2	Coastal forecasting	 Multinational: coordination of oil spill spreading forecasting National: effects of climate changes, oil spill spreading, sea-ice forecast Local: localized effects of climate changes, Port management, MPA management, marine offshore industry 	KSC#1 KSC#2 KSC#3			
#3	Impact of extreme events	 Multinational: contribution to understanding effects of extreme events on large and long scales National: contribution to disaster readiness/remediation, navigation safety, sea-state Local: data on local probability, return time estimates, maritime engineering works, impact/effects of storms and floodings on coastal infrastructures and ecosystems 	KSC#2			

Figure 7: List of the societal needs, their scales and relations to KSCs for each Topic and Themes identified during the WP1 activities for the survey.

Results from the WP1 survey

The analysis of the source information as indicated in the survey by the NRs is considered first (for details see Milestone MS1.2). Out of 14 nations, only one NR indicated that her/his response was based on personal opinions while all other NRs relied at least on some national documents already in place. However only six NRs (43%) indicated meetings with high-level stakeholders to be among their sources of information. This result is an important piece of information with respect to survey representativeness and quality. Even though it provides a good starting point with a fair confidence level for the responses obtained, the low level of interaction with funding bodies and ministries indicates the room for future improvement.

Figure 9 reports the cumulative priority levels for the societal needs identified for the different Topics and Themes grouped on four different choices NRs could check.







In your opinion, within the scientific topic #1 "Biodiversity", are the following societal needs of interest and what is their current implementation level? Please note that more boxes can be marked to indicate both the level of priority and the level of implementation.

	Not relevant	Low priority	High priority	Already implemented	Needs more implementation
biological indicators					
creation of national inventory					
contribution/support to MSFD implementation (Descriptor #1)					
legislational support at the national level					
latitudinal migration					
non-indigeneous species					
multinational networking activities on the topic					
legislation support to international conventions/agreements					
Are other important needs missing within the scientific topic #1 "Biodiversity"? Please specify also priority level (low, medium or high)					
Your answer					
	biological indicators creation of national inventory contribution/support to MSFD implementation (Descriptor #1) legislational support at the national level latitudinal migration non-indigeneous species multinational networking activities on the topic legislation support to international conventions/agreements Are other important nee Please specify also prior	Not relevant biological indicators	Not relevant Low priority biological indicators creation of national inventory contribution/support to MSFD implementation (Descriptor #1) legislational support at the national level latitudinal migration non-indigeneous species multinational networking activities on the topic legislation support to intermational conventions/agreements Are other important needs missing within the Please specify also priority level (low, medi- ginal) Your answer	Not relevant Low priority High priority biological indicators creation of national inventory contribution/support to MSFD implementation (Descriptor #1) legislational support at the national level latitudinal migration non-indigeneous species legislations support to international conventions/agreements Are other important needs missing within the scient Please specify also priority level (low, medium or hi	Not Low High relevant Already priority prelevant priority implemented biological indicators

Figure 8: Two example pages of the WP1 survey proposed to all NRs. Left panel: the page to collect the sources of information used by NRs to reply to the survey; right panel: the page dedicated to the societal need of the Topic Biodiversity. Similar pages were put forth for all other Topics and Themes.

For the Topic Biodiversity, high priority levels were largely (for at least 12 out of 14 nations) checked for the following societal needs: a) biological indicators; b) MSFD support and c) non-indigeneous species with the latter need being the most checked (13 nations).

For the Topic Hydrography and Transport, high priority levels were largely checked only for: a) climate change and b) aquaculture with the latter being one of the only two societal needs in the whole survey selected by all 14 nations.

The cumulative high priority level slightly decreased for the Topic Eutrophication with a) impacts on biodiversity and b) MSFD support being checked by 11 NRs. The word "amenities" was likely not clear and not precise since it received a large cumulative number of "not indicated".

For the Topic Chemical contaminants and litter only the localised measures for protection was largely checked while the riverine input for the Topic Land/Ocean continuum was the other need in the whole survey selected by all 14 nations.

The cumulative high priority level decreased again for the Topic Coastal Carbon with no need being checked by more than 10 NRs.

For the Integrated Themes high priority levels were largely checked for: a) the support to national coordination; b) effects of climate change and c) oil spills; d) impacts/effects of





storm and floods; respectively for the Ecosystem approach, the Coastal forecasting and the Impact of extreme events.

When looking at the cumulative implementation levels for the different Topics and Themes (Figure 10), the option "needs more implementation" is generally the most frequent for almost all societal needs (also including those related to MSFD descriptors and support) with a few exceptions like oil spill dynamics and oil spill forecast.

Not surprisingly, the most checked "High-priority" also "need more implementation", namely:

- Topic Biodiversity: a) biological indicators; b) MSFD support and c) non-indigeneous species for at least 6 nations;
- Topic Hydrography and Transport: a) climate change and b) aquaculture for at least 9 nations;
- Topic Eutrophication: a) impacts on biodiversity and b) MSFD support for at least 6 nations;
- Topic Chemical contaminants and litter: a) localised measures for protection for 10 nations;
- Topic Land/Ocean continuum: a) riverine input for 12 nations;
- Topic Coastal Carbon: with all items that need more implementation for at least 9 nations;
- Theme Ecosystem approach: a) the support to national coordination for 11 nations;
- Theme Coastal forecasting: a) effects of climate change for 9 nations;
- Theme Impact of extreme events: a) impacts/effects of storm and floods for 5 nations.

Important preliminary suggestions can be retrieved when considering the few topics that were indicated as "high-priority" by at least 13 out of 14 nations, namely: non-indigeneous species, aquaculture, climate change, localised measures/protection from marine litter, riverine inputs, impact/effects of storms and floods (see next paragraph on conclusions).

3. Outreach, dissemination and communication activities

This Deliverable D1.1 is a preliminary document of internal use, whose objective is to collect and start introducing the national viewpoint in the JERICO-RI long-term strategy.

A preliminary analysis based on the received survey responses at that time was presented at the JERICO-DS General Assembly held in November 2021 and some important hints were provided at the JERICO-S3 week held in March 2022.

This deliverable is thus not expected to be widely disseminated outside the JERICO consortium or to a wider audience at present.

D1.1 can be seen as a provider of inputs to the specific following WPs:

 JERICO-S3 WP1: for the general implementation plan of the scientific strategy (see also the Conclusions and next steps section). In this respect many of these meetings were also held with the leaders and co-leaders of the JERICO-S3 WP1 and a specific joint session for the scientific strategy alignment between the two on-going projects was held at the JERICO-DS General Assembly in November 2021;





- JERICO-DS WP2: for the scientific vision shaping the JERICO-RI technology outlook and its harmonisation strategy;
- JERICO-DS WP3: for the scientific vision underlining the gap analysis and the JERICO-RI integration strategy. In this respect dedicated joint JERICO-DS WP3-WP2-WP1 meetings were held to discuss the basis for the scientific plan in for the technical design and data integration strategy of the e-JERICO infrastructure;
- JERICO-DS WP6: for the creation of some communication material dedicated to the interaction with national key high-level stakeholders.

4. Conclusion and next steps

Survey results shown in this Deliverable D1.1 highlight the fact that JERICO-RI should pay particular attention and develop specific Data-to-Products Thematic Services (D2PTS) to address the specific common national societal needs as they are directly linked to Pillar#1, "Fostering societal impact for a larger community of stakeholders", of its development strategy.

It should be pointed out that JERICO-RI is already moving along some of these directions as the four pilot-focused regional/thematic services identified in the JERICO-S3 WP7 are:

- HF-Radar tailored products D2PTS: to develop physical oceanography products from HF Radar data to provide gap filled surface current data products;
- Estimation of sea water masses types and transport monitoring D2PTS: to develop physical oceanography products from glider data that may be combined with biogeochemistry observations;
- Biogeochemical state of coastal areas D2PTS: to provide regional, combined multiplatform observations products;
- JERICO-EcoTaxa D2PTS: to provide coastal plankton monitoring products from ecological imaging sensors.

The identification of non-indigeneous species could be a specific service spawning from the JERICO-EcoTaxa D2PTS at least for plankton communities as well as climate change services could be foreseen by the integration of both HF-Radar and glider D2PTS. The estimation of the heat content in specific water masses types by the glider D2PTS could be a specific service for storms and floods while Lagrangian dispersion tools based on the HF-Radar D2PTS could serve for addressing specific needs related to aquaculture (dispersion of pollutants, antibiotics, feasibility of increasing the number of net-pens) and localised measures/protection from contaminants and marine litter.

Lastly, a specific mention should be made for the riverine input, not only because it is a need on which the biogeochemical state of coastal areas D2PTS should likely focus but also because it is directly related to Pillar#2, "Interfacing with other ocean observing initiatives", of the JERICO development strategy. In addressing this national need, JERICO-RI has to clarify "its interaction in overlapping areas (geographical and scientific disciplines) with established RI" as expressed in the evaluation document for the 2021 ESFRI Roadmap. This should be considered in the Deliverable D1.2 and incorporated in the next Deliverable D1.3 which represents the main outcome of the whole JERICO-DS WP1.





The achievements of this Deliverable D1.1 are mainly three-fold and in the following directions:

- the enumeration/classification of the societal needs within specific Scientific Topics and Integrated Themes. A list of six Scientific Topics and three Integrated Themes was put forth considering the important connections with the KSCs of the JERICO community as well as with the MSFD descriptors and the UN Sustainable Development Goals. Inside each Topic and Themes several societal needs were also identified together with their scales (multinational/regional, national and local) to enforce the JERICO-DS bi-directional approach. The number of societal need varies within each Topic/Theme from a maximum number of eight (like in Hydrography and Transport) to a minimum of two (like in Ecosystem approach: integration of physics chemistry and biology observation as a system);
- the identification of common societal needs based on their priority and implementation levels at the national level. Main results from the WP1 survey taken from the NRs indicated that nations shared different high-priority needs. These include non-indigeneous species, aquaculture, climate change, localised measures/protection from marine litter, riverine inputs, impact/effects of storms and floods which were indicated at least by 13 out of 14 nations. With the exception of oil spill dynamics and marine forecast, many relevant societal needs demanded more implementation for most of the nations, with the inclusion of those related to MSFD descriptors;
- the formulation of preliminary suggestions to consider the national scale in the JERICO strategy. The development of specific D2PTS to address the common high-priority national societal needs is strategic and directly linked to Pillar#1, "Fostering societal impact for a larger community of stakeholders". These services are envisioned in the directions taken by the four pilot-focused regional/thematic services identified in the JERICO-S3 WP7 and are also important to sort out the overlapping areas with established RIs, i.e. related to Pillar#2, "Interfacing with other ocean observing initiatives", of the JERICO development strategy.

Two different steps were pondered during the different meetings held with NRs and also through the use of interactive presentation software. In particular, it was first decided by the participants of the JERICO-DS General Assembly to consider the possibility of updating the survey with a one-year frequency, after having more interactions with high-level stakeholders and having reached a greater degree of maturity as RI. Second, it was decided to visualise survey results also with maps to highlight potential regional patterns. In this direction, a preliminary analysis of the geographic distributions of the priority levels for the societal needs for the different Topics/Themes (Figure 11 attached to this Deliverable) shows no evidence of regional patterns apart from trivialities (e.g. sea-ice forecast for high-latitude countries). A more complete analysis together with the geographic distributions of the implementation levels will be incorporated in the next Deliverable D1.3.





5. <u>Annexes and references</u>

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b) HYDROGRAPHY AND TRANSPORT



c) EUTROPHICATION



Figure 9: Cumulative priority levels for the societal needs for the Scientific Topics: a) Biodiversity; b) Hydrography and transport and c) Eutrophication.





d) CHEMICAL CONTAMINANTS AND MARINE LITTER



e) LAND/OCEAN CONTINUUM



f) COASTAL CARBON



Figure 9: Continue. Cumulative priority levels for the societal needs for the Scientific Topics: d) Chemical contaminants and marine litter; e) Land/ocean continuum and f) Coastal carbon.





g) ECOSYSTEM APPROACH



h) COASTAL FORECASTING



i) IMPACT OF EXTREME EVENTS



Figure 9: Continue. Cumulative priority levels for the societal needs for the Integrated Themes: g) Ecosystem approach: integration of physics chemistry and biology observation as a system; h) Coastal forecasting and i) Impact of extreme events.





a) BIODIVERSITY







Figure 10: Cumulative implementation levels for the societal needs for the Scientific Topics: a) Biodiversity; b) Hydrography and transport and c) Eutrophication.





d) CHEMICAL CONTAMINANTS AND MARINE LITTER



e) LAND/OCEAN CONTINUUM







Figure 10: Continue. Cumulative implementation levels for the societal needs for the Scientific Topics: d) Chemical contaminants and marine litter; e) Land/ocean continuum and f) Coastal carbon.





g) ECOSYSTEM APPROACH already implemented already impl., needs more impl. needs more implementation management of transnational ecosystem approach not indicated support to national coordination ò 8 10 12 14 ż 4 6 Number of nations





i) IMPACT OF EXTREME EVENTS



Figure 10: Continue. Cumulative implementation levels for the societal needs for the Integrated Themes: g) Ecosystem approach: integration of physics chemistry and biology observation as a system; h) Coastal forecasting and i) Impact of extreme events.





a) **BIODIVERSITY**





Figure 11: Geographic distribution of the priority levels for the societal needs for the Scientific Topics: a) Biodiversity and b) Hydrography and transport.





c) EUTROPHICATION



d) CHEMICAL CONTAMINANTS AND MARINE LITTER











Figure 11: Continue. Geographic distribution of the priority levels for the societal needs for the Scientific Topics: c) Eutrophication and d) Chemical contaminants and marine litter.





e) LAND/OCEAN CONTINUUM



f) COASTAL CARBON





Figure 11: Continue. Geographic distribution of the priority levels for the societal needs for the Scientific Topics: e) Land/Ocean continuum and f) Coastal carbon.



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g) ECOSYSTEM APPROACH



h) COASTAL FORECASTING



Figure 11: Continue. Geographic distribution of the priority levels for the societal needs for the Integrated Themes: g) Ecosystem approach: integration of physics chemistry and biology observation as a system and h) Coastal forecasting.





i) IMPACT OF EXTREME EVENTS



Figure 11: Continue. Geographic distribution of the priority levels for the societal needs for the Integrated Themes: i) Impact of extreme events.