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Author(s):	Federico Falcini, Mariano Bresciani (CNR); Federico Ienna, Ana Brito Vanda Brotas (FC.ID); Carole Lebreton, Kerstin Stelzer (BC); Adriana M. Constantinescu (GEOECOMAR); Eirini Politi (O&B); Victor Martinez-Vicente, Kim Hockley, Steve Groom (PML)		
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1. Executive Summary

- This report is the third deliverable of CERTO WP2. Its objective is to describe progress in Work Package 2 (WP2) during year 2 of CERTO, highlighting feedback from the on-going exchange of information and requirements between CERTO case study leaders and CERTO users and stakeholders. Users were selected from a variety of aspects: different requirements in terms of targeted sectors, different interaction with the Copernicus services, and different types of users, in accordance with the scheme we presented in the deliverable D2.1
- This deliverable provides a brief review of products and indicators developed in CERTO WP6 and presented to CERTO users and stakeholders in order to receive feedback and additional technical requirements. The exchange with users and stakeholders has been carried out by means of one-to-one interviews. The exchanges also included the description of the Socio-Ecological System Vulnerability Index (SESVI).
- Feedback from users and stakeholders during the year is reported in this deliverable. Results from the survey are framed in terms of i) fitness of purpose; ii) targeted temporal and spatial resolution; iii) required aggregator; iv) data format; and v) type of operationality. The survey also includes suggestions and additional comments from the users and stakeholders.
- Feedback regarding the Socio-Ecological System Vulnerability Index (SESVI) is organised in terms of suitability of the various indicators that compose SESVI, their weight, need of additional indicators, and thresholding.
- The deliverable finally presents the future activities of WP2, which will be dedicated to the continuous, ongoing interaction with CERTO users and stakeholders that will guarantee adequacy and suitability of products and indicators of the CERTO Prototype.

2. Introduction

The general objective of WP2 is to identify user needs, content, technical and quality requirements in terms of specific information required on any aspect of the state of transitional waters. WP2 surveys focus on: i) user-led product definition and development; ii) tailored end-products and indicators; iii) increased project visibility and awareness; iv) information sharing. This is considered as a first step in the co-design and implementation of services and products and sets the basis for an on-going relationship with stakeholders, encouraging multidirectional communication and develop contact networks.

WP2 started the process of continuous engagement with local stakeholders in six European case studies (Table 1), where monitoring and diagnosing water quality is crucial for socio-economic reasons. The six user-case studies encompass a wide variety of stakeholders to focus attention on industrial, policy, and environmental issues in poorly characterised transitional waters (three lagoons and three estuaries) each with associated coastal zones. CERTO case studies are characterised and potentially affected by eutrophication, changes of nutrient and sediment loads, river-sea interactions, dredging, as well socio-ecological changes. The six case studies have been carefully selected to be complementary but also overlap in terms of service or user characteristics, in order to avoid basing conclusions only on a single instance. Each of the six case studies is connected with one project partner, taking advantage of local contacts, and each case study has one or more local users. Dialogue with local users and stakeholders, therefore, focuses on current gaps in data availability from the Copernicus services (jointly exploring what is available and how it could or could not be used), followed by formulation of a minimum and ideal set of requirements for the CERTO Prototype (e.g., water quality variables, spatial resolution, and product uncertainty). This first step produced a user needs analysis, which was done through a series of interviews conducted in 2020 under WP2. A full description of the interview results can be found in Deliverable D2.1.

Following the first interviews with users and stakeholders, a second round of interviews was performed in the final trimester of 2021, providing updates on CERTO's progress. These meetings were essential to present progress on indicator development and to receive continued feedback from the users, which is key to making adjustments during the development phase, promoting improvement of the final set of indicators. Moreover, this second step, on one hand reinforced the on-going, mutual interaction with CERTO case study leaders and local users and stakeholders; on the other hand, it allowed an intermediate exchange of information on how CERTO indicators would be most effective for consolidated and new potential users of the six case studies. Indeed, engaging with Users is crucial during the CERTO indicators development phase, to perform necessary adjustments and refine technical requirements before the Demonstration Phase in 2022/3, noting the nine-month extension to the project. This deliverable D2.3 presents results of those interviews, which were summarised by means of a questionnaire (in the form of a spreadsheet file) that followed a similar scheme of the one proposed for the deliverable D2.1 (approved by the University of Stirling Ethics committee). The questionnaire formed the basis of one-to-one discussions with the users and stakeholders and triggered open discussions on CERTO's indicators and targeted products that were identified from D2.1, D6.1, and D6.2.

Due to COVID-related restrictions, the one-to-one interviews were mostly conducted by using zoom, skype or telephone media, and involved those local users and stakeholders that had expressed interest in exploiting CERTO products. Although the one-to-one approach slowed the survey process, it guaranteed receiving feedback from those local Users who did not speak English fluently. Furthermore, since the second round of user consultation is ongoing, notably due to delays due to COVID-19, this report describes progress to date in year 2 of CERTO.

Table 1. *CERTO case studies: Danube Delta (Black Sea), Venice Lagoon and North Adriatic Sea (Mediterranean Sea), Tagus Estuary (Atlantic Ocean), Plymouth Sound (English Channel), Elbe Estuary and German Bight (North Sea), Curonian Lagoon (Baltic Sea)*

User-case areas	Institutional lead partner
1. Danube Delta	GeoEcoMar
2. Venice Lagoon and North Adriatic Sea	CNR
3. Tagus Estuary	FC.ID
4. Plymouth Sound	PML
5. Elbe Estuary and German Bight	BC
6. Curonian Lagoon	CNR

3. Description of CERTO products and indicators to be developed

This section describes the indicators presented to users in the consultations. Readers familiar with the outputs or deliverables in WP6 (especially D6.2) may wish to jump to section 4.

WP2 surveys highlighted the need for indicators that are relevant to the biological structure, composition, and overall quality of the water in transitional and coastal environments. Concentration of Total Suspended Matter (TSM), Chlorophyll-a Concentration (CHL), and Sea Surface Temperature (SST) were the main parameters required by most of the users for all case studies; Water Turbidity (TUR) was also of high importance for several users. A crucial need that emerged from the surveys was the ability to synoptically monitor the parameters listed above, at specific spatial and temporal resolution (see Deliverable D2.1 and the User Requirements Analysis in D6.1), a feature that, in turn, highlighted the need to provide high quality satellite products for transitional regions.

From this analysis, four indicators were selected for further development by WP6. Two indicators were focused on the identification of turbidity maximum zones and dredging areas; and two indicators were focused on the analysis of phytoplankton dynamics, more specifically the CHL 90th percentile (CHL P90) and the bloom phenology metrics. In addition, the Socio-Ecological System Vulnerability Index (SESVI) complements the four water quality indicators by encompassing both social and ecological components by means of exposure, sensitivity, and adaptive capacity of the study areas to ecological pressures and changes. It gives an exemplar of more complex indicators that would typically be developed or executed by downstream service providers working closely with local end users. Moreover, SESVI was highlighted in the first external CERTO review as “an important element of the project and should be pursued with the available **consultations** and data.”

The description of each indicator is briefly summarised below. Adjustments and improvements regrading technical requirements of these indicators might be required during the second part of the development phase. This Deliverable D2.3 is therefore meant to provide user feedback in this crucial development phase.

3.1. Products and indicators for planning and management

Products and indicators focussing on the influence of sediment and terrigenous loads are being developed and are based on EO products of Total Suspended Matter (TSM) and/or Turbidity (TUR). The subsequent indicators will be aimed at detection of i) maximum turbidity zone/high loads zone; and ii) dredging activities. These indicators allow analysis of trends and recognise the impact of tides and coastal infrastructures on transitional waters.

Accumulation of suspended matter is mainly due to the unbalance of sediment transport towards the open sea/out of the estuary and the transport coming from the upper river (or riverine system) for a longer period. This, in general, causes an increase of the turbidity zone and tends to shift upstream. On the other hand, during a flooding event, the turbidity zone decreases since most of the suspended matter gets washed out. Finally, the presence of infrastructures (e.g., flood gates, harbours, wharves, breakwater structures, etc.) may also trigger sediment accumulation and abrupt changes of the eco-geomorphological systems.

One of the main issues related to these indicators is the definition of thresholds, as well as the type of representation. Absolute thresholds for TUR/TSM values may need to be normalised in order to provide an adequate monitoring of expansion/reduction of maximum turbidity zone for each specific case study. Moreover, the maximum zone turbidity indicators may be presented to users in different forms, depending on their interests. The scope of the new WP2 survey (reported in this deliverable D2.3) and of the ongoing process of exchange with CERTO users and stakeholder refines the development and presentation of products and indicators for planning and management.

3.2. Products and indicators to support EU policy

These indicators are meant for the evaluation of specific metrics of EU Water and Marine Strategy Framework Directives (WFD/MSFD) and provide information on ecosystem health through the analysis of phenological metrics, used to study the dynamics of phytoplankton blooms. In particular, two sets of common indicators were developed for the six CERTO case studies: i) the Chlorophyll-a 90th percentile (CHL P90), calculated by using continuous remote sensing datasets over the growing season, and ii) the Phytoplankton bloom phenology metrics, determined from the time of bloom initiation, peak, and end, as well as from the main bloom duration, number of blooms, and bloom amplitude and area.

The indicators are based on CHL products, generated (in the preliminary data production) by different algorithms, i.e., OC2, Gilerson, and Gons05, which are meant to work for clear waters, medium range turbid waters, and high turbidity waters, respectively. The suitability of the CHL product depends on the regional characteristics of each area and bio-optical algorithms will be regionally refined based on the assessment of optical water types. Therefore, once the final and improved CHL product from CERTO is available, indicators will be computed again in order to guarantee the suitability of products and indicators.

Phenological metrics include: i) CHL mean (mg m^{-3}); ii) CHL maximum (mg m^{-3}); iii) amplitude of the bloom (mg m^{-3}); iv) day/week of bloom initiation; v) day/week of bloom peak; vi) day/week of bloom termination; vii) duration of bloom in days/weeks; viii) area (km^2) of the bloom (over a given threshold CHL value). Blooms are identified by using two criteria: i) CHL must surpass a threshold of 5% of the annual CHL median, and ii) this condition must be maintained for a minimum of 15 days. Bloom duration is calculated as the difference in days/weeks between initiation and termination of the bloom, while the amplitude corresponds to the difference between the annual maximum and mean.

3.3. Social-Ecological System Vulnerability Index (SESVI)

The Social-Ecological System Vulnerability Index (SESVI) addresses needs that are related to broad aspects of water bodies, identifying hotspots across wide regions and holistically assessing how different factors may affect social and/or ecological systems, allowing for comparison among different sites. SESVI provides information on how vulnerable a water body system is, based on its socioeconomic and environmental characteristics. Here vulnerability is defined on a case-by-case basis to suit local user needs; consequently, SESVI is tailored to a specific site. On the other hand, SESVI can also be defined universally and thus applied “globally” for comparison across multiple sites. SESVI can help policy managers and decision-makers quickly identify vulnerability hotspots in their region, recognising change that further informs the degree of vulnerability. It can, therefore, be used to reveal the most relevant pressure factors in a water body.

SESVI is based on three main vulnerability assessment components: (1) exposure, (2) sensitivity, and (3) adaptive capacity. *Exposure* refers to external forcing due to climate change, environmental change and/or human activities; *sensitivity* refers to the inherent degree of resilience of the ecological system to external forcing, and *adaptive capacity* indicates the social system's degree of resilience and measures of adaptation to change.

At the base of these components there is a selection of suitable variables, indicators, and/or descriptors, which are dependent on the type of water body of interest and the main pressures acting on it. The whole process encompasses the recognition of pressures in the CERTO case study sites and the subsequent datasets and indicators that describe these pressures. Table 2 and Figure 1 (from Deliverable D6.2) lists the datasets sourced and processed to date.

Table 2. *Datasets sourced and processed to date for SESVI. Datasets not sourced yet are not listed (see Fig. 1for the full list of datasets under consideration at this stage).*

Data type	Dataset name/Data source	Dataset version
Population density	Gridded Population of the World, Version 4 (GPWv4): Population Count and Density, Revision 11	4.11
Fertilisers	FAOSTAT Fertilisers (Agricultural use)	(Accessed: Summer 2021)
Elevation	Shuttle Radar Topography Mission 1 Arc-Second Global	3
River basins	HydroBASINS 15s	(Accessed: Summer 2021)
River network	HydroRIVERS 15s	(Accessed: Summer 2021)
Land Cover	Copernicus Land Monitoring Service (CLMS) Global CORINE Land Cover	3.0.1
IPCC Sea Level Rise projections	Projected Sea-Level Rise Under Different SSP Scenarios	(Accessed: October 2021)
Mean tidal amplitude (range)	European Atlas of the Seas	(Accessed: October 2021)
Extreme precipitation	Number of precipitation days exceeding 20mm	1
Employment in marine fisheries, aquaculture & processing	European Atlas of the Seas; DG Mare Employment in marine sectors	(Accessed: October 2021)
Employment in coastal tourism	European Atlas of the Seas; DG Mare Employment in marine sectors	(Accessed: October 2021)
Employment in maritime transport	European Atlas of the Seas; DG Mare Employment in marine sectors	(Accessed: October 2021)
Employment in ports, warehousing and water projects	European Atlas of the Seas; DG Mare Employment in marine sectors	(Accessed: October 2021)
(Marine) Natura 2000 sites	European Atlas of the Seas	(Accessed: October 2021)
Population aged 65 years and more (urban region)	European Atlas of the Seas; Eurostat	(Accessed: October 2021)
Median age at national level	Eurostat – Median age at national level	(Accessed: October 2021)
Ageing population	Eurostat – Increase in the share of the population aged 65 years or over between 2010 and 2020	(Accessed: October 2021)

A following step is then the definition of suitable thresholds for those indicators, based on various criteria that are tailored to each indicator. Effort is made to create these thresholds applicable across Europe so that they can be applied to all the six CERTO Case Studies and produce comparable results. To each indicator a specific weight can be assigned, based on local characteristics.

Figure 1. The SESVI wheel summarises in an intuitive visual way the different levels of scoring applied during the application of SESVI. Once applied, a 4-colour traffic-light approach (blue, green, yellow, and red) is used to assign colours to each indicator, component and the SESVI score itself.

SESVI development requires interaction with experts, such as local Case Study CERTO teams and local stakeholders. This lead to the identification of suitable indicators and sourcing of datasets from the CERTO prototype and multiple other sources. Continuous user interaction is, therefore, necessary to ensure the datasets used and thresholds applied are relevant to stakeholders, an ongoing process that will guarantee to demonstrate and interpret the results and receive feedback for potential improvements.

4. Interactions with Users

Starting from the list of users that were presented in the Deliverable D2.1, we carried out a second round of one-to-one interviews, in order to collect additional requirements and feedback in the frame of products and indicators that have been developed in WP6. Since, this report describes progress during the year, noting that interviews will continue into year 3, not least due to continuing restrictions due to COVID-19 and the 9-month extension to the projects, the analysis of the information gathered has been performed at the level of the sectors, in a cross-site fashion.

During the interviews each case study leader showed and explained to local users and stakeholders *ad hoc* presentations regarding the WP6 parameters and indicators briefly summarised in the previous Section. Case study leaders also provided visual examples and preliminary results for all CERTO case studies. Presentations included a specific section, fully dedicated to the SESVI.

4.1 Feedback regarding development of indicators

For each test case areas, we collected information on the most suitable service and technical requirements that the users envisioned for CERTO parameters and indicators. In particular, users were asked to provide information on:

- Spatial and temporal resolutions required for developed parameters and indicators
- Type of aggregation (i.e., daily, weekly means, monthly means, seasonal means, or climatological means)
- Production mode (i.e., near real-time or reanalyses)
- Data format (i.e., GeoTIFF, netCDF, single point/boxed averaged time series, etc.)
- Type of service (operational, on demand)

This type of information was summarised by using schematic spreadsheets, filled by users with the help of case study leaders (Figures 1, 2 and 3). Finally, users were asked to provide information on the suitability of parameters and indicators, as well as eventual improvements (Sub-section 4.1.1 and 4.1.2).

In general, spatial and temporal resolution of CERTO parameters and indicators (daily, weekly products at 50-100 m spatial resolution) were found to be suitable. Some users, however, highlighted the need of integrated data and analysed information. This results from the fact that several users cannot handle a direct provisioning of data and products, but rather, they would prefer a user-friendly visualisation of the indicators, along with an *ad hoc* analysis to highlight trends and anomalies in time and space. Some users asked for smart visualisation tools (e.g., apps for mobile phones) in order to have the water quality information in an easy and portable format.

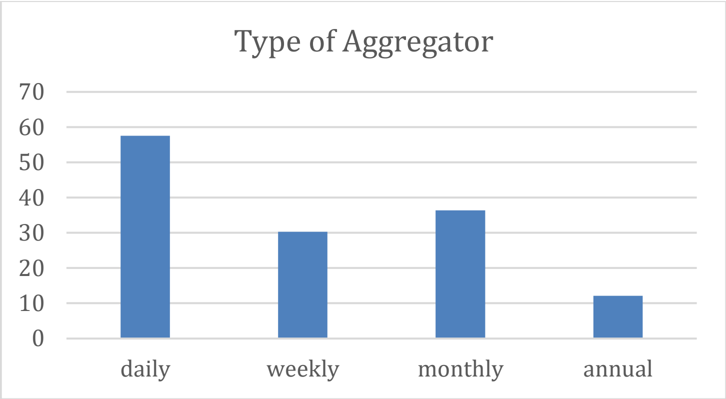

Figure 2. Statistical representation (%) of the outcomes from the 2021 WP2 surveys regarding Type of Aggregator. About 60% of local users would prefer daily products, almost 40% and 30% of users asked for monthly and weekly means, respectively. Few users (~10%) are interested in annual means.

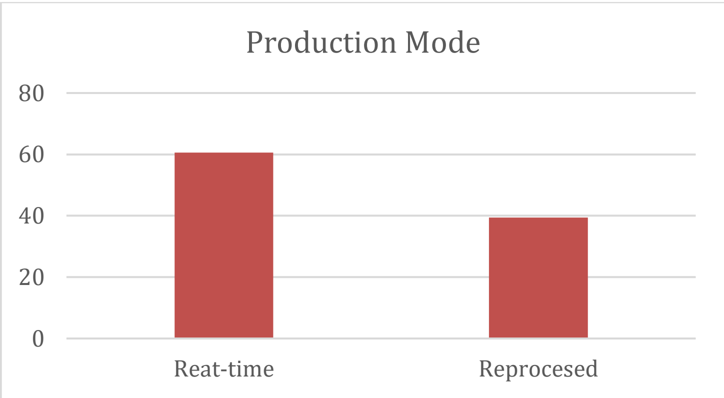

Figure 3. Statistical representation (%) of the outcomes from the 2021 WP2 surveys regarding the Production Mode. About 60% of local users would prefer real-time products while 40% of users asked for reprocessed (not real-time) products.

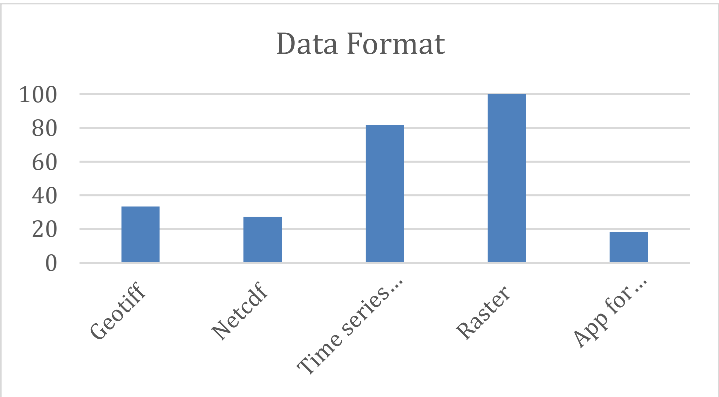

Figure 4. Statistical representation (%) of the outcomes from the 2021 WP2 surveys regarding Data Format. All users asked for raster images while 80% would also prefer time series in the form of spreadsheet files. Few users are interested on GeoTIFF (35%) and NetCDF (25%) files. It is worth noting that 20% of users would also prefer product visualisation for smartphones.

All users stated that all CERTO parameters and indicators are particularly useful for coastal and transitional zones. Users that operate at national and/or international level exhibited their interest in expanding the case studies to additional estuarine systems, ensuring CERTO products will be operational in the future. Users identified two key aspects that would find benefit from CERTO products:

i) an alert system, such as a routine that analyses the daily images, highlights potential problems and sends alerts related to potential problems;

ii) to receive information of the biogeochemical characterisation of the lagoon or estuarine system, pre-analysed by local scientists, avoiding the need to deal with a large amount of data.

CERTO products may indeed represent a common line among entities and users that need to analyse the data in order to improve local management of the transitional and coastal environments. In aiming at very high spatial resolution (i.e., 10-100 m) CERTO indicators and parameters were found to be particularly suitable for supporting EU monitoring plans for both MSFD and WFD, as well as the Habitat and Shellfish Directives, confirming that the high resolution, synoptic satellite information is particularly needed for ecological studies, fishing activities and aquaculture. This implies the possibility to provide products along with specific analysis, such as inter-annual variability, trends, anomalies and/or climatologies.

4.1.1 Products and indicators for planning and management

Water Turbidity (TUR) is recognised as a useful parameter, able to provide general information on water quality, including both biogeochemical elements and terrigenous suspended (or re-suspended) material. However, many users highlighted the need for a more quantitative parameter, such as Total Suspended Matter (TSM), that would assess, in a more quantitative way, issues related to geomorphological instabilities or modifications due to extreme events and, in particular, floods, surges, storms, sediment resuspension due to cruise ship traffic, etc. Estimation of TSM may also work for the assessment of the trade-off between coastal restoration and eutrophication, a topic that is crucial for those CERTO case studies that are sensitive to eco-geomorphological issues.
A specific recommendation for those two parameters (in river systems) concerned the ability to relate them to the local hydrodynamic regime of the river (i.e., velocity of the river flow or bed shear stress) and thus to have a synoptic visualisation of TUR/TSM within the fluvial channel. This information should go along with the possibility to extract time series and to recognise anomalies, with respect to a given climatology within the estuaries and lagoons. A further improvement of TUR and TSM parameters is the estimation of grain-size distribution of suspended material.

Maximum turbidity zone indicator was found particularly suitable for all users. For instance, this indicator would fit in the Venice lagoon for the assessment and monitoring of impacts related to the activation of MOSE, i.e., the dam system that prevents the city of Venice from flooding events. In estuarine case studies this index is useful for relating river hydrology to the activation (release) of upstream dams as well as for monitoring the morphodynamics of river backs and mouths. This index is also useful to study spatial and temporal variation of coastal plumes and will complement the information needed for improvement of daily management of dredging activities. Finally, users stated that such an index would help identify areas with high sediment deposition/clogging tendencies of channels and lakes.

Users pointed out that dredging is one of the most crucial activities that significantly affects the estuarine hydro-morphology, although the spatial effect of resuspension nowadays tend to be limited with suction systems. Despite this, it is often difficult to know, for instance, where dredging occurs, for how long, how deep the dredging is, etc. The **dredging indicator** designed in CERTO is expected to address these points, thus helping local management. This should include the ability to detect patterns at high spatial resolution, that is, to highlight pixels with potential morphodynamical unbalance by comparing daily data with the overall characterisation of the specific location (i.e., anomaly of the pixel with respect to a climatology). Maps with identification of potential problems (i.e., anomalies) would be useful for associated alert systems. A key improvement of the dredging indicator would be the subsequent information on the release of materials to coastal and offshore waters.

4.1.2 Products and indicators to support EU policy

Chlorophyll-a concentration (CHL) is confirmed to be the most useful parameter, mandatory for any monitoring activity to support EU Directives such as MSFD and WFD, as well as for aquaculture activities. Moreover, CHL is crucial, when combined with in situ data, for model validation and assimilation. Also, for this parameter, users explicitly demanded a high resolution (i.e., from 10 to 50 m) synoptic visualisation within estuaries and lagoons. This information should go along with the possibility to extract time series, to recognise anomalies respect to a given climatology, and to easily visualise information on water quality within estuaries and lagoons. A crucial improvement for this parameter would be the provisioning of an optical depth, which represent key information for model validation and assimilation.

Chlorophyll-a 90th percentile (CHL P90) was recognised by users to be particularly useful to detect spatial patterns of eventual biogeochemical anomalies within estuaries and lagoons, also supporting EU monitoring plans for both MSFD and WFD if application is achieved for coastal and offshore waters as well. On coastal and lagoon environments, CHL P90 is recognised by users as a key indicator for water quality that uses indicated “may help understanding where the best fishing areas are” and “it can indicate low water levels or stagnant water, also in the light of global change or anthropogenic effects”. Indeed, based on the results shown for the Danube Delta - Razelm-Sinoe lagoon system, values that exceed the P90 marked well anomalous climatic conditions and changes in hydrologic conditions. A potential issue for the development (and use) of this indicator is the lack of a significant statistical record; in case the statistical record is not robust enough, maps and time-series of CHL anomaly (at weekly basis) might be a good option for several users, as far as the provisioning of the information is operational.

Phytoplankton bloom phenology index was recognised by local users as an innovative tool, potentially useful for further development of WFD and MSFD indicators if its application is achieved for both coastal and offshore waters. Moreover, users stated that it could be key for the Bathing Water Directive, due to its ability to recognise cyanobacteria blooms, and it may provide indication of oxygen levels in water, and indicates stagnant or shallow water in those environments that experience significant blooms. Some users pointed out that the information provided by this indicator should go along with additional parameters, such as sea surface temperature and salinity, in order to diagnose cause and effect of bloom dynamics. In this regard, the indicator would need to be presented in a high-level fashion, associated to some analysis.

4.2 Presentation of SESVI and discussions

Although most of the users stated that they would be directly interested on the development of SESVI, the surveys did not yet receive mature suggestions regarding SESVI indicators. Nevertheless, SESVI itself was perceived as a very useful tool for connecting the dots between social and ecological changes. All indicators that define Exposure, Sensitivity, and Adaptive capacity in the Vulnerability Assessment were found to be suitable.

One issue that we recorded is that, for some users, some of the indicators are too complex and may not fully represent the social-ecological status of the case study environment. For instance, the GDP may change significantly from one area to another area in the same region. Users, in general, recommended to take particular care on data sourcing. Regarding Exposure, crucial indicators that could be eventually added are related to the increase of alien species (e.g., seagulls and other birds) as well as to the increase of tourism activity, which was found to be a triggering issue for socio-ecological, significant modification. These points highlight that, in practice, SESVI and such complex indicators are best undertaken by local downstream service providers who are very familiar with local conditions.

5. Conclusions

CERTO aims to undertake R&D necessary to produce harmonised water-quality data in transitional environments, extending support to the large communities operating in these coastal lagoon, and river-sea systems, also evaluating cross-cutting optical water quality Indicators. CERTO is producing the evidence that will be needed by the “entrusted entities” that run Copernicus services as to the improvements, that could lead to an increase in the user community, possible downstream services and wider impact of the prototype.

By pursuing a similar approach as that set for the WP2 User Requirement surveys, conducted in 2020 and reported in the Deliverable D2.1, we performed cross-regional and cross-sector interviews to CERTO stakeholders and local users in order to present progress on indicator development within WP6 and to receive continued feedback. Exchanges with these users have enabled a better understanding of their needs in terms of information and specific requirements. This will be essential to evaluate further improvements, as described below.

From this second phase of interviews, users were expecting to receive products with the highest temporal and spatial resolutions that work for the whole water continuum. The proposed integration of satellite-based information in the form of percentiles, anomalies and trend analyses was, therefore, welcomed. Users were asked to provide information on suitability of parameters and indicators, as well as suggestion for eventual improvements. In general, parameters and indicators developed in WP6 were found to be suitable. In particular, users recognised that CERTO products are suitable for supporting EU monitoring plans for both MSFD and WFD, as well as the Habitat and Shellfish Directives.

Users highlighted the need for integrated and analysed information, as well as a user-friendly visualisation of indicators and parameters. This would require the provisioning of products that allow for an *ad hoc* analysis, ability to highlight trends and anomalies, in time and space, as well as to set alert systems. About 60% of local users would prefer daily products; 60% of local users would prefer real-time products; the totality of users asked for raster images while 80% of them would also prefer time series in the form of spreadsheet files.

Due to the fact that several users do not have the resources to manage and analyse large amounts of data, an emergent need that came out from the interviews is the provisioning of high-level information, mature enough for management decisions. Almost all users tend to prefer fine temporal and spatial scales, especially for spatial resolution where datasets are desired in the 10-100 m range.

Regarding SESVI, users look for concrete results, tailored to case studies. At this stage, it was quite hard to receive mature feedback from users; this lack will be fully addressed during the demonstration phase, planned under WP8. Nevertheless, they recognise a lot of value and potential in SESVI, especially for connecting the dots between socio-economic changes and water quality indicators.