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NEWSLETTER

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Creating products and knowledge for the Mediterranean

Editorial

Georgios Sylaios

ODYSSEA

Since its launch back in June 2017 ODYSSEA, after completing a complex set of preparatory actions, has carried out a significant part of the project's main tasks in the fields of systems development, data collection and forecast production. Over this 3-year period, several achievements have been accomplished and delivered according to the initial work plan, something that will undoubtedly facilitate dealing with the challenges that still appear ahead of us.

The Platform, the key deliverable of the project was upgraded and has advanced its operation, becoming more robust in its performance and capable to serve multiple users. The system is designed to be scalable and transferable to any cloud system (e.g., DIAS) by encompassing novel platform development tools. Several stakeholders and end-users across the Mediterranean have tested the Platform to obtain easy access to marine data and have provided their feedback through the online survey.

In parallel, significant progress is being made in the development and testing of the novel "chain" of operational numerical models, aiming to downscale the spatial and temporal resolution of existing Copernicus forecasting products. To couple efficiently these models and perform a series of automated tasks, like models initiation and ingestion of initial and boundary conditions, integration of on-site data, processing and assimilation in model results, and finally, forecasts transfer to the Platform, the Consortium has tested two different interfaces: the Delft-FEWS system and the Aquasafe environment. This experience led partners to conduct an in-depth comparative assessment of both systems according to a series of predefined criteria. I consider this as a noteworthy contribution of ODYSSEA to operational oceanography and a demonstration of its capacity to provide services.

Figure 1. The main pillars of ODYSSEA and their link to project main elements.

In terms of sensors, all have been developed according to the work plan. More specifically, the microplastic sensor was miniaturized and was integrated on the mobile and fixed monitoring systems built specifically for the project. The sensor revolutionizes our capacity to measure microplastic particles within the ocean water column. Glider tests were performed in the Gulf of Lions and results were found satisfactory. The main deployment with this sensor is scheduled to take place in Morocco this year. The surface and benthic fixed monitoring systems were developed and some of them already reached the relevant partners and are ready to be hosted by End-Users selected by Observatory managers.

In terms of services, the Consortium worked towards the development of algorithms and products to fulfil the needs of fish and mussel farmers, to alert on the outburst of jelly-fish blooms, to forecast and warn on eutrophication events, to understand the influence of environmental factors on the presence and distribution of seagrass species, to exploit the capacity of selected areas in marine renewables, to integrate environmental and fishery data and to link wind and wave storm data to shoreline change and coastal erosion dynamics.

Several challenges lie ahead and will need to be addressed until the end of the project in November 2021. We have entered the phase of integration of all above described systems into the Platform. Users should be able to see a multi-modular tool capable of providing access to marine data from external providers, but also to produce highly accurate forecasts and digitized products at specific locations, the area of their activities at the sea. Furthermore, the Consortium seeks ways to ensure the sustainability of its operation, utilizing the operational oceanographic Platform as a tool for generating revenues. This is in line with the unanimous decision to gradually transform the Consortium into a corporate structure, achieving sustainability for the tools and systems developed within the project. For this purpose, the appropriate business strategy is being explored, aiming to identify opportunities in all marine and maritime sectors.

In this issue:

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ODYSSEA is an EU H2020 project for Developing and Deploying Integrated Observatory Systems in the Mediterranean Sea. The main objectives are to:

(1) Implement a **Network of Observatories** through the deployment of novel in situ **Sensors** at sea, the development and coupling of new oceanographic Models and the integration of the above with existing data and models for the **Mediterranean Sea**.

(2) Develop and operate an online **Platform** to provide access to observatory **Data**, **Products** and **Services** for **Users** of the Mediterranean Sea.

(3) **Dissemination** and **Capacity Building** to develop **skills** to maintain the Observatories and their infrastructure, create opportunities for **business** development, and transfer **knowledge** across the Mediterranean.

ODYSSEA - Creating products and Services for the Mediterranean Sea

Looking back

A look at what has been achieved over the first 30 months of Project implementation

ODYSSEA Platform Development

The ODYSSEA Platform is now in operation through the newly-purchased data centre of CLS in Toulouse and will be launched to the public in late 2020. This data centre is capable of providing services through the platform to a multitude of users entering the system at the same time. Key elements of the ODYSSEA platform include:

a. The platform is now scalable and potentially transferable to any cloud system since the novel KuberneteS framework was used, bringing the ODYSSEA Platform to the cutting edge of technological developments;

b. As soon as the EU-funded cloud system (DIAS) is ready to host external platforms, ODYSSEA Platform could be easily uploaded on it with the minimum adaptations and the maximum efficiency;

c. The interface to integrate algorithms developed by the Consortium through WP7 tasks has been finalized and is now ready to operate. This interface will significantly reduce the time required to integrate and run new algorithms “on- the-fly” to the Platform;

d. The collection and ingestion of in-situ data is progressing well, thanks to the increased performance of the improved SOS server. For example, glider data will be (for the first time in real time) collected and automatically transferred to the platform, ready to be downloaded and visualized.

ODYSSEA Sensors Deployment

a. Industrial partners, ALSEAMAR (8-12 April 2019) and DEVELOGIC (8-12 July 2019) each held at their own premises, a week-long intensive training workshop for the Observatory personnel. Technical personnel from all North African Observatories were trained on the operation and maintenance of the glider and the operation and deployment of surface and benthic fixed sensor systems.

b. The three glider missions in Greece (North Aegean Sea) have been successfully completed and the team is currently working on processing the data. Another glider mission will take place later in 2020 using the Passive Acoustic Monitoring system.

ODYSSEA Models Development and Implementation

a. Models have been developed, coupled and tested in the Thracian Sea (hydrodynamic, wave and water quality). Model results compared to CMEMS and local wave-riders and buoys are very satisfactory. The model on mussel population growth was also developed and will be tested in real-case conditions at a mussel farm in N. Greece.

b. Observatory managers have already completed the purchase of the required hardware (local Observatory servers) and the connection between model developers and observatory technical staff responsible for running the models has been strengthened.

c. A webinar organized by FORTH and Deltares on 28th January 2020 was another major milestone, as it allowed participants to go over the basic concepts of water quality modelling using DELWAQ, to highlight the selection of processes and parameters, the data needed, etc. and thus give a boost for setting up and operating the water quality models in the Observatories.

d. Ecosystem / fishery models developed by AUTH, HCMR and IU have been completed in two out of three Observatories.

ODYSSEA Dissemination and Management Activities

a. ODYSSEA organized its second Summer School session, focusing on "Oceanography and Fisheries in the Mediterranean", from September 2 - 6, 2019, on the Greek Island of Alonissos (http://odysseaplatform.eu/2019/09/24/odyssea-2nd-summer-school-session-on-alonissos-a-great-success/).

b. The 3rd ODYSSEA General Assembly following the progress of the project was held in Tangier, Morocco, from October 28 - 31, 2019.

c. More recently, ODYSSEA has become a key partner in the intense study session, held from January 8 - 14, 2020 and which was organized by the Commonwealth Small States Centre of Excellence (SSCOE) and the University of Malta's Physical Oceanography Research Group. ODYSSEA project and platform were extensively presented at the seminar (http://odysseaplatform.eu/2020/01/23/odyssea-key-partner-in-malta-winter-school-aiming-to-spread-blue-growth-globally/).

d. ODYSSEA, in cooperation with HiSea and PROTEUS projects has organised the dissemination event "The maritime surveillance in the West Mediterranean". The event was held in Valencia, on 16th January 2020 with attendance of local policy makers and Administrations, Spanish Navy, Rescue agencies, Port Authority of Valencia, law enforcement agents, Universities and other observatories.

Publications submitted / in preparation by the ODYSSEA Consortium

a. Research related to WP13 on data gap analysis in the Med, headed by ODYSSEA project partner, Davide Astasio Garcia of the Sapienza University of Rome, was published in the academic journal "Science of the Total Environment" in its June 10, 2019 edition. The article highlighted the importance of ODYSSEA's goals and concludes that large parts of the Mediterranean are lacking data parameters for many of the data typologies surveyed.

b. Research on fusing systematic and diverse databases (CMEMS, EMODnet) to model the factors determining the presence/absence and families' distribution of seagrass in the Mediterranean Sea was published by the DUTH team comprised from Effrosynidis, Arampatzis & Sylaios in the academic journal "Ecological Informatics" in its November 2018 issue. Machine learning techniques (random forest algorithm) and big datasets covering the whole Mediterranean Sea were used to detect seagrass presence/absence, based on prevailing environmental conditions, with an accuracy of 93.4%. Chl-α and salinity were the prime parameters determining seagrass family presence, as Cymodocea and Posidonia favor the low, limited-range chlorophyll-α levels (< 0.5 mg/m3), Halophila tolerates higher salinities (> 39), while Ruppia prefers euryhaline conditions (37.5–39).

c. In addition, ODYSSEA Coordinator, Prof. Georgios Sylaios, and RTD Manager, Dr Ghada El Serafy were invited as Guest Editors for a Special Issue in the prestigious, open access scientific journal **WATER** (https://www.mdpi.com/journal/water), which will be dedicated to the publication of key project results. The Special Issue will be entitled: "Observations and Models for End-User Services in Coastal Marine Systems" https://www.mdpi.com/journal/water/special_issues/Coastal_Marine_Systems.

First Glider Missions in Thracian Sea bring new data and insights

Kokkos Nikolaos, Zachopoulos Konstantinos, Zoidou Maria, Sylaios Georgios

ODYSSEA is not only a project of integrating and aggregating data from external data platforms, like CMEMS, EMODnet, FishBase and more, but also a project that produces new data collected in areas with limited coverage and recording parameters not previously reported. In this sense, the use of a glider to monitor the oceanographic and environmental conditions along the North Aegean Trough, an area of great significance for marine scientists in the North Aegean Sea, is one of the main activities of the project.

The area receives the buoyancy outflow consisting of low in salinity, enriched in nutrients and organic matter Black Sea Water, exported from the Dardanelles Strait, following a north-eastern path and expanding over the Thracian Sea. One of the most prominent meso-scale features in the area is the Samothraki Anticyclone, a semi-permanent anticyclone of variable strength and dimensions developed in the Thracian Sea, between Samothraki, Thassos and Imvros Islands. The feature affects the first 50 m of the water column and favors and sustains the occurrence of increased chlorophyll-a concentrations (3-5 mg/m3), driving the epipelagic ecosystem dynamics in the area. The pelagic trophic web of the North Aegean Sea depends on the occurrence and dynamics of this anticyclone.

Bottom topography in the area is characterized by a NE-SW oriented deep trough, separated by shallow sills and shelves, constituting the "North Aegean Trough". Within this trough, three main depressions exist: the Lemnos Basin to the north-east (maximum depth 1,470 m), the Athos Basin at the center (maximum depth 1,150 m) and the North Sporades Basin to the south-west (maximum depth 1,500 m). Such basins are filled by the very dense North Aegean Deep Water (NADW), and the presence of sills between them makes water renewal extremely difficult. In parallel, as surface biota die at the surface, their sinking takes place towards the bottom in the form of detritus, i.e., dead organic matter. The occurrence of such deep basins, like those in North Aegean Trough, make them act as funnels collecting detritus at the deep, high in density layers. Detritus decays at deep layers, thereby using up oxygen in the water column, leading to hypoxic conditions and even to benthic anoxia.

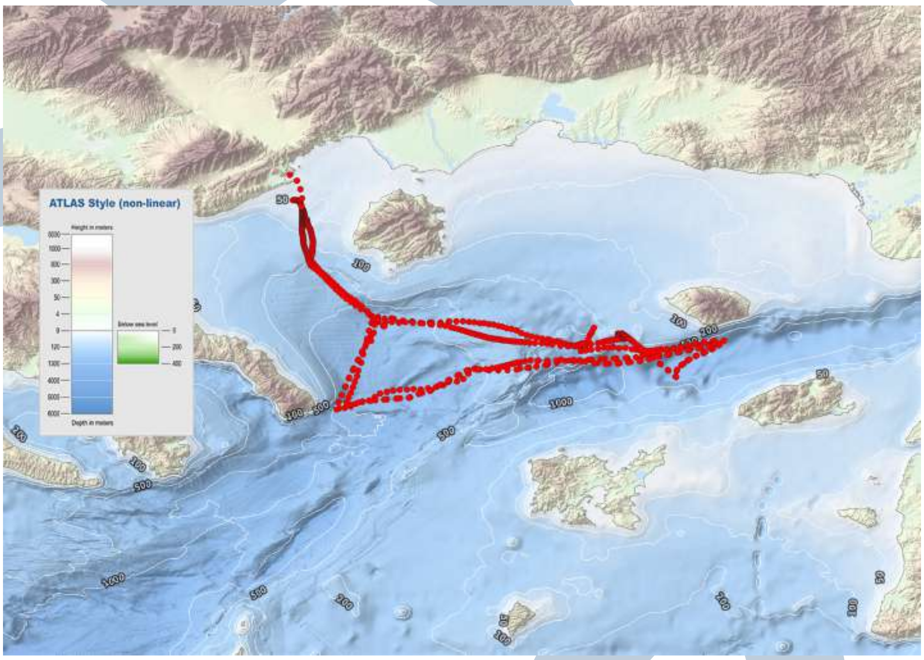

Figure 2. Bathymetric map of the study area and the path followed by the glider during the missions in the North Aegean Sea.

Based on the above, the key scientific question motivating our research in the Greek ODYSSEA Observatory is related to the impact of sinking detritus material on the distribution of organic material and the levels of dissolved oxygen over the water column and especially at the deeper waters.

Nowadays, the most efficient and cost-effective method to tackle such a question is to use a glider equipped with a set of sensors, capable of monitoring such parameters over the water column and until the deeper layers. A glider is an autonomous sensing platform, similar to a miniature submarine, that can actively move vertically and/or horizontally through the water column driven by buoyancy changes. The system is powered by batteries and can carry several sensor payloads. Along its saw-tooth profile, the SEAEXPLORER surfaces regularly to establish a communications link for supervision and piloting (SPS, using GPS positioning) and data transmission.

In ODYSSEA, two SEA EXPLORER gliders were produced by ALSEAMAR, especially for the project, carrying the following payloads:

1. The standard payload, carrying sensors for water temperature, salinity, density, pressure, dissolved oxygen, chlorophyll-a, CDOM and turbidity;

2. The Passive Acoustic Monitoring System, to record marine noise, natural and artificial, and report on the abundance and diversity of marine mammals; and

3. The CTD sensor and the novel micro-plastic sensor, capable of collecting data on microplastic occurrence over the water column.

Figure 3. The SEA EXPLORER glider ready to be deployed during the first ODYSSEA mission.

Presently, three successful glider missions along the North Aegean Trough were completed: a full two-circles mission in summer 2019, a one-circle mission in fall 2020 and a full three-circles mission in winter 2020. The glider covered a 25-day triangle starting from Mt Athos, towards the south of Thassos Island and to the west of Samothraki Island. It followed the 800 m isobath moving from the surface to 700 m depth.

Initial results illustrate that the summer DO, when stratification of water the column is at its highest, has high levels at the surface (~ 220 μM ≈ 5.05 ppm). It reaches a maximum at the bottom of the pycnocline (at 40-60 m depth, DO ~ 260 μM ≈ 6.05 ppm) and reduces gradually over the water column towards ~ 190 μM (≈ 5.40 ppm), until 500 m depth. At 700 m depth DO reduces even more as DO ~ 160 μM (≈ 5.20 ppm). Unfortunately, technical glider capabilities did not allow the movement of the glider at higher depths.

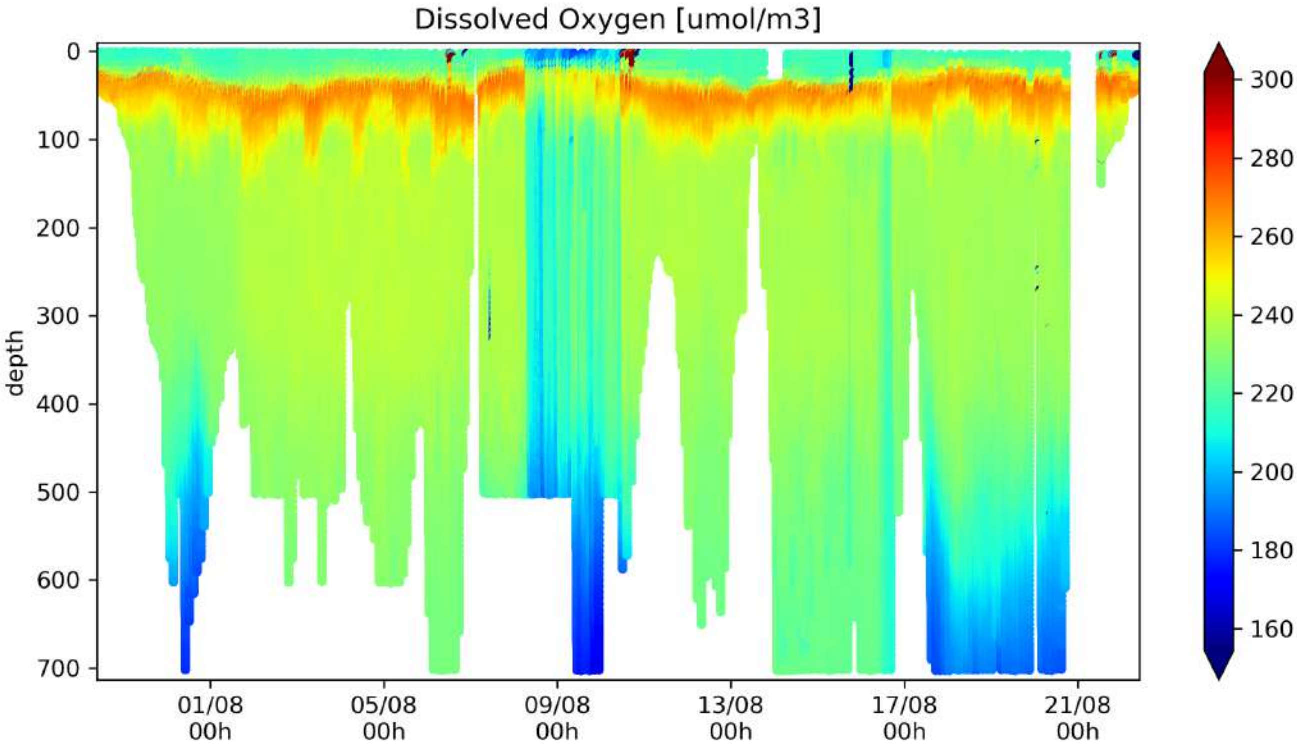

Figure 4. Transect between Mt Athos and Samothraki recorded by the glider during the summer mission in the North Aegean Sea.

Jellyfish Modelling in the Mediterranean Sea

Ghada El Serafy, Sonja Wanke, Lorinc Meszaros, Mercedes De Juan Muñoyerro

Although an essential part of a healthy marine ecosystem, anomalies in jellyfish populations have led to undesirable consequences for societies dependent on marine resources. When favourable conditions for jellyfish are present, they expand their population incredibly fast. This phenomenon is also known as blooms. These blooms consist of large numbers of jellyfish and can be problematic through their direct interference with human activities (e.g. tourism, fishing, etc.) and through the generally negative perception they create. Unfortunately, swarms have been very common in recent years and could be linked to climate change and overfishing and eutrophication. Jellyfish are preys of many Mediterranean top predators, and with the numbers of predators gradually in decline, naturally jellyfish populations are flourishing. Adding to that, an increasing trend in chlorophyll concentration in the Mediterranean Sea shows phytoplankton growth, which builds up a suitable environment with high food availability for jellyfish.

Numerous jellyfish species can be found across the Mediterranean basin. The most abundant native species of jellyfish in the Mediterranean Sea are mauve stingers (Pelagia noctiluca), a holoplanktonic medusa notorious for its painful sting that can be found in coastal waters and offshore.

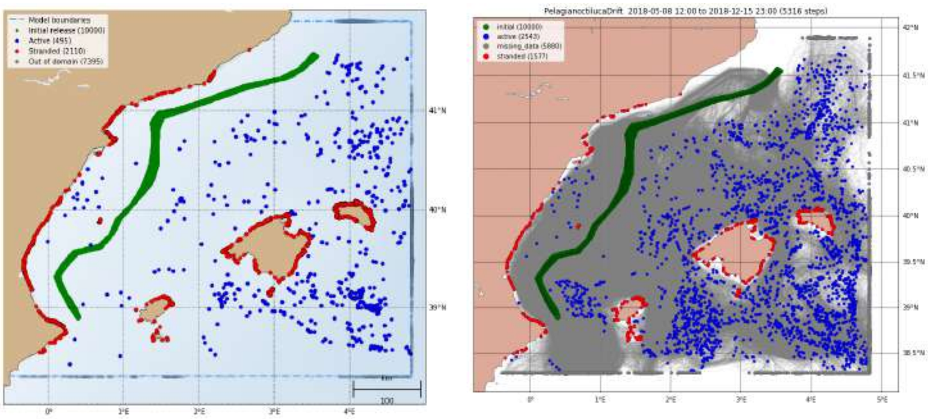

Figure 5. Tracking of Mauve Stingers with the jellyfish drift model developed within the ODYSSEA project. Credit: Joe El Rahi, Deltares

In order to solve this problem, the first and most important step is to report sightings and issue early warnings on jellyfish occurrence to the relevant end-users in the affected sectors.

ODYSSEA services will include early warnings of jellyfish spatial and temporal distributions and potential stranding locations, as well as historical records of jellyfish sightings. These services will be based on innovative IT solutions such as numerical models.

Early warning of jellyfish (for the moment Pelagia noctiluca but others can be included) blooms will be issued, which consists of the likelihood of jellyfish spatial and temporal distributions and potential stranding locations before they reach the coast in touristic areas. These warnings are to inform local authorities and industries for banning bathing on affected areas or to take other appropriate measures. The prediction is based on numerical models (hydrodynamics and particle tracking) which simulate the spatial and temporal variations in distributions of jellyfish including their life cycle (stage development, behavioural processes, daily behaviour, temperature induced behaviour). Besides forecasts of jellyfish stranding locations, probability maps can be produced that answer the following question: What is the probability of encountering jellyfish in location X? Location X could be of interest to fishing vessels, so they could manage their fishing trips based on these maps.

The ODYSSEA project will provide with the necessary tools for supporting an integrated system for the prediction and research of jellyfish on the Mediterranean coast.

Ecosystem models along the southern Mediterranean coastline

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Besides integrating and aggregating data from external data platforms and collecting new data in areas with limited coverage, one of the main activities of ODYSSEA is to produce a chain of models that will be linked together and will be able to examine various hypotheses. Within this framework three ecosystem models have been created, two of which in the southern Mediterranean coastline (Morocco and Egypt), which is a data poor area in terms of fisheries and biological data availability. The third model has been created in Gökova Bay in Turkey. The two areas in the southern Mediterranean are located in the two entrances of the sea, a natural one in the Alboran Sea (Strait of Gibraltar) and an artificial one in the Egyptian coast (Suez Canal).

A mass-balanced Ecopath with Ecosim model was selected as the most appropriate approach, because it is widely used and as a result several other models have been previously created in the Mediterranean Sea, especially the northern coastline. These previous models could be helpful for the development of new models in these data-poor areas and for the comparison of results.

The Ecosim module of EwE allows the user to model the dynamics of the studied ecosystem through time using the Ecopath base model parameterization to examine temporal hypotheses related to environmental factors and fisheries. The model can be informed with time series data of biomass, fishing activities (e.g. fishing effort) and/or environmental drivers directly affecting one or more functional groups (e.g. temperature) while taking into account the trophic interactions among the functional groups. The simulation output, biomass of functional groups and catch of exploited species, can be compared to observed time series of biomass or catch to compute a goodness of fit of the model.

The study area of the Morocco model covers about 23,000 km^2 (GSA 3: southern Alboran Sea) along the Mediterranean coastline of Morocco. The base model was created for the years 2000-2005 and the organisms included in it were organized in twenty-two functional groups. The model was fitted to historical time series of landings and accounted for trophic interactions, environmental factors and fisheries.

The study area of Egypt covers 16,125 km^2 off the Mediterranean coast of Egypt. Although the eastern Mediterranean is an oligotrophic area, the coast of Egypt has been quite productive owing to the annual discharges of the Nile River. Fisheries in the area have been affected by two major events – the construction of the Suez Canal in 1869 and that of the Aswan High Dam in 1965. The model implementation considered several scenarios that included fishery, trophic interactions and environment as drivers. The results were compared with historical time series of landings of commercial species.

Both areas are important fishing grounds, especially for the small-scale coastal fisheries, and host high biodiversity of many groups of species besides commercial fishes and invertebrates. Because of their location, especially the Egyptian coast, their biodiversity may be altered from species migrating through the Suez Canal and the Strait of Gibraltar.

These ecosystem models will form the baseline for testing exploitation and species invasion scenarios, but also for examining the potential effects of climate change and variability as well as other related environmental factors (e.g. river runoff) on marine populations and ecosystems of the southern Mediterranean Sea.

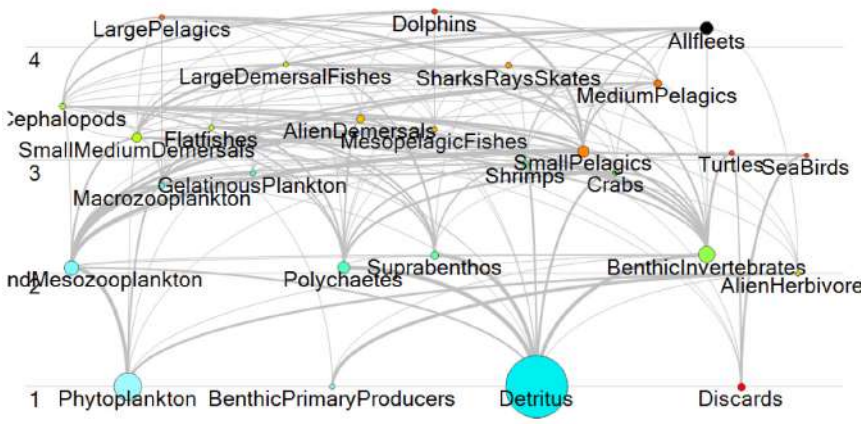

Figure 9. Flow diagram of the Egyptian ecosystem organised by the trophic level of each functional group.

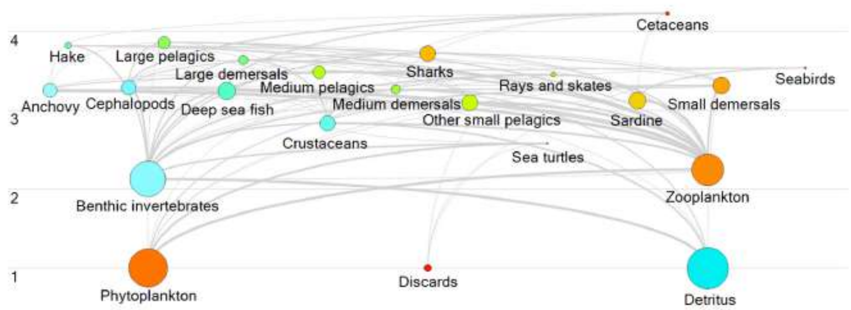

Figure 10. Flow diagram of the Moroccan ecosystem organised by the trophic level of each functional group.

Thracian Sea Models development, testing and implementation

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The operational forecasting system of ODYSSEA Observatories consists of a ‘chain’ of dynamically coupled, high-resolution numerical models comprised of (a) the hydrodynamic models Delft3D-FLOW and MOHID, (b) the SWAN wave model), (c) the water quality models DELWAQ and MOHID-Bio, (d) the oil spill fate and transport model MEDSLIK-II, (e) the ecosystem model ECOPATH, and (f) the in-house mussel farm model developed by the Democritus University of Thrace. Models are nested in Copernicus Marine Environment Monitoring Service (CMEMS) products and provide high-resolution forecasts, early warnings and alerts for currents, waves, water quality parameters, oil spill pollution and ecosystem status for the 9 ODYSSEA Observatories established across the Mediterranean basin, covering coastal and shelf zone environments, Marine Protected Areas and areas with increased human pressure. The Delft-FEWS system developed by Deltares and the AQUASAFE platform developed by Hidromod are employed at Observatory level to perform a series of automated tasks for the efficient operation of the forecasting chain, including: data import, storage and pre-processing (sensors, remote sensing, etc.); linking models to the appropriate initial and boundary conditions; scheduling of tasks to run the series of coupled numerical models; models calibration and validation; data assimilation; post-processing models’ results and transferring data to the ODYSSEA platform. The forecasting systems of the Thracian Sea Observatory in Greece, the Gulf of Gökova in Turkey, the Gulf of Gabes in Tunisia and the Nile river zone of influence Observatory in Egypt are developed and implemented using Delft-FEWS, while the Observatories of Al-Hoceima Marine National park in Morocco, Israel coast and Arzew Bay-Stora Gulf in Algeria are operated through the AQUASAFE platform.

The area of the Thracian Sea Observatory is biodiversity rich and important spawning and nursery ground for small pelagics, while in Kavala Gulf, oil exploration and exploitation takes place. Delft3D-FLOW, SWAN and DELWAQ are set to run operationally in forecast mode, through Delft-FEWS, to provide, on a daily basis, 5-day forecasts of various essential ocean variables. The hydrodynamic and wave models have been configured based on dynamic downscaling of CMEMS products to a grid resolution of 1/100° (~1.1km). Meteorological forcing is provided by the NOAA Global Forecast System (GFS) hourly forecasts at 0.125o resolution. For the hydrodynamic model, 62 z-layers are used in the vertical, following the CMEMS vertical discretization. Boundary conditions at the southern open boundary are provided on a daily basis by the Mediterranean Forecasting System (MFS) at a horizontal resolution of 1/24o. The nesting between the two models involves the zonal/meridional velocity components, the temperature/salinity profiles and the free surface elevation. Moreover, at each section of the open boundary the hydrodynamic model is forced by the tidal variability, originating from the TPXO 7.2 global tidal solution. The model includes parameterisation of fresh water discharge from three major rivers (Evros, Nestos and Strimon), which are located at the northern coastline, based on E-HYPE (https://hypeweb.smhi.se/). For the Thracian Sea wave model, a time and space varying boundary condition is imposed at the southern boundary, retrieving data from the MFS WAM cycle 4.5.4 wave model at a resolution of 1/24°. These data consist of hourly significant wave height, peak period and wave direction time-series. JONSWAP spectrum was chosen as the appropriate spectral shape and for the cosine power representing the directional spreading.

In-situ data for sea currents and waves from the observing buoy at Kariani maintained by DUTH, as well as satellite data for sea surface temperature (CNR Med Sea high resolution and very high resolution L4 gridded data, 0.01o) provide the means for models’ calibration and validation. Ocean variables monitored over the water column from the glider missions along the North Aegean Trough will also be incorporated in the future for calibrating and evaluating the performance of the hydrodynamic and water quality models. Initial calibration and validation tests performed over the period of January 2018-June 2019 show a good agreement between models’ results and available data.

High-resolution forecasts of oceanographic fields will provide the basis for several ODYSSEA products and services in Observatory areas, such as the estimation of the Trophic IndeX (TRIX) for marine systems and the wave power product of ODYSSEA. The Lagrangian oil spill model MEDSLIK-II, which has been coupled to the high-resolution oceanographic fields (currents, temperature, Stokes drift velocity), produced by Delft3D-FLOW and SWAN, can provide reliable forecasts of oil spill fate and transport in the areas of the Observatories in case of pollution incidents, while seasonal hazard maps (surface oil slick, beached oil) can be produced employing multiple oil spill scenarios using multi-year hydrodynamics.

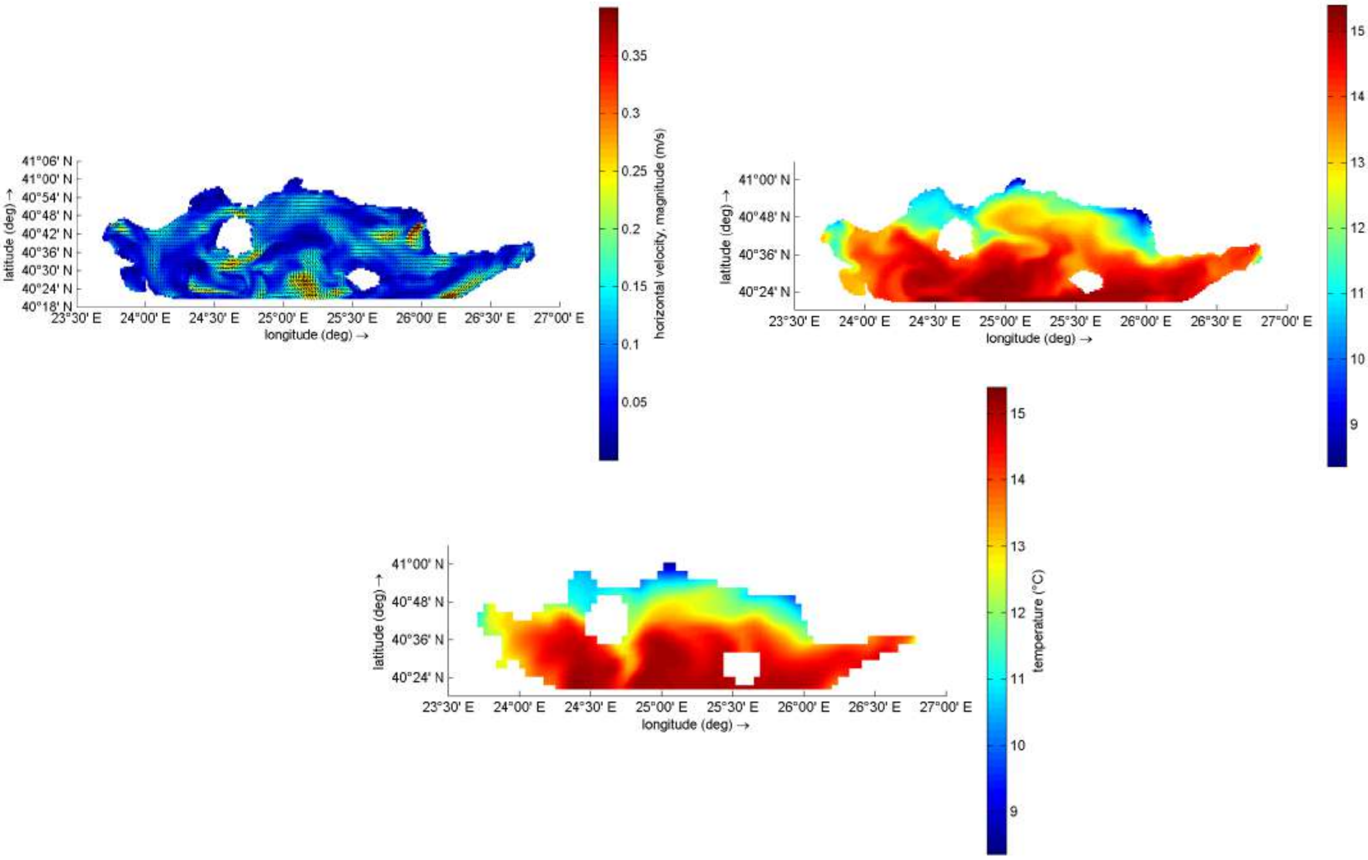

Figure 6. Deflt3D-FLOW top layer velocity and temperature fields (top left and right) and comparison with CMEMS top layer temperature (bottom), for 2019-02-02, 00:00:00

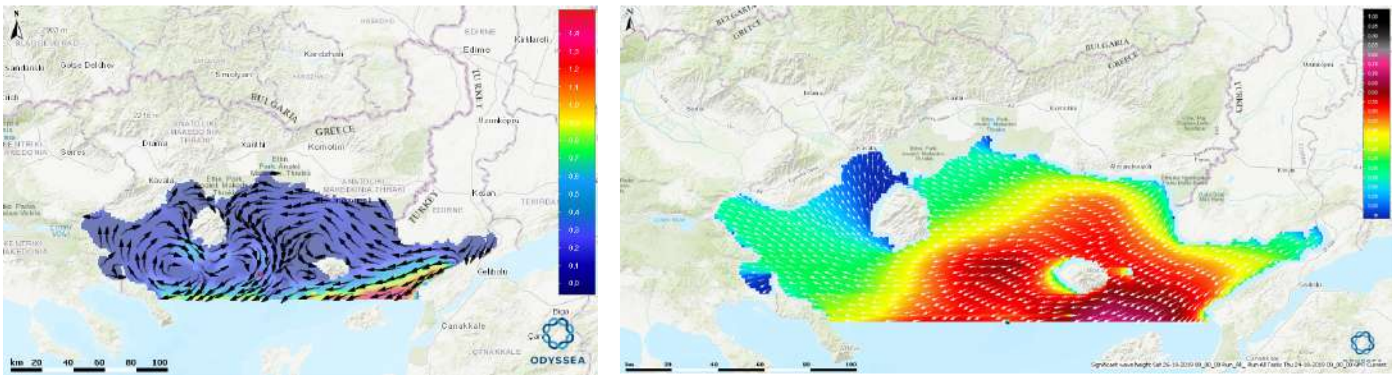

Figure 7. Experimental results of the operational forecasting system in the Thracian Sea in Delft-FEWS: current velocities (top left), significant wave height (top right).

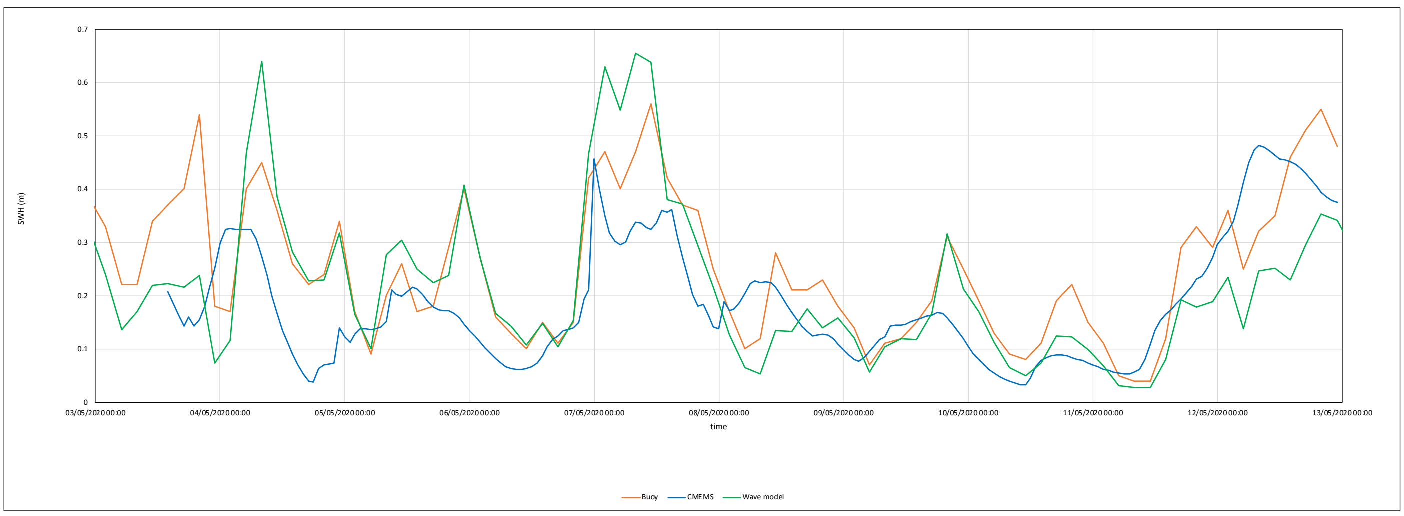

Figure 8. First evaluation of the Thracian Sea Wave model: Significant Wave Height comparison with Kariani buoy in-situ measurements and CMEMS

Introducing ODYSSEA's first value-added products and business development strategy

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Building on the models, algorithms and data that the ODYSSEA project is developing, collating and collecting, the ODYSSEA Consortium is creating a range of value-added, data-based information products. These products will give key Mediterranean stakeholders access to information that will help ensure the sustainability of their operations and safeguard the ecosystems, resources and biodiversity of the Mediterranean Sea. Users will be able to access these products on the online platform that is being developed by ODYSSEA. The first two products to be integrated into the platform will inform users about wave conditions and the state of eutrophication in their areas of interest. To ensure that these products continue providing added value after the end of the project, the Consortium is, in parallel, formulating a business development strategy.

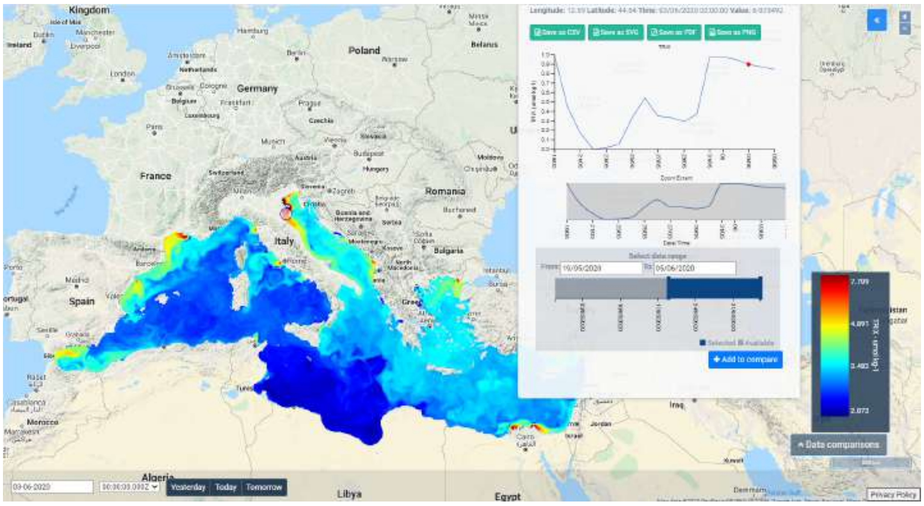

Figure 11. Visualisation of the ODYSSEA TRIX product in form of dynamic maps and time series which can be queried anywhere in the Mediterranean Sea.

The eutrophication product

The ODYSSEA eutrophication product will provide daily updates on the trophic state of Mediterranean coastal waters in maps and plots. Eutrophication is caused by increased input of nutrients into coastal waters, mainly from land-based sources such as wastewater treatment plants or run-off from agricultural land. These nutrients lead to harmful algal blooms and an excessive growth of phytoplankton. The impacts of eutrophication include oxygen depleted dead zones and fish kills. Eutrophication has serious consequences for the health of marine life and significant economic impacts on local fisheries, aquaculture and coastal tourism.

Knowing where and when eutrophication occurs, can help fisheries and aquaculture operators, as well as local authorities and beach side resorts, adapt and respond to minimise negative impacts for human health and their operations. Monitoring eutrophication also supports the implementation of policies and regulations related to marine pollution. Eutrophication is often used as an indicator of good environmental status, including under the European Union Marine Strategy Framework Directive and the Integrated Monitoring and Assessment Programme of the United Nations Environment Programme Mediterranean Action Plan.

ODYSSEA users will be able to view information about the eutrophication status for predefined Mediterranean subregions. They will also receive information for user-defined areas of interest by inserting or selecting specific coordinates. This will enable users to tailor the information to their needs, for example showing eutrophication levels around a fish farm or in a specific bay. The possibility of adding a forecast function to the product is being explored, as well as an alert system that would notify the user when a predefined threshold is reached and eutrophication is likely to occur.

The wave power product

The ODYSSEA wave power product will be part of a package of products describing wave conditions, including significant wave height, wave period, and related data on atmospheric conditions, such as wind and atmospheric pressure. ODYSSEA users will be able to select their areas of interest and receive tailored information on wave conditions in the form of charts, histograms and maps, as well as key statistics (e.g. average, maximum, mean).

The information provided by the wave power product will be useful to a range of industries operating at sea, including offshore aquaculture, oil and gas, and renewable energy installations and port authorities. Near-real time and short-term forecast data will enable users to optimise ongoing operations and ensure safety at sea. Historical data analyses will inform long-term planning of new installations, including scoping out potential areas for renewable energy wave power plants. Tailored information on wave conditions will also support local authorities and leisure and tourism operators, providing forecasts for recreational activities (e.g. surfing, angling, diving, sailing) and informing the assessment of coastal and beach erosion.

ODYSSEA's business development strategy

The Consortium is formulating a suitable business development strategy to identify a sustainable business model for the first ODYSSEA products and services. The strategy is based on four key elements: 1) development of business cases with the regional Observatories, 2) a market analysis, 3) a joint exploitation plan for the Consortium, and 4) economic and financial feasibility assessments.

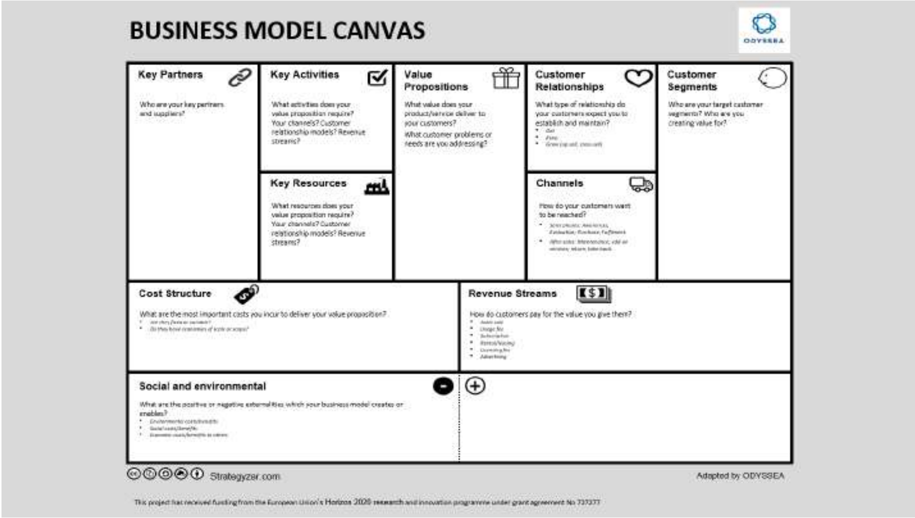

Figure 12: Business Model Canvas as a tool for developing each ODYSSEA business case.

As part of the market analysis, the ODYSSEA Business Strategy team, in close cooperation with regional observatories, is conducting a review of the market environment, a competitive analysis of existing web platforms and a strategic Strengths/Weaknesses/Opportunities/Threats (SWOT) analysis. In particular, work with the ODYSSEA Observatories, will be crucial in identifying customer segments and developing business cases for each product. A Business Model Canvas (BMC) is being drawn for each business case (Figure 12). The BMC approach provides a simple and visual tool to describe, design, challenge and invent tailored business models for the ODYSSEA products.

Establishing a BMC is an iterative process that will help gather key data about customer segments, value propositions, costs and revenue streams for the ODYSSEA products. Based on these business model analyses, financial projections can be made for estimating the global revenues from ODYSSEA products, that will secure the long-term sustainability of the platform.

In parallel, the Consortium is reviewing the individual exploitation intentions as well as claims of each partner through a MULO exercise. This exercise will highlight the value-added benefits generated by ODYSSEA, besides the user products described above. The individual exploitation claims will inform the development of a joint exploitation plan for a possible future legal entity which will keep operating the platform, products, services and observatories when the ODYSSEA project ends.

[1]MULO stands for: Making and selling an output; Using to produce another output; Licensing to third parties; and Providing other services.

What's Next

What are the challenges of 2020?

ODYSSEA Platform Development

The challenges that the platform development team will tackle in 2020 are:

a. Rebrand the ODYSSEA platform application;

b. Develop a series of user-focussed and user-defined products to reach target stakeholder user groups and improve user experience of the application for these groups. These products will require integration of the following ODYSSEA project outputs:

    a. Integrate the output produced by the high-resolution models at the pilot observatories to the platform;

    b. Integrate the output produced by sensors deployed in Observatories to the platform;

    c. Integrate additional external databases, as requested by partners through the internal survey launched;

    d. Integrate the wave power algorithm throughout the Mediterranean as a new product into the platform; more products to come in near future;

c. Take into account feedback received from participants at the ODYSSEA summer and winter-break school sessions.

ODYSSEA Sensors Deployment

a. The third glider mission will commence in Summer 2020 in Thracian Sea using the passive acoustic system to monitor the abundance and diversity of marine mammals

b. The 2nd ODYSSEA glider (featuring a novel microplastic sensor) will be deployed in the Gulf of Al-Hoceima also in the Summer 2020.

c. The deployment of the surface system and that of the Landers will be carried out in all Observatories.

d. Data from all systems will be transferred to the platform.

ODYSSEA Models Development and Implementation

a. Models developed and tested using the FEWS interface and implemented in the Thracian Sea will be replicated the other Observatory areas, i.e., the Gökova Bay in Turkey, the Gulf of Ghabes in Tunisia, the region of freshwater influence of Nile River in Egypt, the northern Adriatic and the Valencia coastal zone in Spain.

b. In parallel, models developed and tested using the Aquasafe interface will be replicated in Al-Hoceima Marine National park in Morocco and along the Israel coastal zone

c. Fishery models have been implemented for Morocco and Egypt and will be completed for the third observatory area (Gökova Bay in Turkey).

d. Data from all models will be transferred to the platform.

ODYSSEA Dissemination and Management Activities

a. ODYSSEA is now planning to organize a 3rd Summer School on the theme of "Satellite observations and Data Processing in Operational Oceanography". It is scheduled to take place in Monastir / Sousse (Tunisia) from 21-30 September 2020 in collaboration with COSPAR and with SPA-RAC from the side of ODYSSEA leading this initiative.

a. WP leaders met in May 2020. This was a virtual meeting due to the Coronavirus outbreak.

a. A discussion with all Consortium members, supported by the legal expertise of the Pearl Cohen team, has begun on the subject of ways to potential means and mechanisms for pursuing ODYSSEA activities after the end of the funding project implementation period.