



Book of Abstracts

BLUE GROWTH: CHALLENGES AND OPPORTUNITIES FOR THE BLACK SEA MARBLUE 2022

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26 – 28 October, 2022, Constanta, Romania



BLUE GROWTH: CHALLENGES AND OPPORTUNITIES FOR THE BLACK SEA MARBLUE 2022

Book of Abstracts

- **Session I: Oceanography, Marine Geology and GeoEcology**
- **Session II: Biodiversity, Ecology and Conservation of Marine Ecosystems**
- **Session III: Sustainable Use of Marine Resources**
- **Session IV: Observing the Black Sea**
- **Session V: Marine Spatial Planning (MSP), Coastal Management and Ocean Literacy**
- **Special Session: European Marine Research Infrastructures: supporting Blue Growth in the Black Sea**

Editors:

Mariana Golumbeanu, Ana-Maria Mihalcescu, Ana Serafia

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26 – 28 October 2022, Constanta, Romania**

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Session I: Oceanography, Marine Geology and Geoecology - Lectures

WATER CIRCULATION IN THE BLACK SEA: OBSERVATIONS AND NUMERICAL MODELLING

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Abstract: Understanding the circulation of water masses in the Black Sea has deepened considerably over the last thirty years thanks to a number of technological advances: remote sensing, development of automatic robots and new sensors, and rapid increase of computational efficiency. In this presentation, I reveal the contribution of satellite altimetry, Argo floats and numerical modelling to increase knowledge of general circulation, water mass formation, eddy dynamics, inter-basin exchange and deep-water ventilation. Some concepts of the dynamics of the Black Sea have been revisited, in particular in relation to climate change in recent decades. The synergy between physical processes and the biogeochemistry of the sea is addressed in the context of the possible use of machine learning to reconstruct biogeochemical states of the Black Sea euphotic zone.

Keywords: *circulation, water masses, climate change, biogeochemistry, machine learning*

MORPHOLOGY AND COMPOSITION OF FINE GOLD IN THE SEAFLOOR SEDIMENTS OF THE NORTHWESTERN BLACK SEA SHELF FOR ADDRESSING ITS GENESIS

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Abstract. The development of marine mineral resources of the seafloor is the task of the coming decades. Fine gold is a valuable mineral and is often occurring in the seafloor sediments, but its genesis remains a controversial topic, a way to resolve it is the research of the morphology and composition of mineral particles using an electron microscope.

Fine gold was researched in the Holocene-Pleistocene deposits in Northwestern Black Sea (NWBS) shelf. The electron microscopic studies of its morphology shows that it has a polygenic (terrigenous and authigenic) character. The mechanisms of the formation of authigenic gold in the Black Sea seafloor sediments have not yet been studied in detail; some experiments show that these processes can be both physicochemical and biochemical. We have much data about the divining of gold in sulfide formations associated with endogenous and hydrothermal processes in the World Ocean.

In the underwater parts of Black Sea accumulative forms (Tendra, Zatoka), formed by alongshore flows, terrigenous gold predominates with traces of transportation and with a significant admixture of silver.

The site around Zmiinyi Island is characterised by the highest frequency of occurrence in samples of authigenic gold.

The richest area of the NWBS shelf is the Dnieper underwater valley, characterized by the presence of particles of different sizes, morphologies and composition. It is a unique structure with Pleistocene coastal facies, a unique modern seafloor morphology, hydrodynamic flows, the presence of active tectonic structures and vertical (possibly endogenous) flows of matter in the sedimentary layer. The wealth of this site of NWBS shelf with fine gold and the authigenic nature of the particles suggest a significant role of deep sources of fine gold in the BS seafloor sediments.

Understanding the genesis of gold mineral particles will make it possible to predict their accumulation in certain areas of the seafloor.

Keywords: *seafloor, fine gold, morphology, genesis*

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GEOLOGICAL SEA LEVEL VARIATIONS IN THE BLACK SEA - CONTROLLING FACTOR OF THE GEO-ECOLOGICAL CHARACTERISTICS OF THE SEDIMENTARY SUBSTRATE

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Abstract. The sedimentary substrate is a key controlling factor for the bottom assemblages of various marine flora and fauna and in some circumstances even for the nekton and plankton. Due to its peculiar characteristics, during the last geological era, the Black Sea underwent several water level variations. We consider these water level variations controlled in a definite manner the type and characteristics of the shallow sediments that form the sedimentary substrate for the benthic organism and could locally influence the water column properties (and consequently the plankton and nekton). Sea level variations control how far from the seacoast is a specific area and subsequently what type of sedimentary grains are available to be deposited (type and mineralogy, grain size of the particles), and also what type of sedimentary bodies to form (beach bars, sediment waves, prodelta bodies, etc.). The dynamics of these variations is also important (the duration of low and high stands, the speed of change between low and high levels). For instance, a long period of low water level means large areas were sub-aerial and were subject of rapid and differential compaction of young sediments. Sub-aerial exposure of large parts of the nowadays submerged areas, could provide a favorable environment for the development of former marshes, peat bogs and/or alluvionary structures along paleo-rivers. The bottom morphology, modelled by the sea level variations, can favor the deposition of large amounts of organic matter, that after some geological time can be buried and be a source of shallow gases that enter the water column. The expulsion of such fluids from the sea bottom could produce carbonate structures and reefs. The above-mentioned geological phenomena are just a few that are in direct relationship with the sea level variations and are the primary controlling factors for the existence of various marine assemblages.

Keywords: *sea level variations, sedimentary substrate, controlling factor, benthos*

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MAIN PECULIARITIES OF DISTRIBUTION AND TYPES OF GAS HYDRATES IN THE BLACK SEA

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Abstract. Gas hydrates (GH) of the Black Sea (BS) can be considered not only as a promising source of energy and chemical resources, a search criterion for the identifying deposits of hydrocarbon raw materials, but also as an indicator of active fault zones, places of development of modern active geological and geochemical processes. Therefore, more attention is paid to the study of the origin and distribution of GH.

Most of the GH in the BS are located in the transition zone from the shelf to the continental slope, which is characterized by complex geomorphology of the seabed and significant tectonic activity.

Two main types of gas hydrate deposits are distinguished in the layer of bottom sediments of the deep-water part of the BS area: a) GH associated with migrating gases of tectonic faults and mud volcanoes, and b) GH of large river fans.

In the north-western part of the BS with a depth of more than 1000 m on the traverse of Sevastopol there is GH-zone of west-north-western extensions. Hydrocarbons flow through a powerful fault zone, which is the north-western extension of the sublatitude fault zone on the shelf and continental slope south of Crimea. In the shelf zone of the NW part of the BS there is hydrate-bearing zone with a thickness of more than 500 m, lying at depths up to 700 m from the bottom surface.

Analysis of the characteristics of the chemical composition, physic-chemical and physic-mechanical properties of the Black Sea gas hydrates allow us to highly evaluate this natural formation and recommend intensifying its study and modeling with the help of well-known theoretical and methodological tools, for example, the theory of complex systems, as well as with the use of the modern methods of complex substances investigations.

Keywords: *gas hydrates, distribution, structural control*

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PARAMETERIZING THE IMPACT OF CLIMATE CHANGE ON SEDIMENT TRANSPORTATION TO THE FISHING PORTS OF TURKEY IN THE BLACK SEA

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Abstract. Terrigenous sedimentation has been accelerated by the unusually high rain that fell in the Eastern Black Sea during recent years as a result the escalated sedimentation negatively affects fishing ports located in the regions. The severe sedimentation at the port entry endangers navigational infrastructure and affects the port depth required for quick and secure fish unloading, ultimately affecting the blue growth in the region. In order to examine how climate change accelerates sedimentation in three important fishing ports, Yoroç-Trabzon, Trabzon, Fındıklı-Rize, and Hopa-Artvin, all of which are situated on Turkey's Eastern Black Sea coast, we have been conducting a series of field surveys. In this research, we look at innovative ways to prevent this serious problem while calibrating sediment movement at fishing ports in the Eastern Black Sea. The preliminary findings will be shared with a detailed discussion during the oral presentation.

Keywords: *Black Sea, blue growth, fishing ports*

Acknowledgements: This study is carried out with the EU funded projects under the agreements: ICME TR09.C1-C2/298 and EU Horizon2020 no: 101000518

MAPPING ACTIVITY BASED ON ROMANIAN BLACK SEA MULTIDISCIPLINARY INVESTIGATION

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Abstract. The systematic geological mapping of the Black Sea continental shelf started in 1971 by the team of the Marine Geology Laboratory of the Romanian Institute of Marine Research, while since 1987 the mapping activities of the Black Sea continental shelf were integrated in the topics of the Geological Institute of Romania. In the aforementioned interval, maps at the scale 1:200,000 were produced. Since 1993, the mapping of the Romanian Black Sea region is performed at national level by the National Institute of Research and Development for Marine Geology and Geo-ecology (INCD GeoEcoMar), which is elaborating maps at the scale 1:50,000. For each map perimeter, multidisciplinary investigations, i.e., sedimentological, biological, geophysical, mineralogical and geochemical are achieved every year. All gathered information obtained by a detailed sample in the mapping perimeter and multidisciplinary analyses are structured on layers and using the GIS technology digital maps are produced. The Digital Terrain Model - DTM allows creating the bathymetric map, serving as base map for all other ones (sedimentological, mineralogical, geochemical and biological). The later ones are focused on benthonic and planktonic ecosystems, including their fluctuation in abundance and diversity, linked to natural and anthropic pressures.

Keywords: maps, NW Black Sea: sedimentology, biology, geophysics, geochemistry

Acknowledgements: The financial support was given by the Ministry of Research, Innovation and Digitalization, throughout the National Programme NUCLEU of INCD GeoEcoMar, Programme GEOECOBIMAR, Project PN 19200101.

NEW HEAT FLOW APPROACH FOR GAS HYDRATE DEPOSITS STUDY

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Abstract. The aim of the GEOHydrate project (Bulgarian Science Fund program “Public Challenges”; 2018-2023) is to prove the hypothesis about the existence on the seafloor of measurable temperature and heat flow (T&HF) anomalies above gas hydrates deposits (GHDs) and the possibility to restore the 4D-process of GHDs growth from these anomalies.

Materials of GEOHydrate (files’ volume ~10 TB) are data from the deepwater Danube paleodelta from 2D and 3D seismic and CSEM; in situ heat flow; hydro- and geophysicochemical measurements; scientific drilling and logging. They are results from the projects BLASON, ASSEMBLAGE, GHASS, and specially developed tools and methods for GHDs research in the frames of the German projects SUGAR I-III. The applied methods include seismic data interpretation; basin analysis; forward and inverse geothermal problems.

The results and conclusions discuss the proof of the main hypothesis of the project GEOHydrate. The new heat flow approach continues to develop in the EU project DOORS with new cruise data and interpretation. Expected practical results include a direct method for GHDs search, precision resource estimation due to the high signal-to-noise ratio of the heat flow method in comparison with seismic and CSEM methods, and a reduction in the production cost from proper planning and reducing the number of production wells.

Results contribute to mitigating the effects of 3 modern global threats - climate change, clean air, and the cost of energy. European GHDs production is the most prospect and important for Bulgaria and Romania.

Keywords: *Black Sea, clathrates, anomalies, energy, climate*

Acknowledgements: This work was supported by:

- Bulgarian Science Fund project KP-06-OPR04/7 GEOHydrate “Geothermal evolution of marine gas hydrate deposits – Danube paleodelta, Black Sea” (2018-2023);
- European Union project 101000518 DOORS: Developing Optimal and Open Research Support for the Black Sea (2021-2025).

Session I: Oceanography, Marine Geology and Geoecology - Posters

UNDERWATER NOISES PRODUCED BY SHIPS AND THEIR NEGATIVE POTENTIAL ON MARINE LIFE

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Abstract. The Romanian coastal shelf includes several important habitats for marine life, either for feeding or reproduction. These important habitats can be endangered due to human activities carried out on the sea surface or underwater. In the Black Sea, the noise produced is associated with maritime transport, oil exploitation, offshore constructions, geological investigations to map oil and gas deposits, as well as military exercises. These activities influence the aquatic environment, having the potential to injure or endanger the aquatic life. These activities need regulations and measures to minimize adverse effects on marine life (dolphins, fish, and molluscs). To solve the negative effects, it is necessary to develop a plan of good practices regarding underwater noise and respect the parameters in which it must fall, and respectively ensure the sustainability of these activities from the point of view of living marine resources.

Keywords: *underwater noise, sound pressure, sound level, marine life, dolphins*

Acknowledgements: This study has been carried out with financial support from the NUCLEU INTEL MAR Programme, funded by the Romanian Ministry of Research, Innovation and Digitization, project no. PN1926010108, no. PN19260101012, and no. PN19260101013.

TECTONIC FACTORS OF LANDSLIDE FORMATION IN THE COASTAL ZONE OF THE NORTH-WESTERN BLACK SEA REGION

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Abstract. Landslides in the coastal zone of the North-Western Black Sea Region (NWPR) are a widespread natural phenomenon. An important role is played by the structures and tectonic activity of the region, as well as its parts; sea level change; climatic, engineering-geological and anthropogenic factors.

Vertical displacements of post-Pontic deposits in the region are: uplifts in the NWBS – 75-150 m, subsidence in the Danube delta – 200-350 m, subsidence in the lower reaches of the Dnieper – 200-700 m. With the help of high-precision bathymetry, the difference in the heights of the sides of the Danube submarine canyon (80-200 m) was established. The perimeter parts of the Black Sea are experiencing active modern differentiated mosaic-block vertical movements of different signs, often with inversion, but with a general tendency to deflection towards the inner parts of the megadepression. The speed of these movements can exceed the speed of background values by tens of thousands of times. Neotectonic movements can have a decisive influence on the activation of landslide processes and zones of their possible development.

Now the anthropogenic factor plays an increasingly important role in the processes of landslide formation: Active development of the coastal zone with mass capital and cottage development without engineering and geological monitoring and without control of the removal of surface, ground and sewage flows provokes the formation of landslide-prone areas in the coastal zone of the NWBS.

The basis for creating a map of landslide zones will be the allocation of areas with the corresponding specific characteristics of morphostructures and natural relief, taking into account the parameters of anthropogenic pressure. The construction of modern detailed neotectonic maps and active diagrams of fault zones and sections is an urgent and important task in solving the problems of natural and safe environmental management in this region.

Keywords: *landslides, tectonics, SRTM relief, Black Sea, Odessa*

SOUTHERN DOBROGEA GROUNDWATER RESPONSE TO THE UPPER QUATERNARY BLACK SEA LEVEL CHANGES

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Abstract. South Dobrogea is a typical geologic platform unit, placed in the south-eastern part of Romania, with a Pre-Cambrian crystalline basement and a Paleozoic – Quaternary sedimentary cover. Four drink water sources have been identified: surface water, phreatic water, medium depth Sarmatian aquifer, and deep Upper Jurassic – Lower Cretaceous aquifer. Surface waters are represented by several springs, occurring at the base of the loess cliff, and a few small rivers, barred by coastal beaches. The phreatic aquifer, developed at the base of the loess deposits, on the impervious red clay, overlapping the Sarmatian limestones. The medium depth aquifer is located in the altered and karstified Sarmatian limestones, and discharges to the Black Sea.

The deep Upper Jurassic – Lower Cretaceous aquifer, located in the limestone and dolomite deposits, is generally confined and is affected by the regional WNW – ESE and NNE – SSW fault systems. The cyclic Upper Quaternary climate changes induced drastic remodeling of the Black Sea level and the corresponding shorelines. During the Last Glacial Maximum (MIS 2), the shoreline retreats eastwards, reaching the 100-120 m isobaths. In these conditions, the base level of surface drainage was very low. Phreatic nappe closely followed the river valleys dynamics. The Holocene Transgression (MIS 1) determined the sea level rise, up to the modern one, and probably higher. The mean rate of sea level rise was about 20 cm in 100 years, probably higher in the Atlantic Period (Climatic Optimum, 4800-7400 y BP).

Keywords: *groundwater, S Dobrogea. fluctuations of the Black Sea level, Quaternary*

Acknowledgements: Financial support of this study was provided by the EU-funded operational programme – Romania Bulgaria Cross-Border Cooperation Programme, in the period 2007-2013, through the project: Submarine Archaeological Heritage of the Western Black Sea Shelf – HERAS, MIS – ETC CODE: 578.

CONDITION OF THE SOUTHERN PART OF THE GEOECOSYSTEM OF THE KUYALNIK ESTUARY AS A COMPONENT OF THE GEOECOTON “BLACK SEA-LAND”

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Abstract. Kuyalnik estuary, which is located on the north-west coast of the Black Sea (Ukraine), has unique natural resources and is a balneological resort of state importance. This pond has formed and exists in transition conditions, among two geoecosystems, the Black Sea and land. The ecological state of the estuary worsens every year. This requires system studies of all components of the pond geoecosystem (subsystem of bottom sediments, aqua- and aerosubsystems) and the factors influencing their composition, dynamics and functioning.

Thus, based on the results of our expedition work, which was carried out in 2020, we established that bottom sediments of southern part of the estuary are represented by peloids, often with salt crystals and admixture of shell detritus, sand, and sandy loam. The average content of Zn in bottom sediments of the pond is 23.68 mg/kg, Cu – 8.64 mg/kg, Cr – 12.16 mg/kg, Pb – 4.26 mg/kg, Cd – 0.76 mg/kg.

Due to the unstable hydrological regime and intensification of evaporation processes, there is a significant drop in the level, as well as an increase in the concentration of salts in the estuary water. Pursuant to the results of our research, the pH of the water ranges from 6.97 to 8.34 units. The values of the Eh vary from 268 to 322 mV.

Over the estuary formed quite specific climatic conditions. Thus, according to other researchers, the temperature and absolute humidity of the air above the pond are slightly higher than in adjacent areas.

Among the main factors affecting the geoecosystem of the estuary, the main ones should be considered global and regional climatic changes of recent years, economic activities (illegal quarries, high degree of decomposition of dividing areas, the formation of numerous landfills on slopes, etc.) and the development of geohazards on the estuary coast (landslide, suffosion, etc.).

Keywords: *geoecology, subsystem, anthropogenic load, geohazards*

SPATIAL AND TEMPORAL VARIABILITY OF AMBIENT UNDERWATER SOUND IN THE NORTHWESTERN BLACK SEA

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Abstract. The Black Sea is one of the world's unique seas as a semi-enclosed sea, and its ports are the eastern maritime frontier of the European Union. This paper aims to complement the work as is required in the Marine Strategy Framework Directive of the European Union (MSFD) Descriptor 11 noise-related criteria for anthropogenic impulsive sound in water (D11C1) and anthropogenic continuous low-frequency sound in water (D11C2). Statistically, the Romanian ports handled about 14% of cargo traffic in Central and Eastern Europe from 2015 – to 2019. Main routes for vessel traffic in the territorial sea, the contiguous zone, and Romania's EEZ can be divided into three main areas: high vessel traffic intensity, medium vessel traffic intensity, and low vessel traffic intensity (D11C2). Furthermore, for anthropogenic continuous low-frequency sound, the variability of underwater noise has been investigated from the in-situ noise data (using the Cetacean Research and Brüel & Kjær Hydrophone systems). Current background noise levels were established for the 63Hz and 125Hz (based on frequency bands where noise from shipping is most likely to dominate over other sources), and we assessed the noise hydrospectral coverage for the summer (2019 and 2020) and spring (2022) recordings period in the Romanian Black Sea waters.

Keywords: *underwater noise, Marine Strategy Framework Directive, background noise assessment, Descriptor 11 – MSFD*

Acknowledgements: This study was funded by Assisting (sub) regional cooperation for the practical implementation of the MSFD second cycle by providing methods and tools for the D11 (underwater noise) "QUIETSEAS" Project, Contract DG Environment No. 110661/2020/839603/SUB/ENV.C.2. (<https://quietseas.eu>).

FINAL RESULTS REGARDING THE MEASUREMENT OF RN-222 IN INDOOR AIR AT NIMRD CONSTANTA, DURING 2018-2019

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Abstract. The location of National Institute for Marine Research and Development “Grigore Antipa” (NIMRD) in the coastal area, close to the Black Sea, makes the activity of measuring Rn-222 interesting both for indoor air quality and for finding out the local geological impact. The measurement of the gaseous radioactive isotope was initiated at NIMRD / Radioecology Laboratory in 2018, being continued. In this work, 8512 results obtained during the period 01.01-31.12.2019 are analyzed, compared to 2214 results obtained during the period 07.05-07.08.2018, all by the active method. For the period of 2018, a result obtained by the passive method was completed. The results obtained by the two methods are compared, as well as the identical periods from different years. Monthly, seasonal and contextual details (temperature, humidity) are analyzed. The annual average of 179.2 Bq/m³ from the year 2019 shows that we are below the legal limit of 300 Bq/m³, but the high value of the average deviation (+146 Bq/m³) signals large jumps between the individual results, recommending detailed analyses. Radon monitoring is still necessary, to avoid the accumulation of the radioactive gas, through appropriate and timely measures, where applicable. Thus the national and European legal requirements in the field are met.

Keywords: *radioactivity, indoor radon, Romanian coastal zone, Black Sea*

Acknowledgements: Dr. Codruț Cheresteș/DOSITRACKER, for the initiation and technical support in measuring radon.

ORGANIZATION OF MICROPLASTICS DISTRIBUTION MONITORING IN MODERN SAND DEPOSITS OF ANTHROPOGENICALLY LOADED TERRITORIES

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Abstract. The last decades have been characterized by the growing accumulation of the plastic component of waste within the boundaries of the dry land with its incessant spread in the surface water areas direction. Today, plastic waste and microplastic are fixed in various quantities in all continental water bodies, seas, and oceans components (water column, bottom sediments, and biota). As evidenced by the results of targeted scientific research and world practice, beach areas are one of the most representative components of the marine environment for detecting the amount of pollution by plastic material, determining its types, origin, and ways of movement. As part of the research initiated in recent years by the SSI “MariGeoEcoCenter NAS of Ukraine” under the DOORS project, in particular regarding the distribution of plastic and microplastic in marine ecosystems, a research training ground was determined and tested within the surf zone of the city beach of Yuzhne. The main goal of these studies is to create a representative area for monitoring the characteristics of microplastic distribution in modern sand deposits and sea suspension of anthropogenically loaded areas. The uniqueness of the selected area lies in its belonging to the region of the Black Sea coast, which is characterized by pronounced natural processes of sea abrasion, the relative shallowness of the water area coastal part, the presence of steady currents, and the proximity to the areas of the Dnipro and Southern Buh rivers confluence into the Black Sea northwestern part water area.

To date, the development of practical experience and an information base, the definition of an arsenal of research methods in accordance with the developed European standards, and further integration into the interstate system of studying the distribution of plastic waste and microplastics in the Black Sea geoecosystems are among the main tasks of the MariGeoEcoCenter scientists.

Keywords: *Black Sea, plastic waste, sand deposits, microplastic.*

Acknowledgements: We especially thank the Black Sea experts for their great efforts to work on WP4 in the framework of DOORS project. DOORS (<https://www.doorsblacksea.eu/>) has received funding from the European Union’s Horizon 2020 Framework Programme for Research and Innovation under grant agreement No 101000518.

HYDRODYNAMIC MODELING OF THE WAVE'S CONDITIONS IN THE NEW EXTENSIONS OF THE CONSTANTA SOUTH – AGIGEA PORT BASIN

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Abstract. Over the last decades the marine hydrological data collections were developed with the aim of an appropriate design of the extension the new operational and multifunctional storage platforms of the Constanta Port. Currently, due to the north breakwater extension, Constanta Port offers new and different conditions for future developments. The analysis-based results of about 11 years western Black Sea basin's wave data were grounded on ECMWF data, which became input to the BOUSS2D model application for South Constanta Port Terminal.

The wave model results with existing and new port extensions were linked with the UAV observed wave heights demonstrating a good comparison of both encompassed data in the validation process of the model. As a main result, wave conditions in the new harbor facilities of Constanța South – Agigea Port were assessed for suitable extension dimensioning of berths design, for the expected wave regime in the waterfront areas.

Keywords: *Western Black Sea ports, waves propagations, numerical modelling, Boussinesq-Type wave modelling, docking conditions*

Acknowledgements: This work was carried out in the framework of the research project CLIMEWAR (CLimate change IMPact Evaluation on future WAVE conditions at Regional-scale for the Black and Mediterranean seas marine system), supported by a grant of the Ministry of Research, Innovation and Digitization, CNCS - UEFISCDI, project number PN-III-P4-PCE-2021-0015, within PNCDI III, in the continuation of the DPW contract no. 1219/01.09.2020.

CALCAREOUS NANNOPLANKTON FLUCTUATIONS IN QUATERNARY SEDIMENTS OF THE WESTERN BLACK SEA

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Abstract. One of the most important groups of primary marine producers are amongst the unicellular algae: the calcareous nannoplankton. In the NW Black Sea, the calcareous nannoplankton assemblages are only made of *Emiliania huxleyi* and *Braarudosphaera bigelowii*.

In the Quaternary, significant variation occurs in the abundance of some species including *Emiliania huxleyi*, the most widespread and cosmopolitan species since the Pleistocene. In the present, *Emiliania huxleyi* can be found in the surface-waters of the Sea of Azov, at 11‰ salinity, but also in the Red Sea, at salinity up to 41‰. *Braarudosphaera bigelowii* is also present in the Red Sea (but not in the Sea of Azov). Currently, the minimum salinity where *Braarudosphaera bigelowii* is found is approximately 17‰, in the Black Sea.

Several cores have been collected from Romanian shelf of the western Black Sea. The calcareous nannoplankton fluctuation observed in the studied cores offer information on the paleoenvironmental changes during the Late Pleistocene to Holocene interval. As anticipated, we found that Unit 3 sedimentation took place within a freshwater environment, overlapping the restricted water circulation period (lake resembling phase) of the Black Sea. The salinity in the Black Sea during the depositional interval of Unit 3 was lower than 11 ppm, the minimum salinity allowing the survival of *Emiliania huxleyi*. The continuous and persistent occurrence of both *Emiliania huxleyi* and *Braarudosphaera bigelowii* over the whole Unit 2 indicates a sharp increase of the salinity, above 17 ppm in deeper parts of the Black Sea. We assume that for Unit 2, as for the youngest Holocene Unit 1, stable marine regime settled in deeper parts of the Black Sea basin.

We present herein results of our investigations performed on calcareous nannoplankton diversity and abundance, using cores situated in the NW Black Sea region. These fluctuations are linked to surface-water salinity changes.

Keywords: *Emiliania huxleyi* and *Braarudosphaera bigelowii* fluctuation, Pleistocene-Holocen, salinity

Acknowledgements: The financial support was provided by the Romanian Ministry of Research, Innovation and Digitization, Project of Excellence in Research-Innovation, AMBIACVA, Contract No. 23PFE/2021 and PN 19 20 01 01 – Programme Nucleu.

LATE GLACIAL TO HOLOCENE PALEOENVIRONMENTAL EVOLUTION OF THE DANUBE DEEP-SEA FAN, NW BLACK SEA

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Abstract. During the Holocene, the Black Sea basin suffered a major shift from a fresh water environment to a brackish one, which is mirrored in the biotical turnover. The transition of the Black Sea from an inland lake to a marine basin during the last glacial/deglacial episode is still generating debates.

The Danube Deep-Sea Fan is one of the most developed deep-sea sedimentary structures in Europe. In 2018, in the framework of the uBiogas Project (24PCCDI/2018), several cores were acquired from the Danube Deep-Sea Fan area for investigating the processes that led to the formation and accumulation of methane. In this study, high resolution microfaunal analyses coupled with sedimentological and calcium carbonate (CaCO₃) ones, were performed on two Kullenberg gravity cores.

The cores were collected from two secondary canyons situated to the east of the Danube Canyon, from 655,7 m (MN183_3_GC_1) and 1315 m water depth (MN183_8_GC_1). In both studied cores, three stratigraphic units were identified: the youngest Unit 1 (Coccolith Mud), Unit 2 (Sapropel Mud) and the oldest Unit 3 (Lacustrine lutite). The glacial cold period is marked by the presence of the cold-water ostracod species. The cores contain a reddish-brown clay and silt interval belonging to the post-glacial melt-water pulse of the Heinrich Event 1. In the upper part of the cores, in Unit 1, a brackish ostracod assemblage, with low diversity and abundance was identified. This interval is characterized by the presence of polyhaline ostracods with Mediterranean origin. The ostracods from this assemblage tolerate salinities comprised between 17-21 ‰ and characterize a sub-littoral environment.

The aim of this study is to decipher the paleoenvironmental and paleoecological conditions by the integration of the fossil record with the CaCO₃ values. Detailed micropaleontological studies, based on ostracod and foraminifera analyses, are also presented herein.

Keywords: *ostracods, foraminifers, reddish-brown clay*

Acknowledgements: The financial support was provided by the Romanian Ministry of Research, Innovation and Digitization, Project of Excellence in Research-Innovation, AMBIACVA, Contract No. 23PFE/2021 and Project PN III PED uBiogas, contract no. 24PCCDI/ 2018.

CONCERNING THE PROBLEM OF THE BLACK SEA GEOECOSYSTEM IMPACTING ON THE NORTH BLACK SEA COAST POPULATION

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Abstract. Understanding and recognition of the importance of the impacts of the Black Sea Geoecosystem (BSGES) on the population of Black Sea Coast (BSC), among involved in the study of Black Sea (BS) problems scientific community, are limited. This is often the reason for restraining the use of the system approach as one of the tools for implementing the theory of ecosystem services not only in the development applied aspects of Earth sciences, but also in the regional environmental, economic and social policies.

From the theoretical and methodological positions of marine geoecology, it is shown that the specificity of the impact on the BSC population is largely determined by the peculiarities of the composition, properties, dynamics and functioning of the BSGES, determined by the synergy its largest geological (GESUS), aquatic and aerial subsystems

On the basis of previous theoretical developments, the authors made an attempt to investigate the practical side of the problem, the essence of which is stated in the title of the report, and to establish certain effects of the influence of BSGES, in particular its GESUS, related to the identification of the role of the EP in providing the population of the BSC with natural resources, comfortable spaces and places of residence, other ecologically, economically and socially significant "products, goods".

The role of abiotic factors in providing ES to the population of the BSC was considered, a list of BSGES ES was created, and their mapping was carried out. As a basis, the original developments, in particular, the author's scheme of geoecological zoning of the Black Sea shelf of Ukraine were used. It is shown that the geoecosystems of the estuarine and transition zones of the Danube, Dniester and Dnipro-Bug districts provide the largest number and variety of BSGES ES are impacting on the population of the BSC.

Keywords: *marine geoecology, ecosystem services, abiotic factors, estuarine zones*

DETECTION OF SULPHUROUS SUBMARINE SPRINGS IN MANGALIA AREA BY GEOPHYSICAL METHODS

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Abstract. Sulphurous springs are well known in Mangalia area on shore, near shore in coastal bays and also in the shelf area. For the habitat protection which contains the sulphurous springs a Site of Community Importance (ROSCI-0094) was established in 2007. The area comprised first mainly by the protected bays by the embankments near shore, and was later enlarged up to 40 meters water depth.

The sulphurous springs near shore or in very shallow water can be easily observed because of the specific change in sea water color whilst the ones in shelf area were observed by divers. While it is not easy to map the springs with the help of divers the geophysical method coupled with water chemistry can be employed for this task.

In 2021 in the framework of National Core program GeoEcoMar researchers carried out measurements offshore Mangalia aiming to detect the underwater springs. A Norbit iWBMSH multibeam and a Picarro G2301 gas analyzer were used for these measurements. The multibeam has the capability to measure the backscatter of sediments and water column and can detect gas bubbles or changes in water temperature associated with underwater springs. The gas analyzer detects the dissolved gases in near surface sea water, thus providing a rough estimation of order of magnitude of the spring gas emissions.

By coupling geophysical measurements with detection of CO₂ and CH₄ gases from seawater with the gas analyzer we can provide a good mapping of distribution of underwater springs thus helping to a better understanding of underwater geological morphology and associated processes.

Keywords: *sulphurous submarine springs, Mangalia, Romanian shelf, bathymetry*

Acknowledgements: The research was carried out in the framework of the project PN-1920-0202 funded by Romanian Government through Ministry of Research Innovation and Digitization within the National Core Programme.

EXTREME WAVES CONDITIONS AT THE ENTRANCE OF CONSTANTA PORT

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Abstract. The aim of the present work is to evaluate the extreme waves propagation at the entrance of Constanta maritime port area, as well as the impacts on port operations. The wave propagation modeling considered the measured bathymetry of the harbor in the area of interest, updated port extensions layout, measurements and digitized bathymetric maps. For the selected offshore waves directions, considered for the harbor entrance area, the incident waves of maximum impact and the peak period values corresponding to the extreme heights of the significant wave at different return periods were calculated. In this regard, it was used a mild-slope wave propagation numerical model. The model provided quantitative evaluation of the vulnerability induced by the wave agitation on the port developing areas and an overview on hydrodynamic conditions which are the basis for various shelter facilities developments in Constanta Harbor, in extreme events circumstances.

Keywords: *maritime ports, waves propagations, extreme conditions, return periods, wave modeling*

Acknowledgement. This work was carried out in the framework of the research project CLIMEWAR (CLimate change IMPact Evaluation on future WAVE conditions at Regional scale for the Black and Mediterranean seas marine system), supported by a grant of the Ministry of Research, Innovation and Digitization, CNCS - UEFISCDI, project number PN-III-P4-PCE-2021-0015, within PNCDI III.

Session II: Biodiversity, Ecology and Conservation of Marine Ecosystems - Lectures

INITIATIVES, CHALLENGES AND OPPORTUNITIES FOR MARINE BIODIVERSITY RESEARCH AND CONSERVATION, TO DELIVER BENEFITS FOR HUMANS

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Abstract. Marine biodiversity, functions and processes at sea are central for ecosystem services delivering (provisioning, regulating and cultural). It is known that a healthy ocean (i.e. ocean in good environmental status) is able to deliver more ecosystem services than a degraded ocean, resulting in more goods and benefits for humans, including better health. To assess the status of marine systems, different legislation and initiatives are in place at global (e.g. United Nations Sustainable Development Goals, Biological Diversity Convention), international (e.g. European Marine Strategy Framework Directive; Biodiversity Strategy 2030), regional (e.g. Regional Seas Conventions), or national. These initiatives should achieve good status for our seas, but, at the same time, governments are promoting blue economy, which can prevent achieving good status due to multiple human activities and pressures, which result in multiple effects on the marine ecosystem elements. For assessing those effects, we can use existing methods and tools, as well as develop new ones, using the different opportunities that the research programmes are providing us. In this abstract, I will give an overview of the initiatives, challenges and opportunities for marine biodiversity research and conservation, to deliver benefits for humans.

Keywords: *Biodiversity, Marine Strategy Framework Directive, conservation, challenges for research, ocean status*

USING ENVIRONMENTAL DNA (eDNA) TO MEASURE THE ROMANIAN BLACK SEA BIODIVERSITY

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Abstract. eDNA or environmental DNA is a promising alternative method for assessing and monitoring aquatic biodiversity. Monitoring eDNA in the sea is a relatively new genomic tool to simultaneously survey microbes and species larger than microbes (algae, fish, invertebrates, marine mammals) in marine communities without visualization or capturing them, allowing the census of species on a global scale in near real time. Despite of progress registered in eDNA monitoring of the biodiversity of the world’s seas and oceans, no such research has been undertaken in the Romanian Black Sea. Here we present the results of the first study designed to estimate species diversity (from microbes to mammals) of the Romanian marine ecosystem community based on eDNA. The study aims to unveil the “unseen” diversity of micro- and macrofauna inhabiting the Black Sea ecosystem along the Romanian coast, by using DNA metabarcoding approach. For this study, seawater and sediment samples were collected during 2020 - 2021 from the Romanian coastal locations for eDNA extraction and sequencing with metabarcoding using COI, 18S and 16S rDNA primers. The resulting sequence information were used for eDNA taxonomic assignment. eDNA detected 150 prokaryotic and 750 eukaryotic species (pelagic and benthic), covering the holistic biota from unicellular to multicellular marine organisms. Furthermore, the eDNA approach made it possible to identify high diversity of eukaryotic microorganisms (fungi, protist, algae, ciliates), which included a substantial number of species previously unreported for the Romanian coast (134 species of fungi and 77 species of tintinnid). For the first time, this study illustrated that eDNA provided a substantial supplement to traditional biodiversity monitoring in Romanian Black Sea coast (over 700 eDNA identified eukaryotic species versus 300 species reported by classical methods) and thus we recommend to include eDNA methods to conventional national monitoring program in the future.

Keywords: *environmental DNA, biodiversity assessment, monitoring, Black Sea, Romanian sector*

Acknowledgements: This research has been carried out with financial support from the NUCLEU Programme (INTELMAR PN-19260201).

INVASIVE SPECIES AND BLUE GROWTH – A CHALLENGE

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Abstract. Invasive species represent one of the most important environmental problems facing human society today. The unprecedented development of international exchanges at sea, on land and in the air has also led to an explosion of the phenomenon of invasive species. And, last but not least, global climate warming enhances the ability of some invasive species to acclimatize quickly in new territories. Examples can be given both between terrestrial species - and the case of the tiger mosquito *Aedes albopictus* is the most obvious - as well as between marine species. Although it is an isolated sea, the Black Sea is a sea basin strongly affected by marine invasive species. Blue Growth implies a set of strategies and methods of socio-economic development that must take into account sustainability aspects and the issue of invasive species is one that should not be ignored. Some of these species have a major economic impact - both negative and positive, as a food source, so their presence in coastal waters must be an aspect that should not be ignored for any socio-economic development trend.

Keywords: *invasive species, blue growth*

MECHANISMS OF TROPHIC TRANSFER OF CONTAMINANTS IN MEDITERRANEAN FOOD WEBS AND PERSPECTIVES FOR FURTHER STUDIES IN THE BLACK SEA

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Abstract. Total mercury (THg) and especially its methylated species (MeHg) which represents more than 90 % of total Hg in most fishes, are toxic chemicals that contaminate humans via the consumption of seafood. In the Mediterranean Sea a recent estimation indicated that marine biota contains ~ 4.68 Mg of THg and ~2.22 Mg of MeHg.

To better understand the integration of contaminants in marine systems, it is essential to consider their integration and transfer into the first trophic levels. This is the main objective of the ANR CONTAMPUMP (ANR-19-CE34-0001) project in the Mediterranean Sea. The highest bioconcentration of THg ($K_d = 4.2 \times 10^6$) occurs between water and the smallest phytoplankton cells, because of their high surface/volume ratio, which induces large exchange surfaces. High biomass of plankton may locally induce dilution processes, but this occurs rather rarely in the oligotrophic waters of the Mediterranean Sea.

A recent CNRS EC2CO project (PARME) analyzed THg and MeHg in a real food web in the Gulf of Lions taking into account food web characteristics. Bioaccumulation of THg and MeHg in higher trophic level organisms such as fishes is mainly related to species diet, ontogenetic changes in diet and increasing age and size. However, other biological (weight, sex, life duration, growth rate, reproduction, metabolism, proximal composition, detoxification mechanisms, etc.) and environmental (depth, habitat, temperature, primary production, etc.) factors should also be considered. Prey selection of species strongly influences the contaminant fluxes and their biomagnification with trophic levels (TMF) (in the NW Mediterranean Sea food webs $TMF_{THg} = 2.53$; $TMF_{MeHg} = 3.41$).

The relative importance of these processes may be different in the eutrophic waters of the Black Sea, where the higher phytoplankton cell size and biomass may contribute to a biodilution of contaminants and a lower trophic transfer in the muscles of fishes.

Keywords: *food web, bioconcentration, bioaccumulation, biomagnification, Mediterranean and Black Sea*

MORPHOLOGICAL IDENTIFICATION OF INTESTINAL HELMINTHS ISOLATED FROM TURBOT ALONG THE BULGARIAN BLACK SEA COAST

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Abstract. Turbot (*Psetta maxima*) is one of the most important fish species being fished in the Black Sea countries. Internal helminthes are widespread among turbot in the Bulgarian Black Sea coast. However, description of this infection is relatively limited and they have not been reported in the scientific papers. The current study described the morphological identifications of *Bothriocephalus scorpii* and *Anisakis simplex*. The aforementioned parasites were characterized morphologically based on a microscope observation and comparing with data available in the reference. The present study represents the first report of internal helminths in Turbot (*Psetta maxima*) from Bulgarian marine waters.

Keywords: *Anasakis spp.*, *Bothriocephalus spp.*, Bulgarian Black Sea, helminths, turbot

Acknowledgements: This work was supported by Agriculture Academy, Bulgaria, Project number: G167/2021.

ARE DIFFERING VIEWPOINTS AMONGST KEY ACTORS INFLUENCING IMPLEMENTATION OF KEY EU MARINE ENVIRONMENTAL POLICIES? CASE OF STRICTLY PROTECTED AREAS

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Abstract. The transboundary nature of marine ecosystems and their more difficult accessibility create challenges for the conceptualisation of effective marine conservation, because of the complexity of the marine functioning and often unclear competences. Marine conservation thus often relies on (international) policies. The EU environmental policies are known for their high ambition levels, however, their implementation has been subpar so far. This study investigates the viewpoints and social constructions of marine nature and wilderness in the EU seas and whether those help explain why the implementation of EU marine environmental policies has been incoherent and uncoordinated so far. The social constructions and nature imaginaries were investigated amongst key actors in policy implementation from national to the EU and Regional Sea Conventions levels, using semi-structured interviews, policy analysis, and a Q study. The results show a variety of divergent viewpoints that frame marine issues in different ways, resulting in different interpretations of common policies and definitions, as well as a variety of policy implementation priorities. While the actors aligning to the viewpoint of needing to sustainably use the seas are coherent in their problem and priority framing, arguing for continued, but more planned use of marine resources, the actors supporting more environmental protections are internally fractured. There are four distinct protection viewpoints based on personal worldviews and perceptions of the environmental crisis, thus supporting anything from extensive strict protection to flexible approaches with predominance of multiple-use marine protected areas and focussing on reducing external environmental stressors. The variety of different values associated with marine nature, wilderness, and the role of EU policies is thus likely to influence the way common EU policies will be implemented in the future and by extension their effectiveness.

Keywords: *EU Biodiversity Strategy 2030, strictly protected areas, marine nature, wilderness, EU policies*

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USING FOULING COMMUNITY PARAMETERS FOR MONITORING THE SEA COASTAL ZONE

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Abstract. It is known that monitoring objectives are biological systems and environmental factors that affect them. However, taking into consideration the multiplicity of these factors, as well as the different level of their combined influence, it is very difficult to obtain a complete environment characterization by measuring them. The solution to this problem may lie in the analysis of certain biological responses observed in living systems as an integral response to the impact of several factors.

The most suitable solution for this kind of monitoring is a marine coastal fouling community formed by an attached species that is an ecosystem engineer. The parameters of such biological system can be used as complex indicators for marine status environment, since monitoring the state of the community is much more informative than regular observations of individual species included in it. The fouling community is convenient for this procedure due to its relative availability, the possibility of obtaining sufficient data for performing correct statistical processing; acceptable cost of methods for obtaining primary information that do not require the use of sophisticated equipment.

One of the most accessible characteristics of the fouling community state are represented by total abundance and species biomass included in its composition. For monitoring purposes, the determination of the dimensional characteristics of individual species is also suitable. The analysis of the ratio of steno- and eurybiontic species and r-K strategists also reflects the degree of influence of environmental factors. Particular attention should be paid to the development of indicator and alien species of the community.

Thus, the most accessible parameters of the fouling community integrally reflect the state of the environment and can be used for monitoring the coastal zone of the sea.

Keywords: *biological responses, environmental factors, indicators*

Session II: Biodiversity, Ecology and Conservation of Marine Ecosystems - Posters

OVERVIEW OF THE MICROALGAL BLOOMS OCCURRENCES IN THE ROMANIAN BLACK SEA WATERS DURING 2021

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Abstract. The 2021 Romanian Black Sea waters' microalgal blooms overview was based on the biweekly surface samples collected from the Mamaia' Bay station (111 samples) and the samples collected during the June scientific cruise on the monitoring network profiles which covered the variable salinity, coastal and marine waters from Sulina to Vama Veche (39 samples). During 2021, eight phytoplankton species recorded densities of more than one million cells per liter, of which three species only in the Mamaia' shallow waters. Although the magnitude of these phenomena was much lower this year compared to the maximum value of 2019 ($8.65 \cdot 10^6$ cells/L) and 2018 ($23.44 \cdot 10^6$ cells/L), their frequency increased, being present in each season. From the analysis of the physico-chemical parameters, the main factor that determined these blooms was the nutrients enrichment from different sources such as river input, upwelling, land-based pollution sources (wastewater treatment plants). Added to this cause is the sea water temperature increase, more pronounced in recent years. Another important factor was the salinity decrease, especially due to the Danube's hydrological regime, which together with the mentioned factors favoured the blooms of some freshwater species (*Pseudanabaena limnetica*, *Limnolyngbya circumcreta*, *Spirulina* sp. and *Skeletonema subsalsum*). We are thus witnessing ecosystem's alteration controlled by climate change specific elements which require special measures to reduce nutrients from human activities.

Keywords: *microalgae, blooms, climate change, Black Sea*

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OVERVIEW OF THE CHLOROPHYLL A VARIATION IN THE ROMANIAN BLACK SEA SHALLOW WATERS OF MAMAIA DURING WARM SEASON 2020-2021

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Abstract. Chlorophyll is a light-harvesting green pigment found in most photosynthetic organisms including phytoplankton. The concentration of chlorophyll *a* is used as an indicator to assess the state of the coastal, marine and variable salinity waters. Following the analysis of 97 samples collected from the Mamaia Bay coastal station in the warm season of 2020 and 2021, the concentration of chlorophyll *a* varied between 0.73 and 25.98 µg/L in 2020, with higher values compared to those recorded in 2021 (0.33 and 11.99 µg/L). The average value of the chlorophyll concentration recorded during May-October 2020 (2.51 µg/L) is slightly lower than in 2021 (2.71 µg/L). The assessment of the ecological status of the coastal waters of Mamaia Bay according to the Marine Strategy Framework Directive based on the chlorophyll *a* indicator (the 75th percentile of the values recorded in the warm season), suggested a good ecological status in both years. Continuous monitoring of chlorophyll *a* concentration in seawater represents an easy to measure indicator, essential for the assessment of the marine ecosystem quality according to the requirements of the European directive MSFD (Marine Strategy Framework Directive).

Keywords: *chlorophyll a, MSFD, coastal waters, Black Sea*

Acknowledgements: This research has been carried out with support from “Ovidius” University of Constanta in collaboration with National Institute for Marine Research and Development "Grigore Antipa", Constanta.

VARIATIONS IN MICROZOOPLANKTON (TINTINNID CILIATES) COMMUNITY ALONG THE ROMANIAN BLACK SEA AREA IN 2021

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Abstract. Here is the summary of the results from 2 cruises performed in May-June and August-September 2021 in the Romanian Black Sea area. A total of 23 tintinnid species were identified in 2021, the taxa number and distribution recording variations from an investigated period to another. From the 20 species identified in the first cruise, 19 were identified in the 0 m layer, while only 8 species were identified in the 10 m layer. The species *Eutintinnus* sp. and *Salpingella decurtata* were found exclusively in the 10 m layer. *Tintinnopsis cylindrica* represented 74% of the mean biomass of tintinnid's community in May-June, the best quantitative representation being recorded in the northern sector of the Romanian coast. The second cruise led to the identification of a microzooplankton community consisting of 16 species: 16 in the 0m layer and 9 species in the DCM (Deep Chlorophyll Maximum) layer. *Amphorellopsis acuta* represented 91% of the mean biomass of tintinnid's community in August-September. Tintinnids were best represented from the quantitative point of view in P10 station which was located in the offshore area.

Keywords: *variation, tintinnid ciliates, Romanian Black Sea*

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DISTRIBUTION AND SEASONAL DYNAMICS OF MESOZOOPLANKTON FROM THE ROMANIAN BLACK SEA DURING 2013-2020

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Abstract. The analysis of the mesozooplankton community from the Romanian Black Sea coast has revealed variations both qualitatively and quantitatively. Regarding the identified mesozooplankton species, a decrease in the species number according to the season was observed, with a maximum of 25 species in the warm season and a minimum of 15 species in the cold season. The Simper analysis for the warm and cold season highlighted the high contribution that the nonfodder component represented by *Noctiluca scintillans* had in the warm season, in the cold season being less represented. The mesozooplanktonic fodder component in the warm and cold season of 2013-2020 showed variations of density and biomass, copepods and the meroplanktonic component being best represented in the warm season. Worth noting in the warm season is also the group of cladocerans that recorded higher average values of density and biomass, unlike in the cold season where they were very poorly represented. Other groups were better represented also in the warm season, showing a decrease in terms of abundance and biomass in the cold season.

Keywords: *analysis, species, density, biomass, variations*

Acknowledgements: This research has been carried out with financial support from the NUCLEU Programme (CEMAR 2012-2015, PROMARE 2016-2017, SIMAR 2018, INTELMAR 2019-2022) and from the Integrated monitoring program of the marine ecosystem at the Black Sea according to the requirements of art. 11 of the Marine Strategy Framework Directive (2008/56/EC).

THE ZOOPLANKTON COMPOSITION, DISTRIBUTION, AND ASSESSMENT OF THE QUALITY STATUS OF PELAGIC HABITATS OF THE ROMANIAN BLACK SEA WATERS

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Abstract. The paper presents the mesozooplankton population characteristics and distributional patterns within the coastal, transitional, and marine waters of the Romanian Black Sea shelf in August 2021. The assessment of water bodies' quality status based on the zooplankton indices agreed for the Black Sea according to the Water Framework Directive (2000/60/EC) and Marine Strategy Framework Directive (2008/56/EC), showed that 70.97% of stations were in GES, while the remaining in non-GES. A new index, namely the Plankton Index (IP), aiming to integrate the results of all three indices, has been proposed. At a threshold value of 90% set for the IP, the overall quality status of the water bodies of the Romanian shelf in August 2021 did not achieve GES. The results also point out the utility of zooplankton as a biological indicator for delimiting the pelagic habitats due to its features strongly linked with the environmental variables.

Keywords: *pelagic habitats, MSFD zooplankton-based indices, Plankton Index (IP), water quality status assessment*

Acknowledgements: The study was financially supported by the Romanian Ministry of Research in the framework of the CORE Programme projects - PN19200302, PN19200102 and P19200101.

ICHTHYOPLANKTON DISTRIBUTION AND ABUNDANCE IN RELATION TO MACROZOOPLANKTON COMMUNITY ALONG THE ROMANIAN BLACK SEA COAST

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Abstract. Ichthyoplankton and macrozooplankton assemblages were studied from samples collected from the Romanian Black Sea coast during 2020 – 2021. The reproduction of the fish species and the development of the larvae is closely related to the environmental conditions, the breeder's stock state, the trophic base, but also prey-predator relation. Ichthyoplankton analysis should not only address the simple description of the presence or absence of species, but it should also focus on the type and nature of the interactions established between the populations and their environment. The qualitative structure of ichthyoplankton in 2020-2021 included eggs and larvae of *Engraulis encrasicolus*, *Scorpaena porcus*, *Merlangius merlangus*, *Sprattus sprattus*, *Trachurus mediterraneus* and *Mullus barbatus*, the dominant species being anchovy - *Engraulis encrasicolus*. The macrozooplankton community was represented by four species: *Aurelia aurita*, *Pleurobrachia pileus*, *Mnemiopsis leidyi* and *Beroe ovata*. Macrozooplankton blooming led to structural and functional transformations in the ecosystem, having direct and indirect effects on ichthyoplankton. Following the quantitative analysis of the collected samples, it was found that in the areas where the macrozooplankton recorded high densities values, the ichthyoplankton density was low.

Keywords: *analysis, eggs, larvae, interactions, prey-predator*

Acknowledgements: This research has been carried out with financial support from SIPOCA-608 Project "Improving the capacity of the central public authority in the field of water management in terms of planning, implementing and reporting European requirements" co-financed by the European Social Fund (ESF) through the Operational Programme "Administrative Capacity" 2014-2020.

CULTURE TECHNIQUES FOR *ACARTIA CLAUSI* FROM THE ROMANIAN BLACK SEA COASTAL WATERS

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Abstract. As copepods are an important food source for most fish larvae, there is a continuing interest in developing techniques for culturing marine copepods as live food in aquaculture and testing organisms in acute toxicity tests. Studies have shown that several species of calanoid copepods can be used successfully in aquaculture, acclimatized and grown in the laboratory over several generations. However, significant difficulties in cultivating calanoid copepods in high quantities were reported. They are related to their low tolerance to changes in water quality and reduced production capacity compared to other taxonomic groups. Therefore, working methods for obtaining viable cultures of calanoid copepods are dependent highly on the local environmental context. Until now, such a method has not been implemented for calanoid species from the Romanian Black Sea coast. This paper details the methodology we adapted and used for achieving a viable *Acartia (Acartiura) clausi* (Giesbrecht, 1889) culture using specimens collected along the Romania Black Sea coast. The method was successfully tested. Reproduction and egg hatching occurred under laboratory-controlled conditions, and viable individuals of *A. clausi* were obtained. Our results open the possibility of integrating this species in toxicity tests and food production for the marine aquaculture industry.

Keywords: *Acartia clausi*, copepod, Black Sea, culture

Acknowledgements: The study has been supported by NUCLEU Program (INTELMAR), funded by the Ministry of Research, Innovation and Digitization, financing contract no. 45N/14.02.2019, project PN19260202 Ecological, ecophysiological and biotechnological research of ecosystems in Romanian marine waters - Phase 12: Studies on the culture of copepods under controlled laboratory conditions; breeding methodology and egg hatching success according to abiotic and biotic conditions.

IMPLEMENTATION OF THE ACUTE TOXICITY TEST ON MARINE COPEPODS IN THE SPECIFIC CONDITIONS OF THE BLACK SEA

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Abstract. Ecotoxicity tests are designed to determine specific concentrations of chemicals that have a measurable effect on a target organism. The environmental context may influence the effects of pollutants. Therefore, the ecological risk assessment should include relevant environmental characteristics for each region so that the toxicity test gives accurate results on the tested organism. To our knowledge, no such experiments are conducted on marine copepods from the Romanian Black Sea coast. This study aims to develop the acute toxicity test on marine copepods under the specific conditions of the Black Sea and test it. To validate the protocol, we used individuals of *Acartia clausi* in copepod stage V, a widespread marine copepod along the coastal regions of the Black Sea. Individuals of *A. clausi* were exposed at various concentrations (0; 0.06; 0.17; 0.49; 1.4; 4 mg/L) of 3.5 dichlorophenol (a reference substance) at 20° C for 48 hours. Considering the literature recommendation, we tested the toxicity of zinc, which can reach significantly higher than the normal concentrations, especially in coastal regions under the influence of river waters, domestic and industrial wastewater discharges, and ports. The main purpose was to assess the impact of this substance on marine copepods and develop a proper methodology for the monitoring programs along the Black Sea coast. The LC50 for zinc in our case study was 0.785 mg/L. Various studies have shown values of LC50 for zinc, between 0.29 and 4.09 mg/L for different species of marine copepods and 0.95 mg/L for *A. clausi*. Our results demonstrate the applicability of such an ecotoxicity test for monitoring purposes of water quality in the Black Sea conditions.

Keywords: *Acartia clausi*, concentration, pollutant, laboratory, chemicals

Acknowledgements: The study has been supported by NUCLEU Program (INTELMAR), funded by the Ministry of Research, Innovation and Digitization, financing contract no. 45N/14.02.2019, project PN19260202 - The project: Adaptation of the experimental methods for evaluating the ecotoxicity of pollutants to the specific conditions of the Black Sea, in support of decision-making by the interested parties. Phase: 1 - Obtaining the culture of *Acartia clausi* from organisms collected from the Romanian coast of the Black Sea and Phase: 2a - Performing acute toxicity tests on organisms from the *Acartia clausi* culture.

MODELLING THE DYNAMIC PROCESSES OF THE BLACK SEA ECOSYSTEM REGARDING THE CAUSAL RELATIONSHIPS BETWEEN ABIOTIC AND BIOTIC COMPONENTS

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Abstract. The study's aim is to assess the relationships between abiotic factors, phytoplankton and zooplankton from the Romanian Black Sea coast by using qualitative and semi-quantitative models facilitate the understanding of ecosystem processes. The water and biological samples were collected in expeditions organized in the warm season (May-September) of 2008-2018, within the monitoring network, from 39 sampling stations in variable salinity, coastal and marine waters. Over the entire analyzed period, an increasing trend in temperature and salinity was observed, the phytoplankton community was represented by 298 species belonging to 16 taxonomic classes and the zooplankton component recorded a number of 32 taxa, copepods representing the bulk of the community. Based on the collected data and by using Machine Learning algorithms from ArcGIS Pro, we obtained the models and proliferation scenarios of phytoplankton and zooplankton. The importance of water temperature was observed, being the dominant variable in the case of copepod's density (36%) and other zooplankton groups (30%) but not influencing *Noctiluca scintillans* blooms. Salinity variations greatly influenced the normal proliferation of phytoplankton, while its extensive blooms were due, to the greatest extent, to phosphate concentrations. Two scenarios for predicting the development of phytoplankton and zooplankton were analysed: Business as usual, in which temperature increased by 0.4°C, salinity increased by 0.84‰ and nutrient concentrations remained constant and the Mild scenario in which sea water temperature increased by 0.8 °C until 2050 and salinity by 1.68 ‰. According to the scenarios run, it turned out that water temperature did not influence the nonfodder zooplankton (*Noctiluca scintillans*), unlike salinity and nutrients that facilitated the proliferation of phytoplankton and implicitly led to the growth of the dinoflagellate *Noctiluca scintillans*.

Keywords: *abiotic, phytoplankton, zooplankton, scenario, blooms*

Acknowledgements: The study has been supported by NUCLEU Program (INTELMAR), funded by the Ministry of Research, Innovation and Digitization, financing contract no. 45N/14.02.2019, project PN19260202.

BENTHIC AND PELAGIC HABITATS AT THE ROMANIAN BLACK SEA COAST

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Abstract. Most of the ocean floor is still not explored (Wölfl et al., 2019), therefore mapping the seabed is currently an essential task for maritime spatial planning and implementation of strategies for sustainable management and protection of the coastal environment. This study has been set up to identify and describe the distribution of the main benthic habitats of the Romanian Black Sea coast using the revised EUNIS 2021 classification system and based on the most up-to-date references and the unpublished sources that were available to the authors. The broadscale habitats is the result of the spatial combination of biological zones and benthic communities' distribution. 32 broad scale habitats have been agreed for the Romanian Black Sea, of which 19 coastal, 12 soft bottom circalittoral habitats, and two for bathyal and abyssal, respectively. Our study has contributed to the improvement and updating of knowledge in terms of biodiversity and habitat distribution. Over the last 15 years, GeoEcoMar has considerably intensified the research effort managing to obtain information from more than 400 stations.

Some considerations on the steps forward and current gaps on the classification and evaluation of pelagic habitats at the Romanian littoral will be also presented. We summarized and performed a critical analysis of quality assessment indicators of pelagic habitats currently used at European level. According to recent researches, both the benthic and pelagic ecosystems have witnessed a period of improvement, exemplified by the reappearance of some species, which used to be abundant in the period of ecological stability. The results showed an increased macrobenthic diversity comparative with the period of the '90s.

Keywords: *Mapping benthic habitats, ecological state, indicators*

Acknowledgements: The study was financially supported by the Romanian Ministry of Research in the framework of the CORE Programme project - PN19200302 and EASME/2020/OP/0006: "European Marine Observation and Data Network (EMODnet)" "Lot 3 Seabed Habitats".

USING NATIVE TAXA TO BOOST ECOLOGICAL RESTORATION OF COASTAL HABITATS

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Abstract. The health of the marine environment is also dependent on the health of the terrestrial coastal ecosystems. There is an urgent need for developing methods that are feasible, low-cost, environmentally friendly and sustainable, for the restoration of lands degraded as a result of intensive economic activities. We assessed the effectiveness of using native taxa to colonise/stabilise polluted areas, by inventorying the communities inhabiting different types of habitats (i.e. more or less densely vegetated) and considering a gradient of disturbance (i.e. sites that are currently under exploitation vs. sites where the exploitation has ceased). Our study focused on the structural and functional diversity of the investigated communities, and on the identification of plant species and invertebrates that are easily dispersed and tolerant to intensely polluted areas. We considered such taxa as viable options for ecological restoration, when dealing with similar types of degraded habitats. Our recommendations provide support to practitioners and environmental managers, facilitate the decision-making process and will be further developed in experimental setups. The research was carried out as part of a project that focuses on novel technologies for the ecological remediation of tailing dams.

Keywords: *plants, invertebrates, degraded, polluted areas, restoration*

Acknowledgements: This work was supported by a grant of the Romanian Ministry of Education and Research, CCCDI – EUFISCDI, project number PN-III-P2-2.1-PED-2019-2584, within PNCD III.

CURRENT INFORMATION ON THE DISTRIBUTION OF THE CRITICALLY ENDANGERED RED ALGA *DASYA BAILLOUVIANA* (S. G. GMELIN) MONTAGNE, 1841 ALONG THE ROMANIAN BLACK SEA COAST

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Abstract. Along the Romanian Black Sea coast, red algae, along with brown ones, were the most affected over time by the cumulative action of unfavourable natural and anthropogenic factors, hence the current qualitative decline. Consequently, a number of 10 species of red and brown algae are included in the current Red List of endangered marine species. *Dasya baillouviana* (S.G. Gmelin) Montagne, 1841, a red alga considered disappeared for a long period of time, nowadays Critically Endangered (according to Order no. 488/2020 published in the Official Gazette of Romania), was reported after many years near Constanta city, around the newly built dikes, in a monospecific association, at depths in the range of 0.5 – 1 m, on rocky substrate. With a last report in the 70s, currently the species seems to thrive at the base of the newly built dikes in Pescarie - Constanta area, developing a stable, small population, with a punctiform distribution, but with well-developed specimens and clearly differentiated reproductive elements. Identified after more than 50 years during summer season 2019, it was subsequently reported every year since then. The species was found with all its reproductive organs. Morphological and reproductive features are described and discussed in the current paper.

Keywords: *macroalgae, qualitative decline, reappearance, Red List*

Acknowledgements: The study has been supported by NUCLEU Program (INTELMAR), funded by the Ministry of Research, Innovation and Digitization, financing contract no. 45N/14.02.2019, project PN19260202.

RED ALGAE (RHODOPHYTA) FROM ROMANIAN BLACK SEA COAST AND POSSIBLE OCCURENCE OF NEW SPECIES

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Abstract. Phytobenthos include marine vegetation that attach to solid substrate and marine phytobenthos is made up especially of pluricellular algae of the green algae category (*Enteromorpha*, *Ulva*, *Bryopsis*), brown and red algae. Red algae represent an important component at Black Sea ecosystem, even though the number of species have decreased over time.

This paper shows the situation regarding the presence red algae at our littoral in present, compared with previous decades. We consider that a particular attention should be paid to this group, because there is a dramatic decline regarding the number of Rhodophyta, this being explained by the fact that this group has some particular preferences regarding the physico-chemical conditions of the water and is the most sensitive to pollution, even though some genera of red algae (*Ceramium*) can also develop in eutrophic waters, sometimes covering the hard substratum up to 90%.

In particular after year 2000, researches highlighted some positive signs, in terms of the physico-chemical conditions of Black sea littoral waters, which has consequences for all biota. In this regard, it is possible to notice the appearance of species not mentioned for a long time, and perhaps even the identification of some species not signaled at our seaside before.

The present paper signals the presence of some species of red algae, considered either lost for many years or never signalled at our littoral, collected from various sites along the littoral, over the last years.

Unfortunately, no exact data about their location and biomass could be achieved, as the thalli of these species were collected from the beach, teared away from the rocky bottom, so further investigations are absolutely necessary.

Keywords: *phytobenthos, red algae, Rhodophyta*

FOUR NEW SPECIES OF SOFT-SHELLED MONOTHALAMOUS FORAMINIFERA AND GROMIIDS IDENTIFIED ON THE ROMANIAN BLACK SEA SHELF

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Abstract. Based on molecular and morphological data, the current study reveals the presence of four new species for science from “soft-shelled monothalamous” Foraminifera (Saccamminidae family) and Cercozoa (Gromiidae family) for the first time in the studied areas of Sulina, Sf. Gheorghe, Portița, Constanta, Tuzla and Mangalia. Gromiids are characterized as unicellular organisms with soft test full of stercoma (consisting of organic material and clay minerals from ingested sediments), is enclosed by a proteinaceous test. The foraminiferans from Saccamminidae family are characterized by agglutinated test, which is defined by an irregular, rounded, tubular or branched agglutinated test, non-septate or with only partially subdivided interior. The investigated areas are located from North to South, belonging to the Romanian continental shelf of the Black Sea. The samples transect ranged from shallow to deep water between 19.5 and 149 m depth. The measurement campaign was conducted in 2021 with the GeoEcoMar’s research vessel Mare Nigrum. The main objective of this contribution is to present the first genetic data on two monothalamid species – Saccamminidae Family – Psammophaga Genus and two gromiid species - Gromiidae Family, identified on the Romanian Black Sea shelf. In the Black Sea, soft-shelled monothalamous foraminiferans and gromiids are poorly documented and few species have been described. The Black Sea gromiids and soft shelled monothalamous were mostly found in surficial sediments in areas of elevated organic input, suggesting that deep-sea gromiids are likely to play an important role in carbon cycling in bathyal eutrophic regions through the ingestion and degradation of fresh organic matter.

Keywords: *Benthic Foraminifera, Black Sea, Gromiidae, Saccamminidae*

Acknowledgements: The research leading to these results has received funding from the Romanian Ministry of Research in the framework of the CORE Programme NUCLEU, PN 19 20 01 02 “Multidisciplinary research in order to achieve the objectives of knowing the interactions between climate change and anthropic and effective pressures in the case of Black Sea ecosystems” carried out by GeoEcoMar.

CHEMICAL STATUS EVALUATION OF THE ROMANIAN BLACK SEA MARINE ENVIRONMENT BASED ON BENTHIC ORGANISMS CONTAMINATION

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Abstract. The use of living organisms to provide information on the quality of aquatic environments is now a widely accepted methodology for assessing contaminant bioavailability. Molluscs have developed tolerance mechanisms towards environmental stressors and can accumulate a large range of contaminants. The assessment of marine environment quality was based on heavy metals (HM), persistent organic pollutants (organochlorine pesticides – OCPs and polychlorinated biphenyls - PCBs) and polynuclear aromatic hydrocarbons (PAHs) analysis in *Mytilus galloprovincialis*, *Rapana venosa*, *Anadara kagoshimensis* species sampled during 2016 - 2020 along Romanian Black Sea coast. Toxic metals (cadmium, lead) had bioaccumulation levels below threshold values in most molluscs samples investigated. Cadmium registered few values (15%) surpassing maximum admissible levels, in all three species. Data evaluation demonstrated the maintenance of a high level of concentrations of persistent organic pollutants in the mollusc tissue, but also of the exceedances of the values that characterize the good ecological status of these compounds. Polynuclear aromatic hydrocarbons showed a declining trend and no exceeding of the maximum allowed limit for benzo[a]pyrene was recorded in the last years. In consequence, the overview assessment based on “OneOutAllOut” (OOAO) approach, considering all groups of substances, indicates a bad chemical status for this period.

Keywords: *Black Sea, chemical status, benthic organisms, contaminants, pollution*

Acknowledgements: This study has been supported by the ANEMONE project (funded by the EU under ENI CBC Black Sea basin Program 2014-2020, grant contract 83530).

**MICROPLASTICS POLLUTION IN MUSSELS
(*MYTILUS GALLOPROVINCIALIS* LAMARCK, 1819)
ALONG THE ROMANIAN BLACK SEA COAST**

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Abstract. Microplastics, an emerging pollutant in marine environments, are one of the primary environmental risks because of their bioavailability for aquatic organisms. Bivalves are of particular interest because their extensive filter-feeding activity exposes them directly to plastics present in the water column. In the present study, we investigated microplastic pollution in mussels (*Mytilus galloprovincialis*) from four sites along the Romanian Black Sea coast, between May and November 2018. The number of total microplastics varied from 18.89 to 69.89 items/individual. The highest mean abundance of microplastics per size class was observed in mussels of 2-3 cm (172.22 items), followed by those of 6-7 cm and 7-8 cm. The most common microplastics were fibers, followed by fragments. The abundance of microplastics in mussels grew with increasing length. The highest number of microplastics were recorded in summer and autumn in sites with intensive human activities. Our results suggested that the number of microplastic exhibited a high level in mussels and was closely related to the contamination of the environment. The presence of microplastics in seafood could pose a threat to food safety, however, estimations of the potential risks for human health are not yet possible.

Keywords: bivalves, plastics, pollutant, marine environment, seafood

Acknowledgements: This research has been carried out with financial support from the NUCLEU Programme (PN-18340201).

MICROPLASTIC POLLUTION INVESTIGATIONS IN *MYTILUS GALLOPROVINCIALIS*, MIDIA HARBOUR, WESTERN BLACK SEA

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Abstract. Microplastic (MP) ingestion by marine species has been observed and studied intensively in the last years due to the critical negative impact on the entire food chain. The medical investigations performed on several mollusc species show a decreasing in growth and lower body conditions of the individuals that ingested MPs. Other similar studies on different marine molluscs present lower capacity of reproduction, an increase of hemocyte mortality, in general the long-term exposure to plastic particles led directly to toxic effects at tissue, cellular and molecular levels.

In the regional Mediterranean – Black Sea the average concentration of MP per one individual of *Mytilus galloprovincialis* is ranging between 1 and 3 particles. However, in the Midia Harbour located north of Constanta City, Romania - the present study perimeter - the concentration of MPs is increased up to 6 particles per individual, with an average concentration of 3 particles per individual, a total of 10 individuals were digested and filtrated through fiber-glass membranes. Quantitative analyses were performed using a stereomicroscope, taking into account the optical characteristics of MPs: size, morphology, colour, etc. The most encountered MPs are fibers, several fragments are also identified, dominantly ranged between 1 and 1.5 mm and all colours have been observed, yet most of the particles were black.

As we resume to quantitative research, specific source of the MPs cannot be indicated. However, the provenance area of the particles is presumed to be terrestrial and related to the sewerage system, due to the high concentration of fibers.

Keywords: *microplastic, pollution, Mytilus galloprovincialis, Black Sea*

Acknowledgements: The financial support was provided by Projects Research of Excellence AMBIACVA, No. 23PFE/30.12.2021 of the Romanian Ministry of Research, Innovation and Digitization (MCI).

A NEW METHOD FOR MONITORING THE STABILITY OF PARABENS AS MICROPOLLUTANTS IN SEAWATER

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Abstract text: Among the potentially dangerous micropollutants in the marine environment, there are alkyl esters of p-hydroxybenzoic acid. They are synthetic compounds with increased stability that are used in the preparation of various pharmaceutical and personal care products, having a preservative role. The increased stability and the low cost for obtaining them motivates the presence of these substances, frequently, in products of general use, and, implicitly, this leads to the increase of their concentration in the environment.

Through this work, the behavior of these derivatives in seawater was monitored, under the influence of some natural, variable factors, such as: pH, temperature, the presence of other chemical compounds, etc. Thus, a quantitative analytical method was proposed for the identification and dosage of parabens in seawater. The method can be used to monitor the stability of parabens in the aquatic environment.

The effects of p-hydroxybenzoic acid on the planktonic larvae by in vivo cytotoxicity brine shrimp lethality assay (BSLA) at the salinity variability (5, 15, 35 ppm) were evaluated. The effects were recorded at 24-48h after exposure, in laboratory conditions. The correlation dose-effect was identified. The fast lethality effects were identified at high salinity (35 ppm) and low concentrations of p-hydroxybenzoic acid.

The study was carried out on water samples from the Black Sea, from different areas of the beach in Constanta, Romania, in the summer season (June-August), the period when it is assumed that there are more sources of paraben pollution: waste water spills, bathing tourists, etc.

Keywords: *micropollutants, parabens, monitorization*

Session III: Sustainable Use of Marine Resources - Lectures

THE GFCM AND ITS WORK IN THE BLACK SEA: BLACKSEA4FISH

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Abstract. The common efforts of the Black Sea coastal states in terms of protecting the ecosystem and conserving the fish stocks through improved fisheries management and investments in sustainable aquaculture sustainability stay high among priorities of the Blue economy and Blue Growth in the region. The General Fisheries Commission for the Mediterranean and the Black Sea (GFCM) of the Food and Agriculture Organization (FAO) is the competent regional fisheries management organization (RFMO) that ensures the cooperation of the countries towards the sustainable use of living marine resources at all levels (biological, social, economic and environmental) and development of the Black Sea mariculture. In recent years, GFCM has made many positive strides in supporting the Black Sea fisheries and aquaculture sectors identifying the future challenges that remain before they can be assured of a sustainable future and contribute to their full potential to the wellbeing of coastal communities. The new GFCM Strategy 2030 is the main tool guiding this process and supporting the 2030 Agenda for Sustainable Development and its 17 goals to end poverty, achieve food security, fight inequalities and tackle climate change issues. In line with the Bucharest and Sofia Declaration there have been already established two aquaculture demonstrative centres (ADCs) in Romania and Turkey addressing the need to share knowledge on best practices to address common challenges within the aquaculture sector.

The adoption of the Bucharest Declaration in October 2016 on occasion of the High-level meeting towards enhanced cooperation on Black Sea fisheries and aquaculture has been an important milestone towards regional cooperation. Among others, this declaration recognized the existence of an incipient regional project manned by the GFCM, namely the BlackSea4Fish project, and called upon all riparian countries to cooperate in its implementation. Right after the adoption of the Bucharest declaration, a brainstorming meeting was held to discuss the challenges that this project needed to address. Under the aegis of the GFCM, initial challenges identified included the need to provide timely data and information, to encourage the active participation of scientists in technical work, to improve the evaluation and management of fishery resources, to protect marine biodiversity and marine ecosystems from harmful bycatch and discarding practices and to reduce the incidence of illegal, unreported and unregulated (IUU) fishing. Most importantly, there was agreement that the project had to support the work of the WGBS – which in the meantime had proven to be a very active setting

to foster cooperation, seeing the tasks assigned to its work plan progressively increase each year. The need for more solid support to its work was evident in light of the alarming state of Black Sea fisheries and ecosystems and the need for strong scientific advice in support of management decisions. The BlackSea4Fish project therefore came about as the tool which would contribute to further bridging gaps at the regional level, helping the riparian countries, where needed, to overcome regional priorities and infrastructure needs and endowing the WGBS with the necessary resources to ensure that its work plan is efficiently implemented.

Keywords: *GFCM, The Black Sea, Fisheries, Aquaculture*

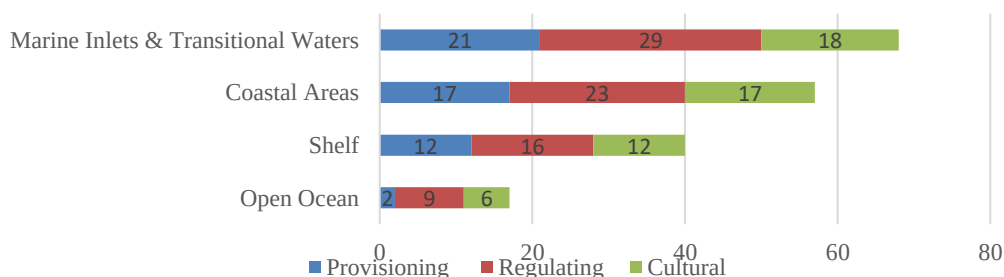
MAPPING AND ASSESSMENT OF THE POTENTIAL OF THE BLACK SEA TO PROVIDE COASTAL AND MARINE ECOSYSTEM SERVICES

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Abstract. Coastal and marine ecosystems represent almost 70 per cent of the biosphere. They provide invaluable ecosystem services for the benefit of society. Despite this fact, coastal and marine ecosystem services are some of the most degraded and least mapped amongst ecosystem services. This is also the case for the Black Sea. The EU project DOORS Black Sea aims to make operational the Black Sea SRIA, support the successful Blue Growth implementation and contribute to a healthy, productive and resilient Black Sea. Sustainable use of ecosystem services is fundamental for Blue Growth. The DOORS project, therefore, seeks to map and assess the potential capacity of the Black Sea in providing coastal and marine ecosystem services. Within the DOORS project, this research uses an ecosystem services matrix constructed using 19 ecosystem services identified from existing literature and 4 Black Sea ecosystem types (see Figure) that can potentially provide these ecosystem services. Final ecosystem service potential was calculated using a weighted mean function using scores from 24 experts from six Black Sea countries with scores ranging from 0 (no capacity) to 5 (very high capacity to provide the ecosystem service). Overall, “Marine inlet and transitional waters” were found to have the highest capacity to provide ecosystem services. “Open oceans” have the least potential to provide the identified ecosystem services. Amongst the ecosystem services, the Black Sea ecosystems were found to have the highest potential to provide for “air quality” and “cultural, historical, religious and identity values”. Work in DOORS continues by estimating of the condition of the four Black Sea ecosystem types and based on that the possible provision capacity will be quantified for a few ecosystem services.



Keywords: *Ecosystem services matrix; coastal and marine habitats; Black Sea; expert-based*

Acknowledgements: We especially thank the 24 Black Sea experts for their effort to fill out the matrix. DOORS (<https://www.doorsblacksea.eu/>) has received funding from the European Union’s Horizon 2020 Framework Programme for Research and Innovation under grant agreement No 101000518.

BOOSTING BIOMASS GAIN AND MEAT QUALITY OF RAINBOW TROUT *ONCORHYNCHUS MYKISS* (WALBAUM, 1792) - AN APPROACH FOR FOSTERING ROMANIAN AQUACULTURE

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Abstract. Rainbow trout *Oncorhynchus mykiss* (Walbaum, 1792) is one of the most widely cultured fish species, with a high market value. Although in the Black Sea there is a well-established tradition of cage farming in Turkish waters, in Romania rainbow trout farming has been limited to inland mountain areas. Whereas there is an increasing interest of Romanian economic operators to engage in sea cage farming, this research aimed at testing the adaptation of rainbow trout to the Romanian Black Sea marine environment, determining its growth rate, establishing the optimal size for transfer to saltwater, and increasing meat quality. The research was performed for 7 months, during the cold season, and comprised two batches of *O. mykiss* individuals transferred to marine water from a mountain trout farm (with initial mean biomasses of approximately 300 g and 180 g, respectively). Upon completion of the experiment, growth parameters showed values much higher compared to freshwater culture, and the biomass gain was remarkable in both batches (reaching final biomasses of approximately 1,700 g and 1,600 g, respectively), the results indicating smaller fish as best fitted for transfer to marine water. The carotenoid-enriched feed provided to the fish resulted in a highly nutritious meat, with the much-appreciated pink colorization.

Keywords: rainbow trout, Black Sea, marine water, biomass, meat quality

Acknowledgements: This study has been carried out with financial support from the NUCLEU INTEL MAR Programme, funded by the Romanian Ministry of Research, Innovation and Digitization, project no. PN 19260301, and the GFCM, through the Shellfish Aquaculture Demonstrative Center (S-ADC). The authors kindly thank the trout farm “Păstrăvăria Valea Stâni Zăganu” (Cheia, Prahova County, Romania) for providing the experimental material.

TURBOT SURVIVABILITY, CATCHES AND GILLNET-CAUSED INJURIES. SCIENTIFIC SUPPORT FOR THE EXEMPTION FROM THE LANDING OBLIGATION IN EU BLACK SEA COUNTRIES

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Abstract. The European Common Fisheries Policy aims to gradually eliminate discards in all European Union fisheries through the introduction of a landing obligation for all catches of species subject to catch limits. In 2016, the Commission established a discard plan for turbot fisheries in the Black Sea, that provided for a survivability exemption of turbot caught with bottom-set gillnets, applied from 1 January 2017 until 31 December 2019. Subsequently, Romania and Bulgaria submitted an updated Joint Recommendation to the Commission, requesting the renewal of the discard plan and the survivability exemption based on the high survival rates of this species. The Scientific, Technical and Economic Committee for Fisheries (STECF) acknowledged the existence of data demonstrating the high survivability of turbot caught by vessels from non-EU countries using the same gears, however they requested that Member States concerned should submit additional data on survival estimates relating to the gillnet fishery for turbot. In this context, NIMRD implemented a pilot study aiming at obtaining scientific evidence for the exemption of turbot from the landing obligation. Scientific fishing was performed in the Romanian marine area with specialized gears - turbot gillnets on board of NIMRD's boat. The methodology consisted of launching the gillnets in established locations and recovering them after a soaking time depending on weather conditions. After each operation to recover the nets from the water, all turbot specimens caught were retained on board, parked in a fiber-reinforced polymer (FRP) container filled with seawater and equipped with an aeration system. The specimens were kept in the tank for 1 hour, during which time they were monitored from the point of view of their condition. Subsequently, all turbot specimens declared viable were released back into the sea. The results indicate high survivability rates of turbot caught in gillnets (81.67%).

Keywords: *turbot, gillnets, landing obligation, exemption, survivability*

Acknowledgements: This research was carried-out in the frame of the “Pilot Study Aiming at Obtaining Scientific Evidence for the Exemption of Turbot from the Landing Obligation, in Accordance with Commission Delegated Regulation C (2021) 2065/25.08.2021“, acronym DerLOT (contract no. 145/27.12.2021), funded by the National Agency for Fisheries and Aquaculture (NAFA) Romania.

GAS HYDRATES AND BULGARIA PROSPERITY (VISION)

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Abstract. This work presents results from a gas hydrate (GH) study with a focus on the EU, the Black Sea, and the Bulgarian Exclusive Economic Zone (BEEZ) and a preliminary content and notes of a national program for GH technologies and infrastructure development (BGHP: Bulgarian Gas Hydrate Program).

The BGHP must include changes in education, social and economic stimuli to face new innovative national priorities; development of technologies for carbon capture, utilization, and storage (CCUS), and hydrogen (H₂) production from the GHs' methane (CH₄) after CH₄ replacement with CO₂ based on thermodynamic models; development of infrastructure for European CO₂ transport to the Black Sea marine GH deposits (GHDs) of Bulgaria and Romania; creation of diverse applications based on the unique GH properties for low energy innovative support for the business and society; social equity notes.

The vision of the BGHP must target solution or mitigation of the main Bulgarian problems:

- ✓ Prosperous country building – reach the economic level of the most developed EU countries;
- ✓ High level of energy independence and low energy prices (If NEGATIVE methane price possible?);
- ✓ Energetics with a NEGATIVE footprint on the atmospheric greenhouse gases and H₂ production;
- ✓ Creation of a highly educated and innovative nation with an annual product per person among the highest worldwide;
- ✓ Develop green GH technologies for a clear country, air, and waters.

Example calculations illustrate the realism of the vision and the perspective of a BGHP.

Keywords: *Black Sea, clathrates, national program, energy, climate*

Acknowledgments: This work was supported by:

- Bulgarian Science Fund project KP-06-OPR04/7 GEOHydrate “Geothermal evolution of marine gas hydrate deposits – Danube paleodelta, Black Sea” (2018-2023);
- European Union project 101000518 DOORS: Developing Optimal and Open Research Support for the Black Sea (2021-2025).

ASPECTS REGARDING THE ICHTYOFAUNA BIODIVERSITY ON THE ROMANIAN COAST

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Abstract. Marine biodiversity provides a multitude of valuable ecosystem goods and services and is valued for its direct utility to humans. However, marine ecosystems are subject to a variety of anthropogenic threats: pollution, climate change, overexploitation, and invasive species. The main objective applied in fisheries management is to maintain the diversity of species within the marine ecosystem. Thus, the study of the biodiversity of the ichthyofauna is very important and in recent years an increase in the number of species identified on the Romanian coast of the Black Sea has been observed. In the last 10 years, 71 species of fish have been identified, of which 14.28% are rare species, 28.57% are dominant species and 57.15% are common species. The structure and function of fish communities are considered good indicators of the ecological status of marine ecosystems. Therefore, the long-term assessment and the development of predictions regarding the size and productive capacity of the fish populations are necessary.

Keywords: *ichthyofauna, biodiversity, ecological indicators, diversity index*

CHITOSAN - A SIGNIFICANT VALORIZED MARINE RESOURCE AT THE ROMANIAN BLACK SEA COAST

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Abstract: Nowadays, the disposal of food waste has become a critical concern for industry and society. According to recent studies, roughly 10^{12} - 10^{14} tonnes of chitin are created annually by living species in the ocean, with arthropods in freshwater producing 2.8×10^{10} kg and marine organisms producing 1.3×10^{12} kg. If commercial technology were developed to extract chitosan and other components (pigments, carotenoids, proteins, etc.) from the structure of discarded exoskeletons, there would be ample raw material. If they are not treated properly, these wastes could have harmful effects to human health, biodiversity, and the environment.

Our research indicates that there are significant sources of chitin along the coast of the Romanian Black Sea, including both seafood waste and shellfish waste, discovered on the beach after storms. There is a correlation between the frequency of this type of waste and natural seasonal elements (sediment, substrate, species abundance, ecology, or biology). Our work aims to demonstrate that by processing all types of marine wastes discovered along the Romanian coast, chitosan is obtained, which was studied in terms of molar mass, deacetylation degree, and solubility in diluted organic acids solutions. FTIR spectrophotometry was used for the identification of chitosan.

Achieving chitosan with the appropriate characteristics (molar mass and deacetylation degree) for uses in various domains (pharmaceutical, medical, agricultural, environmental engineering, etc.) would necessitate optimizing the extraction technologies of these different sources of marine waste.

Keywords: *Lythrum s., biosorbent, PAH pollution*

Acknowledgements: This work was supported by a grant of a Romanian Ministry of Education and Research, CNCS – UEFISCDI, project number PN-III-P4-ID-PCE-2020-2243.

Session III: Sustainable Use of Marine Resources - Posters

ANALYSIS OF SEABASS & SEABREAM AQUACULTURE SECTOR PROGRESS IN GREECE, IN TERMS OF ECONOMIC PERFORMANCE AND EMPLOYMENT

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Abstract. During the last two decades, aquaculture in Greece, favored by the ideal conditions provided by its 16,000 km long coastline and its innumerable islands, has demonstrated a strong growth of the aquaculture sector, characterized by continuous changes in the structure, organization, and operation of the sector's enterprises, and the development of aquaculture technology and production methodology. Those factors led to the development of a new aquaculture enterprise model set by the legal framework of the European Union and international competitiveness. Greece represents 10% of the total EU aquaculture production volume and since the dominant species of national aquaculture production are sea bream and sea bass, Greece also represents 47% of the total EU production value of those species. Consequently, the sector has also a significant contribution in employment terms since it is also estimated that the total number of employees in the Greek aquaculture sector, taking into account not only the directly related jobs but also the indirect jobs created by the support services of the industry (fish feed, technical equipment, packaging, transport, etc.), amounts to a total of 12.000 employees, directly and indirectly employed (including scientific, technical and skilled labor staff). Another important element for the aquaculture sector employment in Greece is that many jobs are created in remote areas of the Greek territory, which contributes significantly to the economic development of local communities. Aquaculture creates jobs in 10 of the 13 Regions of Greece, with the Regions of Western Greece, Central Greece, Peloponnese, and Attica representing the greatest percentage. Given the important role of aquaculture in the Greek economy, this paper will attempt to describe the sector's development of production, costs, and cost structure, the productivity of sea bream and sea bass aquaculture in Greece and the sector's employment structure during the last two decades.

Keywords: *economic performance, production, cost structure, socio-demographics, labor productivity*

ENVIRONMENTAL AND OPERATIONAL COMPLICATIONS OF THE COASTAL AQUACULTURE MANAGEMENT IN THERMAIKOS GULF

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Abstract. Shellfish farming, and especially mussel farming, is the second most important sector of aquaculture in Greece, after fish farming and one of the most dynamic of the agricultural economy. The 75-80% of Greek mussel production is produced in Thermaikos Gulf ($\approx 20,000$ tons). The largest part of the production is exported to the EU (e.g. Italy, France) and contributes positively to the trade balance between Greece and the EU's countries.

This paper describes and evaluates the main environmental and operational difficulties faced that shellfish farming face in Thermaikos Gulf. The main environmental problems focus on the frequent development of 'red tides' during the annual cycle and on the increase of sea water temperature in recent years. These issues result in mass mortality of the produced mussels and even the predation of the mussel brood by 'invasive species' (blue crab). Some of the structural problems are the inappropriate location and operation of the mussel farming units regarding the circulation of the waters of the gulf. The delays in the establishment of 'Organized Aquaculture Development Areas' (OADA), the arbitrary decision of building shellfish farming facilities and the incorrect implementation of the production instructions contribute also to this situation. Other major problems are the reduced production in shallow water (stake farming type), the long periods of mussel ban due to 'red tides', the professionals' response to the distance from the coast of the mussel farms and the pollution that they bring to touristic and environmentally sensitive areas.

The establishment and maintenance of a new institutional framework for the development of sustainable aquaculture in the Thermaikos Gulf, should aim at the development of the mussel farming sector. It can be accomplished by utilizing the maximum potential of the area through increasing of the production and improving the quality of the product and the protection of the coastal environment.

Keywords: *shellfish farming, mussel farming, mussel production, coastal aquaculture management*

ALTERNATIVE APPROACH TO THE SEGMENTATION OF FISHING FLEETS

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Abstract. The appropriate segmentation of fishing fleets is controversially discussed in fisheries research and management and a variety of approaches have been introduced. The present approach, developed in a pilot study funded by the European Commission - Data Collection Framework (DCF), introduces a standardized multivariate approach for characterizing fisheries fleet segments by hierarchical agglomerative cluster analysis (HAC) of their catch composition. We selected data from 2021 of the Romanian fishing fleet as the basis of our analysis. Statistical analyses were performed using the program RStudio V3.6.1 by running the fleet segmentation package script. The specific indices, tests, and visual validation methods of the package were applied to determine the optimal number of clusters. The procedure was finalized by a post-hoc validation of the clustering result to identify the actual fleet segments. From the basic data, 6 fleet segments for vessels using active and passive gears (PMP) were highlighted, representing 52 boats, where it was noted that fishing for Rapa whelk (RPW) prevailed with 91.94% of the total catches on the segment, respectively 5 fleet segments for vessels using passive tools (PG) only for vessels <12m, representing 78 vessels where the main catches were recorded for European anchovy (ANE) 25.16%, turbot (TUR) 13.08%, horse mackerel (HMM) 8.75%, thus totalling 130 vessels from two classes of different gears. We detected mixed fishing, especially on various assemblages of demersal and pelagic fish, as well as target fishing on demersal and pelagic fish, Rapa whelk and mussels. For a better understanding of the approach, further research is needed.

Keywords: *fishing fleet, segmentation, clustering, target fishing, mixed fishing*

STATUS OF THE RAPA WHELK AGGLOMERATIONS ALONG THE ROMANIAN BLACK SEA COAST

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Abstract. The Black Sea Rapa whelk (*Rapana venosa*, Valenciennes, 1846) is, on one hand, a non-indigenous species harming Black Sea benthic ecosystem and on the other hand, since its ever-expanding stock found market in the Far East, one of the most profitable in the basin. For this reason, the GFCM Working Group on the Black Sea (WGBS) agreed on the fact that, despite the invasive nature of the species, its stock in the Black Sea should be exploited within biologically safe limits. In order to ensure implementation of the decision, the GFCM, at its 42nd annual session, adopted Recommendation GFCM/42/2018/9 on a regional research programme for rapa whelk fisheries in the Black Sea (geographical subarea 29). In order to cover the area of study in high percentage, a number of 51 stations were proposed for Romanian area, that were distributed evenly. The duration of one haul was 30 minutes and the hauls were performed at a constant depth and rectilinear in a big percentage, but to avoid tangles and gear destruction, some deviations have been made. Age composition in 2020 was formed by 3 to 12 years generations, highest percentages recorded for 6 and 7 years classes, regarding 2021 age composition was composed by 3 to 11 years with highest numbers recorded for 5 and 6 years classes. Highest abundance and biomass values for rapa whelk in 2020 have been recorded in the north part of the Romanian coast in sectors Zaton, Sahalin, Sf. Gheorghe and Mila 9, for 2021 the same trend is observed.

Keywords: *rapa whelk, biomass, age composition, strata*

Acknowledgements: This research work is part from the project MTF /INT/943/MUL – Baby 31 ‘*Select activities of the strategies towards the sustainability of fisheries and sustainable aquaculture development implemented in the Mediterranean and the Black Sea*’- “*Rapa Whelk research surveys in the coastal waters of Romania*” with the support of Food and Agriculture Organization of the United Nations (FAO).

STUDY REGARDING THE SUPERIOR ECONOMIC VALORIZATION OF MUSSEL SHELLS FROM THE ROMANIAN BLACK SEA COAST

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Abstract. Shells of various mollusks such as mussels are quite available abundantly all around the world. Edible parts of mussels are few and thus large amounts of shells as waste material are produced from processing of seafood. The disposal of mussels waste led to serious environmental problems.

From the last decade, such recovery techniques have been developed and shells are currently used for various applications. Seashells are notable as natural source of calcium for food and other similar products. This kind of calcium carbonate from shells is completely organic and with possibility of using as alternative biomaterial. Calcium is a nutrient that is essential for many functions in human health.

In this study were used the shells of *Mytillus galloprovincialis*, the mussels from the Romanian Black Sea coast which can be superior economic valorized through biotechnological techniques.

The shells were processed in order to obtain calcium carbonate (CaCO_3) and subsequently calcium chloride (CaCl_2), natural compounds with multiple practical applications in the pharmaceutical industry, medicine, agriculture, animal husbandry, environment, etc.

Calcium carbonate was obtained from mussel shells with a yield of 95.31%, and calcium chloride was obtained with a yield of 73.80% from CaCO_3 , percentages that support the efficiency of the biotechnological processes for obtaining these products. Calcium carbonate as well as calcium chloride are quite used in the economy and can still represent safe sources of marine origin (mussel shells) that can cover the current demands of the domestic market.

Mussel shells from the Black Sea are a natural source of mineral substances that can be extracted using modern biotechnological processes that are inexpensive and do not affect the environment.

Keywords: shells, calcium carbonate, calcium chloride, *Mytillus galloprovincialis*, Black Sea coast

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INTRODUCTION AND COMPARISON OF TWO METHODS IN WHITE CLAM FISHERY

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Abstract. White clams belong to a group of invertebrates called bivalved mollusks. Nowadays in Bulgarian coastline of Black Sea do not have a developed aquaculture and the white clams are harvested by different methods. Some of the fishing practices used can seriously damage habitats and directly affect other marine species. This study examines and compares the potential physical, chemical and biological impacts of different methods used in the white clam fishery. It was found strong mechanical impacts associated with mortality in epibenthic populations and changes in seafloor topography caused by trawling.

Keywords: *Black Sea, hydraulic dredger, mechanical dredger, white clam*

GREEN MACROALGAE *ULVA SP.* AND *CLADOPHORA SP.* FROM BLACK SEA ROMANIAN COASTLINE AS A PROMISING SOURCE OF VALUABLE ANTIMICROBIAL COMPOUNDS: EXTRACTION AND VALORIZATION AS COSMECEUTICALS

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Abstract. Due to the increase in the phenomenon of microbial resistance against classic antibiotics, in the last few decades attention focused on new natural antimicrobial compounds. Worldwide, marine algae are known to produce significant quantities of a wide variety of bioactive secondary metabolites, such as phenolic compounds, polysaccharides, fatty acids, proteins and peptides, terpenes, steroids, halogenated compounds, pigments, reported present in all plants, displaying antitumor, antibacterial, antiviral and antioxidant activity. The algae found in the Black Sea are essential resources for all border countries of the Black Sea, due to both ecological and economic impact. Published data are underlining as important local species such as green algae Clorophyta *Ulva lactuca* (L.) (Ulvophyceae) and *Cladophora vagabunda* (L.) Hoek (Ulvophyceae), brown algae Ochrophyta *Cystoseira barbata* (Stackhouse) C. Agardh (Phaeophyceae), and red algae Rhodophyta *Ceramium rubrum* C. Agardh (Florideophyceae) as sources for bioactive compounds.

This study presents the main antimicrobial potential of Clorophyta green macroalgae *Ulva Lactuca* (Linnaeus, 1753) and *Cladophora vagabunda* (Linnaeus-van den Hoek, 1963), their specific bioactive compounds and a green extraction technology to efficiently extract them, with emphasis on the antibacterial and antifungal data evaluated on two bacterial reference strains: gram negative *Escherichia coli* ATCC 25922 and gram positive *Staphylococcus aureus* ATCC 25923 and on *Candida albicans* fungal reference strain ATCC 900288. Antimicrobial activity of the active principles extracted from marine organisms has been tested for both crude extracts and pharmaceutical formulations prepared from the algae extracts in association with other substances of synthetic origin, in order to appreciate their efficiency in different preparations with topical application. The comparative study of the experimental variants of cosmetic gels was conducted to qualitatively highlight the influence of functional parameters (pharmaceutical formulation, concentration and volume of alcoholic plant extract used) on the antimicrobial activity of natural plant compounds, incorporated in gels, with dermato-cosmetic targeting.

Keywords: *green macroalgae, antimicrobial activity, bioactive compounds, cosmeceuticals*

ECOSYSTEM SERVICES OF THE NORTHWESTERN BLACK SEA REGION: BRIEF OVERVIEW OF THE PROBLEM

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Abstract. Ecosystem services are resources and benefits that modern humanity can receive from the nature. It is the material benefit from abiogenic and biogenic components of various natural ecosystems. There were not large-scale studies according of evaluation ecosystem services in the Ukrainian water area of the Black Sea before.

The report presents the results of analysis of modern state of ecosystem services in the northwestern Black Sea region and perspectives of their using. During the preparing of the presentation published data had been used, as well as the materials of personal research on various aspects of the evaluation of ecosystem services of the Northwestern part of the Black Sea. Some types of anthropogenic activities have a very negative effect to the condition of natural ecosystems and to receive of their services. The ecosystems of the Northwestern part of the Black Sea are the living place of numerous organisms. Take into account of the limited information of the of ecosystem services under the Northwestern part of the Black Sea, the first task is to determine the needs of local populations for these services, collection and generalization of information about their condition, coordination of their assessment methods for the region and the evaluation itself.

Keywords: *ecosystems, ecosystem services, Northwestern part of the Black Sea, Blue Growth Accelerator, sustainable development*

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THE OFFSHORE WIND POWER POTENTIAL OF THE BLACK AND AZOV SEAS

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Abstract. Today, the renewable energy sector in Europe belongs to the established sectors of the economy and special attention is directed to the development of such areas of the Blue Economy as offshore wind energy.

The report presents the results of analysis of the distribution of wind power density in the Black and Azov Seas, as well as to identify areas with the most favorable conditions for the placement of offshore wind turbines. The assessment of the offshore wind power potential of the Black and Azov Seas is of considerable interest, in terms of, that the development of offshore wind energy could provide additional capacity to the energy system of Ukraine and other countries of the Black Sea region and strengthen the transition of their national energy complexes to renewable energy sources, which will help reduce carbon dioxide emissions into the atmosphere and help to counteract climate change on the planet. Thus, according to the Global Wind Atlas, most of the Black and Azov Seas are characterized by significant wind resources. On the north-western shelf of the Black Sea, as well as throughout the entire water area of the Azov Sea, there are significant areas with depths of less than 50 m and a distance from the coast of not more than 200 km, suitable for placing both floating and fixed offshore wind turbines.

Keywords: *offshore wind turbines, wind power density, Black Sea, Azov Sea, blue economy.*

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ASPECTS REGARDING THE AGE READING OF MEDITERRANEAN HORSE MACKEREL AT THE ROMANIAN COAST

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Abstract. The species *Trachurus mediterraneus* (Steindachner, 1868), mediterranean horse mackerel, is significant for the commercial fishing sector in Romania. Information on the age of fish species significantly improves the quality of studies on population characteristics such as growth, recruitment, mortality and reproduction. Also, this information is at the basis of fisheries resource management strategies and stock assessment. The age for horse mackerel was estimated by analyzing otoliths from 1197 individuals. Statistical analyzes were performed using the program STATISTICA var. 12.7, important for determining the age differences of individuals, between sexes, stations, years and months. The individuals analyzed in the present study fell into the age range between 0+ and 5+ years old; only two specimens being identified over 5 years old. Most of the analyzed individuals were aged between 0+ and 2+ years old. The age of individuals varied between stations, years and months. It is well known that fish, in general, are species that can be highly influenced by environmental factors during their life cycle, so it is necessary to carry out more comparative studies in terms of age determination and environmental factors.

Keywords: *age, otoliths, horse mackerel, environmental factors*

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GREEN CHEMISTRY BASED ON PLANTS IN CRUDE OIL DECONTAMINATION OF MARINE ENVIRONMENTS

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Abstract: At present, oil pollution is the form of pollution that has the greatest impact on marine ecosystems. Any oil spill has the potential to pollute wide regions of water and destroy marine life and the ecosystem due to the chemical composition of oil. Because of their capacity to dissolve in water and bioaccumulate there, hydrocarbons contained in crude oil pose a threat to marine life. Particularly problematic are aromatic hydrocarbons, volatile organic compounds, and cycloalkanes, all of which have been shown to reduce water pH, inhibit photosynthesis in algae and phytoplankton, and enhance toxicity in the marine environment. To lessen these harmful effects on the marine ecology, efforts are being made to develop low-cost eco-friendly technologies and resources that can replace the present chemical cleaning processes. This is being done to mitigate these detrimental effects on the marine ecology. In order to reduce or eliminate the use of dangerous chemicals in a selection of decontamination procedures, this study intends to examine and emphasize the significance of creating and implementing alternative and revolutionary green chemistry research approaches.

Keywords: *green chemistry, decontamination, eco-friendly technologies, marine environment*

POTENTIAL DECONTAMINATION ACTION OF AQUEOUS ENVIRONMENT BY USING BIOSORBENTS BASED ON PLANTS

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Abstract: Nowadays, specialized studies release that marine pollution represents a major phenomenon with a severe impact to the environment, and maritime transport is associated with this. Among all forms of marine pollution, polyaromatic hydrocarbons (PAH) pollution is the most relevant form, that occurs both through operational and accidental pollution. As a result, it is necessary to find and develop new alternative technologies for the decontamination of oil and oil product pollutants, which can have a negative impact on human health and could produce significant harm to aquatic ecosystems.

A number of regulations, methods, and technologies have been developed to prevent contamination of the marine environment with these chemicals. They are designed to regulate the amount and types of pollution entering both fresh and marine waters, preventive measures, and actions aimed to annihilate the contaminations caused by oil spills.

This study will focus on the comparative research of the PAH sorption characteristics of *Lythrum salicaria* L., as a potential eco-friendly and low-cost sorbent material for petroleum products and a standardized material currently used successfully in the clean-up of petroleum products (Spill- Sorb), from the marine environment. In order to identify the appropriate biosorbent, the specific analyses for this type of testing were carried out for the powders derived from the aerial and root sections of *Lythrum salicaria* L. plant and were correlated with the type of crude oil and its physical-chemical properties.

Keywords: *Lythrum s.*, biosorbent, PAH pollution

EFFECTS OF SEAWEED (*ULVA LACTUCA*) SUPPLEMENTATION ON IMMUNITY, TOLERANCE TO STRESS AND GROWTH PERFORMANCE OF DIFFERENT AQUACULTURE SPECIES

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Abstract. The inclusion of various species of macroalgae in fish feed has proven to be a viable alternative for replacing plant protein from traditional agricultural crops. Moreover, numerous studies have demonstrated the beneficial effect of compounds extracted from algal biomass on fish immunity and resistance to stress induced by rearing conditions. Nevertheless, in terms of growth performance, studies show also conflicting results. In the present literature review we aimed to analyse the benefits of introducing macroalgae into fish feed and the drawbacks associated with different strategies of using this valuable aquatic resource in aquaculture technologies.

The Romanian coastline abounds in seaweeds that could be exploited. Among the green algae, *Ulva lactuca* is found in significant quantities in the Black Sea. Considering the composition and functional properties of this algae, their exploitation in aquaculture is opportune and sustainable in the context of negative climate change effect on accessibility for conventional plant protein.

Keywords: seaweed, aquafeed, aquaculture, functional ingredients

BIOMECHANICAL, BIOCHEMICAL AND PHYSICAL-CHEMICAL CHARACTERISTICS OF *RAPANA VENOSA* VALENCIENNES, 1846 (GASTROPODA, MOLLUSCA) EGG CAPSULES

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Abstract. The structure of the *R. venosa* egg capsules that were analysed in this study at the microstructural level showed complexity in terms of the filament layout and the microfibrillar composition; furthermore, the presence of chitinous structures was confirmed. The specific properties (mechanical, chemical, antifouling and optical) could explain the reproductive efficiency and the spread of the species with remarkable adaptations of this organism. Validation of the presence of a significant amount of chitosan in these capsules by analytical methods led to the conclusion that this structure may be correlated to the properties of this biopolymer. The evolutionary impact on the reproductive success and habitat expansion of many taxonomic groups. The present study proposed to evaluate the biomechanical, biochemical and physical-chemical characteristics of *R. venosa* egg capsules, starting from observations related to antifouling activity and mechanical resistance to currents in the mid-shore areas for the "in situ" capsules.

The observations were carried out by microscopic (optical, epifluorescence and SEM) investigations and UV-VIS-NIR spectroscopy on eggs capsules of marine snail, *Rapana venosa*, collected from Romanian Black Sea waters. Moreover, the biodegradability of the capsular structure in different solutions (water, acid and alkaline solutions, the sediment, the bacterial load) was analyzed, through the simulation testing in the laboratory.

Keywords: biopolymer, chitosan, biodegradability, *Rapana*, antifouling

Acknowledgements: This work was supported by a grant of a Romanian Ministry of Education and Research, CNCS – UEFISCDI, project number PN-III-P4-ID-PCE-2020-2243.

GENOTOXICITY PROFILE OF RECYCLE CHITOSAN FROM RAW WASTE OF ROMANIA COASTAL WATERS

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Abstract. The great research interest on this oligomer results not only from its physical-chemical properties such as better water solubility and cationic nature at neutral pH, but also from its biological activities, e.g., anti-tumor, antiinflammatory, antioxidant, antibacterial activity, biological recognition, and immune enhancing effects. These unique properties and activities continuously attract many research interests in drug, food, cosmetics, biomaterials, and tissue engineering fields. These oligomers with a chitosan-like structure, but with a linear disposition are also distinguished by the unique peculiarities from a biological point of view.

R. venosa oligochitosan with 1500-3000 Da molar weigh, 75% DDA was spectral identified by FT-IR and RX analyses and was compared with spectra of crustacean's chitosan reference (Sigma Aldrich).

Our study aimed to identify how *R. venosa* oligochitosan induced DNA damage and activates the SOS repair system. Genotoxicity assay (GT assay) with *Escherichia coli* (SOS Chromotest) mutant stain PQ37, was tested. The oligochitosan samples were incubated in the presence of *E. coli* strains with various mutations present in a certain amino acid synthesising gene. Also, the oligochitosan and metabolic activation system usually rat liver S9 mix containing induced drug-metabolising enzymes was analysed. The enzymatic activation has been included for understanding mutagenic or potentially mutagen effects of oligochitosan metabolites resulting from interaction with to specific molecules from phase I and II of metabolism. Non-genotoxic effects were identified after enzymatic inductions.

Keywords: biopolymer, chitosan, biodegradability, *Rapana*, antifouling

Acknowledgements: This work was supported by a grant of a Romanian Ministry of Education and Research, CNCS – UEFISCDI, project number PN-III-P4-ID-PCE-2020-2243.

IMPROVING GROWTH PERFORMANCE OF HIGH-VALUE FISH SPECIES BASED ON DIETS ENRICHED WITH SPIRULINA (*ARTHOSPIRA PLATENSIS*) CULTIVATED USING PHOTOBIOREACTORS

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Abstract. Based on the current research, spirulina could be used in the treatment of wastewater containing residues from fish farming activities due to its effectiveness in removing heavy metals and metabolizing excess feed present in the water stream. The high demand for proteins depletes the planet's resources, which is why we want a more sustainable and environmentally friendly alternative by replacing animal protein sources with plant ones. Bioactive components such as vitamins (especially vitamin A and B₁₂), minerals, polyunsaturated fatty acids, carotenes and other pigments that have antioxidant activity made spirulina suitable for use in fish feed. Due to these qualities, spirulina can be used in fish farming to enhance growth, survival, immune response, disease resistance, improvement of meat quality, coloration and hematology of fish. On the other hand, spirulina proved suitable biofilter for aquaculture wastewater. This review highlights the advantages and drawbacks of integrating the treatment of aquaculture wastewater with production of high-quality Spirulina biomass that can be safely used for fish nutrition.

Keywords: *sustainable aquaculture, fishfeed, photobioreactor, spirulina*

BIOPRODUCTS DERIVED FROM ALGAL SOURCES AND THEIR POTENTIAL APPLICATIONS IN MEDICINE

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The Black Sea and other seas or oceans represent a huge resource of raw materials with potential applications in pharmacy. From this point of view, we chose four algal species, respectively: *Cystoseira barbata*, *Undaria pinnatifida*, *Porphyra umbilicus*, and *Chlorella sp.*, from which we obtained 4 polysaccharidic extracts and four polyphenolic extracts, using the methodology described by Zaharie and collab [1]. All these crude extracts were used in studies regarding antimicrobial activity, using the Kirby Bauer methodology [2-3]. As target microorganisms, we used 8 standardized microbial strains respectively: *Candida albicans* ATTC 10231, *Candida parapsilopsis* ATTC 22019, *Escherichia coli* ATTC 11303, *Serratia marcescens* ATTC 14756, *Salmonella enterica* ATTC 51741, *Pseudomonas aeruginosa* ATTC 13388, *Staphylococcus aureus* ATTC 25923 and *Staphylococcus aureus* MRSA ATTC 33592. The results obtained from these studies showed the following: 1). The polysaccharides crude extracts do not exhibit antimicrobial activity. 2). The polyphenolic crude extracts show moderate antimicrobial effect against fungi such as *Candida albicans* (for which are obtained inhibition diameters of (10.5÷17) mm), and *Candida parapsilopsis* (inhibition diameters of (7÷15.3) mm). The same polyphenolic extracts exhibit moderate antimicrobial activities against enterobacteria such as *Salmonella enterica* (inhibition diameters of (6.5÷15.2) mm), *Serratia marcescens* (for which are obtained inhibition diameters of 14÷18 mm), and *Escherichia coli* (inhibition diameters of (7÷15.3) mm). Moderate antimicrobial activities were obtained for polyphenolic crude extracts against pathogenic bacteria such as *Pseudomonas aeruginosa* (for which are obtained inhibition diameters of 9-16 mm), *Staphylococcus aureus* (inhibition diameters of (12.93÷16.63) mm), and *Staphylococcus aureus* MRSA (inhibition diameters of (9.8÷10) mm). In conclusion, the polyphenolic extracts from the studied algal strains can represent a valuable source for developing o new bioproducts with antimicrobial activity, in special for pathogenic microorganisms that exhibit antibiotic resistance.

Keywords: *algae bioproduct, antimicrobial activity, medicine applications*

Session IV: Observing the Black Sea - Lectures

EARTH OBSERVATION IN CATCHMENT AND COASTAL ENVIRONMENTS FOR THE 21ST CENTURY

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Abstract. We are living at a time of unprecedented environmental change, which we are experiencing through hydrological extremes resulting in both floods and droughts. These extremes are usually accompanied by deteriorations in water quality. Our transitional environments (deltas, estuaries and lagoons) are specially vulnerable, where the additive effects of climate extremes occurring in the catchment and coastal environment can have non-linear environmental, societal and economic impacts. Here we will chart the role Earth observation (EO) can play in providing key intelligence on environmental change as well as providing measures of the impacts and benefits of our interventions. The last decade has witnessed a transformation in EO platform and data processing technologies, specially in these challenging dynamic aquatic environments. This presentation will highlight some of the key developments enabling us to make a step change in improving the accuracy of the estimation of water constituent concentrations from optical remote sensing using the Sentinel 2 and 3 platforms, especially using the Optical Water Type methodology, with examples of development work in the Black Sea. The application of Synthetic Aperture Radar data for flood prediction will also be highlighted. Finally, the presentation will explore the exciting transformational opportunities presented by next generation satellite platforms that have recently or are about to be launched.

Keywords: *Earth observation, catchment, coasts, floods, droughts, water quality*

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IDENTIFICATION OF THE KNOWLEDGE GAPS AND RESEARCH NEEDS FOR ADDRESSING ANTHROPOGENIC AND CLIMATE CHANGE PRESSURES ON BLACK SEA ECOSYSTEMS

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Abstract. The Black Sea (BS) Region has undergone rapid and abrupt changes in recent decades. Increased anthropogenic and climate change pressures are affecting its fragile ecosystems and the viability of important economic activities sectors such as fisheries, tourism and others. Furthermore, there are important knowledge gaps related to the application of different research methodologies, insufficiency of systematic in situ monitoring, general lack of an open data culture by the BS countries, as well as the high degree of data heterogeneity, which hinder the ability to accurately assess the status of the BS ecosystems.

These problems are also affecting the development of a qualitative modeling of processes in the future. It is obvious that FAIR-data are needed, including modern and archive biological, climatic, physical, chemical, geological and other data on parameters of sea surface, water column, seafloor and atmosphere. Such data including modern and historical are distributed mainly in international global platforms and data aggregators, currently offering data sharing capabilities provide access to ready-made analytical products, however without direct access to the observational data, hence reducing use capabilities.

The pressing need of increased cooperation among the Black Sea countries to help achieving comparable assessments and equal levels of protection, while reducing costs and overall technical difficulties in order to facilitate implementation of environmental policies was revealed through an interactive stakeholders' workshop identifying their requests, an online survey, and a desk study on the availability of data in national and international platforms. In conclusion, it is crucial for BS countries to harmonize data for their successful inclusion in a single knowledge system, the creation of which is one of the tasks of the EU DOORS project. Furthermore, in order to overcome the main issues of inefficient monitoring, it is needed to identify and establish common typologies and criteria to be used for agreed harmonised methodologies.

Keywords: *FAIR Data, Harmonisation, Monitoring, Stakeholders*

Acknowledgements: We especially thank all Black Sea experts and stakeholders that contributed during workshops and surveys to identify BS Countries needs towards harmonisation of methods and strategies. DOORS (<https://www.doorsblacksea.eu/>) has received funding from the European Union's Horizon 2020 Framework Programme for Research and Innovation under grant agreement No 101000518.

SUPPORTING MARINE AUTONOMOUS SYSTEMS FOR THE BLACK SEA OCEAN RESEARCH AND OBSERVING SYSTEM

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Abstract. Underwater and surface drones (later in the text: Marine Autonomous Systems (MAS)), particularly gliders, have become essential vehicles for comprehensive observation of the ocean and coastal environment from the surface down to 6000 m. An extensive set of sensor payloads enables these MASs to operate in large numbers, acquire key data from the marine environment, and support the blue economy. Autonomous devices complement traditional measurement methods. They enable observations to be made even in conditions and places where research vessels cannot operate, or fixed anchors cannot be installed.

To fully benefit from existing MAS infrastructures and expertise, a distributed research infrastructure (RI) is required. GROOM II, a project supported by H2020, will define the organization of such a distributed European RI for MASs. The envisioned GROOM RI will enable exploiting these assets to fully meet the observing demands for research and monitoring of the marine environment, public services, and industry needs, alike. The rapid evolution of observing and analysis technologies (e.g. robotics, sensors, artificial intelligence, big data) will find in the GROOM RI a resource for R&D to ensure a fit-for-purpose structure that responds to future users' demands.

The strategic set-up for the GROOM RI shall ensure that complex hardware and information technology provide optimized access to its resources and R&D and seamless integration into the Global and future European Ocean Observing Systems. The GROOM II project leverages the RIs that developed in Europe over the past decade and coordinated in Europe and globally. GROOM II will establish the organizational bases for the GROOM RI and will enable the important step to overcome today's fragmented European marine RIs landscape.

Keywords: *autonomous drones, gliders, observation, infrastructure*

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MONITORING METHANE EMISSIONS AND FATE IN THE BLACK SEA: WHY, WHAT ARE THE CURRENT CHALLENGES AND HOW TO TACKLE THEM?

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Abstract: The Black Sea is characterized by high concentration of gases in its water masses. Hydrogen sulfide and methane are amongst the most abundant ones. Large quantities of methane are emitted at the seafloor from the very shallow coastal shelf to the deep basin (Riboulot et al., 2017). The degradation of huge amount of organic matter transported by the connected rivers has largely contributed to the generation of the largest anoxic water body on Earth with high concentration of hydrogen sulfide in the bottom water (Kosarev, 2007). The assessment and monitoring of the fluxes of these compounds are key for the economic growth related to the Black Sea ecosystem services. Hydrogen sulfide is a toxic gas that becomes lethal over a certain threshold. Methane is one of the most powerful greenhouse gases. Important methane discharges at the seafloor can lead to local acidification that may jeopardize the ecosystems. In addition, with the increase of the seawater temperature due to climate change, the Black Sea may release methane into the atmosphere and potentially become a significant additional carbon source. Yet, systematic measurements of these gases are not currently implemented on the monitoring infrastructures of the Black Sea.

We will focus on methane as we have undergone a programme to assess the reliability of sensors for *in situ* measurements in the severe chemical Black Sea environment by combining lab tests and calibration in an instrumented high-pressure tank and data collection from fieldwork. Two types of instruments are considered for the measurements of dissolved methane concentration: commercial sensors and a prototype laser spectrometer (Grilli et al., 2021). Fluxes have been measured at the sediment/ bottom water interface and calculated for surface water/ air exchanges. At the conference, we will present our preliminary results, and discuss the challenges associated to such a monitoring.

Keywords: *gas monitoring, methane, sensors, fluxes, transfer at interface*

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SATELLITE OCEAN COLOUR PRODUCTS SUPPORTING BLUE GROWTH. A CASE STUDY CONCERNING SUSPENDED PARTICULATE MATTER CONCENTRATION

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Abstract. The concentration of Suspended Particulate Matter (SPM) is one of the essential oceanographic variables that can be accurately derived using Earth Observation data. It also represents a key parameter in assessing the habitat suitability for different fish and bivalve species. An increase in SPM has been previously associated with a decline in fisheries resources and with a general degradation of the aquatic environments. Nevertheless, an equilibrium needs to be achieved in coastal areas which are dependent on the sediment inputs in order to mitigate erosion trends. Therefore, the provision of high-quality SPM products is essential for setting up a proper monitoring program that can support the Blue Growth initiatives. In this study we provide evidence on the need for development of regional adapted algorithms. In-situ measurements were used in order to calibrate better inversion models, from satellite measured reflectance to biogeochemical variables. We also show the challenges associated with SPM retrieval in the complex waters of the Black Sea and especially during extreme events, such as abnormal Danube solid discharge scenarios.

Keywords: *satellite, Suspended Particulate Matter, fisheries, aquaculture, habitat suitability*

Acknowledgements: Initial activities were carried out as part of the European Space Agency contract *Earth Observation data For Science and Innovations in the Black Sea* (EO4SIBS, ESA contract no. 4000127237/19/I-EF). This work was also supported by a grant of the Romanian Ministry of Education and Research, CNCS - UEFISCDI, project number PN-III-P1-1.1-PD-2019-0894, within PNCDI III.

BLUE-CLOUD: YOUR OPEN SCIENCE PLATFORM FOR COLLABORATIVE MARINE RESEARCH

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Abstract. The H2020 project Blue-Cloud is developing the thematic EOSC for ocean science, through a collaborative virtual environment to enhance FAIR and Open Science.

Blue-Cloud federated leading European marine Research Infrastructures and e-Infrastructures, allowing researchers to combine, reuse, and share quality data across disciplines and countries with their existing MarineID account.

The project has developed three main assets:

- The Blue-Cloud Data Discovery and Access Service (DD&AS) facilitates access to 10+ million multi-disciplinary datasets. The DD&AS functions as a broker, both for metadata and for data access, interacting with web services and APIs from each of the Blue Data Infrastructures federated in Blue-Cloud. This way, it enables users to discover first at the collection level which infrastructures might have data sets interesting for their use case, and next, to identify and download relevant data sets at granule level from those selected infrastructures, by means of a common interface.
- The Blue-Cloud Virtual Research Environment (VRE) enhances collaborative research. Services include Data Analytics (Data Miner, Software and Algorithms Importer (SAI), RStudio, JupyterHub), facilitating to build and run analytical pipelines, Spatial Data Infrastructure to store, discover, access, and manage vectorial and raster georeferenced datasets, and services for provenance, documenting, and either sharing with selected colleagues or make available online any generated product (e.g., analytical methods, workflows, data products, publications, notebooks). The VRE is also accessible via the federated login of the European Open Science Cloud (EOSC).
- This innovation potential is explored by a series of domain-specific Virtual Labs developed by five teams of experts, addressing societal challenges related to biodiversity, genomics, marine environment, fisheries, and aquaculture.

These assets, including specific services developed within the V Labs, are also available via the EOSC Marketplace. The poster highlights key services developed within the Blue-Cloud technical framework and their potential impact on marine research, ultimately promoting a sustainable and data-driven ocean management.

Keywords: *Ocean science, Open science, Blue Cloud, EOSC, Biodiversity*

Acknowledgements: Blue-Cloud has received funding from the European Union's Horizon programme call BG-07-2019-2020, topic: [A] 2019 - Blue Cloud services, Grant Agreement No.862409.

SEADATANET – DELIVERING MARINE AND OCEAN DATA FROM THE CLOUD

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Abstract. SeaDataNet is an operational pan-European infrastructure for managing marine and ocean data and its core partners are National Oceanographic Data Centres (NODC's) and major data centres from 34 coastal states in Europe. Currently, SeaDataNet gives discovery and access to 2.6+ million data sets for physical oceanography, chemistry, geology, geophysics, bathymetry and biology from 900+ data originators. Population is increasing all-the-time due to its intense cooperation with several EMODnet thematics and other EU projects. The SeaDataNet infrastructure was set up in a series of projects in last two decades. Recently, the core services and standards have been upgraded in EU H2020 'SeaDataCloud'. This included a move "to the cloud" in cooperation with the EUDAT consortium of e-infrastructure service providers. This way SeaDataNet also entered the European Open Science Cloud (EOSC).

The CDI Data Discovery and Access service provides users access to marine data from 110 connected data centres. A central data buffer in the cloud has been introduced which synchronises by replication from the data centres, while also the user interface and import process have been completely revamped, successfully introducing cloud technology. Further upgrades have been added to fit the requirements of several EMODnet thematics for which the CDI service is a major instrument, both for gathering and structuring increasing amounts and types of data sets as input for derived EMODnet data products, and to serve users in search of data sets.

The presentation will provide more background on the evolution and position of SeaDataNet in the European marine data landscape and further details on the upgrading of the SeaDataNet infrastructure and its various services, standards, and products.

Keywords: *ocean data management, data infrastructure, physics, chemistry, bathymetry, geology, geophysics, biology*

Acknowledgements: SeaDataCloud received funding from the European Union's Horizon programme call H2020-INFRAIA-2016-2017 – Integrating and opening research infrastructures of European interest, Grant Agreement No.730960.

Session IV: Observing the Black Sea - Posters

RIP CURRENTS DYNAMICS ON THE ROMANIAN BLACK SEA COAST

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Abstract. Rip currents are a relatively narrow and concentrated seaward-directed water flow, extending from the shoreline through the surf zone, occurring on many wave-exposed coasts worldwide. They are variable in space and time due to changes in incident wave conditions and nearshore morphology, often threatening the safety of the beach, beachgoers, or the infrastructure.

Despite the low to moderate wave energy environment, the Southern Romanian Black Sea coast is characterised by a relatively high potential of rip currents formation due to the rapid hydrodynamical and morphological change (minutes to months) of the beach state and the very low public's awareness related to rip currents associated dangers.

The rip currents spatial distribution reveals that more than 50% of the Romanian touristic beaches are affected by various types of rip currents (the dominant one being channel rip currents), especially on beaches with 3D sandbar morphology. The most affected sector is the Eforie Nord beach, with the highest rip currents frequency associated with the largest number of deaths and rescues during the summer season each year. Two field experiments during low-energy wave conditions in October 2021 and May 2022 highlighted the circulation patterns and dynamics of these rip currents. Drifters and ecological dye deployments, complemented by UAV surveys and video camera footage, revealed both ‘circulatory flow’ and ‘exit flow’ circulation regimes, with alongshore feeding channels developing between adjacent rips. The average surface velocities registered during drifters’ deployments ranged between 0.34 and 0.43 m/s, with maximum instantaneous values exceeding 1 m/s. These circulatory patterns and surface flows were then successfully reproduced for similar hydrodynamic conditions by employing a modelling framework (Delft3D) for this area.

We hope that our results will raise the public's awareness of rip currents and their related hazards on the Romanian Black Sea coast to reduce beach management and lifeguarding costs, risks to public health and safety and losses of human lives.

Keywords: *offshore flow, nearshore circulation, sandbars, wave breaking, beach hazard*

Acknowledgements: This work was supported by a grant of the Romanian Ministry of Education and Research, CNCS - UEFISCDI, awarded to F.T., project number PN-III-P1-1.1-TE-2019-1444, within PNCDI III, project title „Rip currents hazard on the Romanian Black Sea beaches: Need for action!” (RORIP) – <https://ro-rip.unibuc.ro/>.

YOUR DATA WORK AT EMODnet-INGESTION.EU

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Abstract. In four years, EMODnet’s Data Ingestion Portal published over 1000 new datasets from over 180 data submitters from scientists, blue economy businesses, governments, and NGOs. Marine data ingestion has never been easier! But what becomes of this data? This poster shows country cases collected by the EMODnet Ingestion roaring factory.

This poster gives an overview of success stories in ingesting available marine data in Europe and dives a little deeper into three cases from countries bordering the Black Sea: Bulgaria, Romania and Georgia. Who knows, you could be our next success in waking up historical and new marine datasets?

Discover how old and recent data, even near real-time data, from various sectors strengthen Europe's marine open data network. With the UN Decade of Ocean Science for Sustainable Development already upon us all eyes are on the data. More data for accurate science, smarter engineering and durable policy making. More data for a resilient ocean. Take part in our success story. Join the EMODNET community, and make your data work harder, for more impact at EMODNET-INGESTION.EU.

Keywords: *EMODnet, data sharing, partnership, success stories, Blue Growth*

Acknowledgements: The European Marine Observation and Data Network (EMODnet) is financed by the European Union under Regulation (EU) 2021/1139 of the European Parliament and of the Council of 7 July 2021 establishing the European Maritime, Fisheries and Aquaculture Fund and its predecessor, Regulation (EU) No. 508/2014 of the European Parliament and of the Council of 15 May 2014 on the European Maritime and Fisheries Fund.

WAKE UP, SAFEGUARD AND SHARE YOUR MARINE DATA WITH EMODnet-INGESTION.EU

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Abstract. Wake up your marine data! Set them free for blue society.

Research institutes, academic institutions, university departments and, more generally, any organisation heavily involved in promoting, supporting, and enabling research producing activities in the Blue Growth sector, play an essential role in the marine and maritime ecosystem. They are also key users and data providers of EMODnet, together with the industry. Potential data providers outside the network are supported by partners to release their datasets for safekeeping and further processing, publishing as open data and contributing to applications for society. The EMODnet Data Ingestion partners are national and regional marine and oceanographic data repositories and data management experts.

In the life cycle of a data submission, we make a distinction between 2 phases:

- Phase I - from submission to publishing of the submitted datasets package "as is".
- Phase II - further elaboration of the datasets and integration (of subsets) in national, European and EMODnet thematic portals. This split allows the publishing, in an early stage, of the original data package with high quality metadata. If you want to know more on the EMODnet Ingestion process, have a look at the **movie “Wake up your data”** (3’30” on YouTube).

Successful operation! So far, the work of EMODnet has resulted in many submissions and use cases, such as for monitoring data from offshore renewable energy projects or minting DOIs for research data to support data citing for data submitters. Please, also have a look at the Use Cases webpage to see how other organisations have benefited from EMODnet’ services and products. Contact us at EMODnet-Ingestion.EU

Keywords: *Open data, FAIR data, data mobilisation, Blue Growth*

Acknowledgements: The European Marine Observation and Data Network (EMODnet) is financed by the European Union under Regulation (EU) 2021/1139 of the European Parliament and of the Council of 7 July 2021 establishing the European Maritime, Fisheries and Aquaculture Fund and its predecessor, Regulation (EU) No. 508/2014 of the European Parliament and of the Council of 15 May 2014 on the European Maritime and Fisheries Fund.

QUIETSEAS - ASSISTING (SUB)REGIONAL COOPERATION FOR THE PRACTICAL IMPLEMENTATION OF THE MSFD SECOND CYCLE BY PROVIDING METHODS AND TOOLS FOR D11 (UNDERWATER NOISE)

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Abstract. QUIETSEAS, a project funded by the DG Environment of the European Commission within the call “DG ENV/MSFD 2020” Marine Strategy Framework Directive (MSFD), aims to support Member States (MS) Competent Authorities for the practical development of the MSFD through assisting (sub) regional cooperation by providing methods and tools for underwater noise (D11) assessment and management.

Built on the work developed by the QUIETMED (2017-2019) and QUIETMED2 (2019-2021) projects, QUIETSEAS (2021-2023) main objectives are oriented to enable progress towards the risk of impact assessment of underwater noise on biodiversity and facilitate the implementation of coordinated mitigation measures in order to attain the Good Environmental Status (GES). Practical outcomes will be produced by providing guidance for GES assessment through i) identifying specific impact indicators (for sensitive species-marine mammals) and enabling anthropogenic continuous sound risk-based assessment, ii) providing common methodologies to facilitate the implementation of assessment frameworks and setting threshold values for continuous sound and iii) delivering tools for effective risk-based management of anthropogenic impulsive (D11C1) and continuous sound (D11C2).

Under a wide scope, the QUIETSEAS project will consider particularities for the Mediterranean Sea and Black Sea regions, continuing the cooperation already established, not only at the EU regional and subregional level but also with the participation of non-European Countries in the context of the Barcelona Convention. Furthermore, the QUIETSEAS project aims to boost this cooperation by iv) assessing the effectiveness of potential coordinated measures to reduce the pressure caused by maritime traffic and v) building capacities to ensure knowledge transfer.

Keywords: *Underwater noise, Marine Strategy Framework Directive (MSFD), GES, D11, continuous sound*

Acknowledgements: This study was funded by *Assisting (sub) regional cooperation for the practical implementation of the MSFD second cycle by providing methods and tools for D11 (underwater noise)* „QUIETSEAS” Project, Contract DG Environment No. 110661/2020/839603/SUB/ENV.C.2.

MARINE FRONTS DETECTION IN THE WESTERN BLACK SEA BASED ON EARTH OBSERVATION DATA

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Abstract. Mapping and characterization of marine fronts are essential aspects of physical oceanography due to their significant impact on local dynamics, ecology, and climate. Also, these areas are generally associated with increased production through multiple trophic levels, thus are essential for fisheries management. Better detection and (potential) prediction of marine fronts can lead to proper implementation of sustainable growth initiatives in the Black Sea. We present our first analyses concerning fronts identification, using Earth Observation data. The work was performed using two types of satellite derived products: Chlorophyll-a concentration (Chl) and Sea Surface Temperature (SST). Therefore, the detected marine fronts have a dual nature: thermal and primary production driven. The study area covers the Western Black Sea basin. Daily products delivered by the Copernicus Marine Service (CMEMS), at 1 km spatial resolution, are used. These are Level 3 datasets, based entirely on observations. Thus, no gap-filled or modelled data are involved. In terms of methodology, a filter-based algorithm was chosen. It implies the use of a contextual median filter followed by a Sobel edge detection pass. The results are then post-processed in order to derive meaningful information concerning the dynamics of the identified marine fronts.

Keywords: *marine fronts, contextual median filter, edge detection, satellite, Copernicus Marine Service*

CERTO PROJECT COPERNICUS EVOLUTION: RESEARCH FOR HARMONIZED TRANSITIONAL WATER OBSERVATION. PRELIMINARY RESULTS FROM THE DANUBE DELTA AND THE NW BLACK SEA AREA

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Abstract. Transitional waters – estuaries, lagoons, coastal seas, are key areas for economic activities, recreation and geo and biodiversity. Water quality is one of the main problems affecting these areas, and is the focus of scientists, administrators, and policy makers.

The H2020 CERTO - COPERNICUS EVOLUTION: RESEARCH FOR HARMONIZED TRANSITIONAL WATER OBSERVATION project aims to address the lack of harmonization of water quality related products for transitional environments, using data split across three services - Copernicus Marine, Copernicus Climate Change and Copernicus Land. The details of the products and service will be defined in close cooperation with the end-users in six regional case studies, one of them being located in the Danube Delta and NW Black Sea.

An extensive work of measuring surface water physical-chemical parameters, above water reflectance and water sampling for chlorophyll-a and total suspended matter was done in the Razelm-Sinoe Lagoon System, the large lakes of the delta and its main channels, the Musura and Sahalin Lagoons and the discharge areas of both Sulina and Sfântu Gheorghe channels. This data covers a gap of in-situ data for this area and will contribute to improving algorithms for water quality parameters.

Based on the Copernicus data provided by satellite mission Sentinel 2 and Sentinel 3, an optical water type (OWT) characterization has been done for the entire area. The preliminary results show a very good match between the different OWT and the different controls of water surface turbidity (hydrology, morphology and seasonality) in lakes, lagoons and the coastal area of the Danube Delta.

Several surface water quality indicators were developed, in collaboration with stakeholders, which will be tested in real life situations. These comprise chlorophyll-a statistics and turbidity and phenology indicators.

They will be used to assess water quality distribution and complexity in the area, as well as the effects of changing climate and hydrology, sediment input and local anthropic impacts.

Keywords: *Copernicus, satellite, water quality, chlorophyll-a, turbidity*

Acknowledgements: This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 870349.

BLACK SEA IN THE CONTEXT OF EMODNET CHEMISTRY

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Abstract. The European Marine Observation and Data network (EMODnet) Chemistry (<https://www.emodnet-chemistry.eu/>) is the long-term initiative from DG MARE aiming to assemble fragmented marine chemical data into interoperable and publicly available data streams for complete maritime basins, to assess data quality according to common and standardized protocols and to generate suitable data products in agreement with the requests from the MSFD addressing four of the descriptors: 5 (eutrophication), 8 (chemical pollution), 9 (contaminants in seafood), and 10 (marine litter).

The project, which is in its fifth phase, started in 2009, is built upon 48 connected marine research and monitoring institutes, and oceanographic data management experts from 32 countries and 5 International organizations (the International Council for the Exploration of the Sea and the Regional Sea Conventions) from EU and not EU countries acting either as Data Centers, to provide data collections for the European seas, or as specific experts, to further develop and expand the distributed infrastructure, the data analyses and validation and the creation of data products.

Black Sea is one of the six European regional seas providing data and metadata to the EMODnet Chemistry. The EMODnet Chemistry portal gives free and open access to aggregated, standardized, validated Black Sea data and data products made available as regional and global data collections for eutrophication, acidity, contaminants, and marine litter.

Keywords: *EMODnet, Black Sea, eutrophication, contaminants, marine litter*

Acknowledgements: EMODnet Chemistry is supported by the European Union under the service contract no. EASME/EMFF/2020/3.1.11/Lot 5/SI2.846161. Authors acknowledge the contribution of the EMODnet Chemistry partners involved in the technical infra-structure development, in marine chemical data gathering, harmonisation, standardisation and quality control, and in data products preparation, as well as all Black Sea partners.

USE OF QUALITATIVE AND QUANTITATIVE METHODS FOR THE CO-CREATION OF KNOWLEDGE ABOUT BLACK SEA

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Abstract: The aim of this poster is to explore and present the advantages of using both qualitative and quantitative data collection methods, applicable in geographical and geological studies. A focus is given to the hydrological and hydrogeological quantitative and qualitative methods. The author uses this opportunity to revisit the participatory research methods she used during her PhD study on Danube River. Her intention is to use these methods in a study on hydrology and housing concerning the Black Sea coastal zone. This is having a reference to the methods used by local authorities such as Milton Keynes City Council in Thames River watershed area, which can be adapted in a community such as Murighiol, Tulcea, Romania. The international agenda is currently focusing on science dissemination to the masses and nature observations by non-scientists and participatory GIS are very important methods which can be used by non-academia for the co-creation of knowledge and information about the Black Sea coast.

Keywords: *academic/non-academic, hydrological information, PGIS*

Session V: Marine Spatial Planning (MSP), Coastal Management and Ocean Literacy - Lectures

THE STATUS AND MAIN PROVISIONS OF THE MARITIME SPATIAL PLAN PROJECT IN ROMANIA

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Abstract. Marine and coastal activities are often closely linked, and to promote the sustainable use of maritime space, maritime spatial planning must take into account the interactions between land and sea and the protection of the marine ecosystem. For this reason, maritime spatial planning has a very important role in establishing guidelines for sustainable and integrated management in the use of maritime area, environmental conservation, combating erosion and mitigating the vulnerability of coastal ecosystems, and social and economic development. Maritime spatial planning must integrate the maritime dimension of certain coastal uses or activities and their impact, as well as enable the development of an integrated and strategic vision.

The Maritime Spatial Plan identifies the spatial and temporal distribution of activities and uses in marine waters so that the competent authorities can establish the principles and long-term objectives for guiding the way of using the maritime area, with a view to minimizing the negative impact on the marine environment and to support the sustainable development of the blue economy.

The main objective of the Plan aims to promote a coordinated and integrated decision-making process regarding the sustainable development of the Black Sea region, through coherent policies regarding the maritime domain.

The long-term vision of the Plan is for the future uses of marine waters in the Romanian sector of the Black Sea to be developed sustainably through the synergies created at the level of sectorial policies and through the mobilization of the competent authorities and the key actors of the blue economy, so that the good ecological status of the Black Sea is achieved, supporting resilience, competitiveness and inclusion.

Keywords: *MSP, Maritime Spatial Plan, Black Sea.*

Acknowledgements: Competent authorities, research institutes and all interested factors who contributed to the elaboration of the MSP through their proposal and valuable comments.

OCEAN LITERACY WHITIN THE UNITED NATIONS DECADE OF OCEAN SCIENCE FOR SUSTAINABLE DEVELOPMENT

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Abstract: Ocean literacy is a rather new concept that creates a link among many dimensions of the ocean and education, at its various levels. Even it is frequently connected with the purposes of school education, it is sometimes oriented towards general public and communities in order to create a positive change in people's behavior. Starting from the understanding of the ocean's influence on humanity, it should end with moral and ethical choices that have to be make daily. As it is always hard to measure with a proper scale the extension and the quality of changes generated by an educational programme, in terms of behaviour, we propose a semi-quantitative approach which put together several principles of ocean literacy (in term of knowledge, values, attitudes and skills).

Ocean Literacy has evolved from the environmental education, through education for sustainable developement, growing to a global scale movement. Being an interdisciplinary field, it integrates knowledge, techniques and tools from marine sciences, education sciences, sociology and psichology, science communication, digital technologies etc. Another important aspect is the opportunity to involve citizens in marine sciences as a first step to increase awareness towards specific nature conservation goals. That is why, wide social participation is essential in order to identify knowledge gaps and to move forward solutions that can lead to real action, ensuring that community members feel empowered to promote and undertake actions to address the most pressing threats to ocean health.

Keywords: *ocean literacy, semi-quativative method, skills*

IMPROVING OF THE COASTAL ZONE MANAGEMENT AS A REQUIREMENT FOR ENSURING A BLUE GROWTH IN THE ROMANIAN SECTOR OF THE BLACK SEA

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Abstract. Coastal area has a major influence on the marine environment of Black Sea through the land-based sources, the activities which are developed in coastal area and coastal waters and through the connections with existing developments on the continental platform and in the open sea. Ensuring a sustainable use of the Black Sea resources will require a balanced approach between economic activities and marine environment protection. Taking into account that Romania has the shortest coastline of the Black Sea, Romanian authorities decided to strengthen institutional capacity to manage this very important area and in this respect promoted a project financed from the EU funds which is focused on the integrated coastal zone management and its connection to the main objective of the marine policy namely, good environmental status. Presentation is focused on the main objectives of the project, its progress, expected results and its contribution to the blue growth in the Romanian sector of the Black Sea.

Keywords: *ICZM, marine environment, blue growth*

MONITORING OF COASTAL EVOLUTION IN THE CONSTANTA AND EFORIE NORTH AREAS

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Abstract. Following research carried out by research institutes as well as other institutions and international agencies which concluded that the outhern part of the Romanian shoreline is constantly under attack by erosion, reaching measured land loss rates of up to 2 meters per year which in turn impacts litoral ecosystems, overall safety, businesses, livelihood and living quality, the Dobrogea-Litoral Water Basin Administration contracted technical assistance in order to devise a coastal zone management strategy (Coastal Zone Master Plan).

The whole coastal area between the Chilia branch of the river Danube to the north and the Vama Veche locality to the south was analyzed, studies in multiple fields were carried out including hydraulic modelling and a diagnostic analysis of the erosion process and its effects on the environment was made. The results of these studies laid the base for a coastal zone management strategy over the span of the following 30 years. Conclusions of the master plan were that the northern unit was not an immediate priority from the point of view of the erosion, the coastline was more stable and no human presence. The southern unit, however, was classified as being under the intense influence of coastal erosion and thus determined the introduction of short-term structural measures materialized through the completion of the first phase of the “Reduction of Coastal Erosion” major project. Total length of protected coastline is 7,3 kilometers and the works were finalized in 2015. Since then, we have been investigating the evolution of the morphology of the coast area (shoreline) and modifications due to natural and human factors by means of photogrammetry and GNSS on a UAV and underwater echo sounders. In addition, other factors such as water biology, chemistry and even beach sand grain size were monitored to create a better image of the coastline evolution.

Keywords: *coastal geomorphology, monitoring, Romanian Shoreline, Digital Terrain Model*

SCIENCE AT WORK – TOOLS FOR PRACTICE COASTAL PLANNING

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Abstract. The marine ecosystem is characterized by a network of interrelated components, influencing each other or even themselves through causal closed chains or loops. That is why to keep healthy, the management of human activities in coastal areas involves a complexity that cannot be solved by simple cause-effect analysis. Moreover, their planning requires the analysis of scenarios, as predictive tools that take into account different options for the benefit of the sustainable development of the coastal area and the marine environment. Our research aims to develop the scientific tools and methodologies for the ecosystem-based management (EBM) of the Romanian coastal zone to be used in the following phases: identification of societal goals, setting up the knowledge base and conducting a risk assessment, planning of ecosystem-based management, and implementation, monitoring and evaluation.

Keywords: *pressures, effects, coastal zone, ecosystem-based management*

Acknowledgements: This research was funded by European Commission, Research Executive Agency (REA), grant number 773782-COASTAL and SIPOCA 608.

TOURISM IMPACT MODEL AS SUSTAINABLE DEVELOPMENT PLANNING TOOL FOR AUTHORITIES. CONSTANȚA AND SF. GHEORGHE CASE STUDIES

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Abstract. Technology continues to develop and it is more and more accessible to implement and so increases the probability to help solve societies day to day problems, or even strategic ones, at larger scales. IT solutions like Big Data analysis or blockchain could be used in order to analyse the positive and negative impacts that tourism generates so that tourism destination management organisations (DMOs) could make informed decisions, based on almost real time data, regarding the policies or measures needed to be taken. Tourism Impact Model (TIM) is such a technology product, that if presented with reliable data, could provide such policies and decision-making support. We will present the advantages and disadvantages of such a tool, and our experience with collecting necessary information for the TIM analysis for Sf. Gheorghe commune the Danube Delta, and Constanța, both on the Romanian seashore of the Black Sea. We will present the level of details needed for such an analysis, discuss about availability of data, and communication and cooperation with data-provider institutions. We conclude that TIM analysis could provide a snapshot of tourism in a certain location for a certain time, and that this could evolve into a real time analysis as technology, but mostly data collection, evolves over time. Thus, we propose these solutions in the framework of Blue Economy in the Black Sea region, for a sustainable development of tourism, one that should benefit, as equitable as possible, all the invested stakeholders.

Keywords: *Tourism Impact Model (TIM), spatial planning, Sfântu Gheorghe, Constanța, tourism 4.0*

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RESEARCH AND INNOVATION IN MONITORING MARINE MAMMALS IN THE BLACK SEA

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Abstract. In early 2000, Mare Nostrum NGO was already making the first steps toward monitoring marine mammals along the Romanian Black Sea coast. Starting with stranded dolphins and porpoises identification and reporting to testing measures to reduce the incidental catches. In 2010, the research program was extended, including population structure by means of photo-identification, and later population abundance and distribution. Diseases and causes of death investigations within the network were established in cooperation with Romanian and international research and veterinarian institutions. First marine mammal observer and passive acoustic specialist training, under the ACCOBAMS certification, was performed in 2018. The knowledge started to be later applied (2020) in a research activity called BlackCeTrends, monitoring the diel pattern of cetaceans using F-PODs. All of these paved the way toward a better knowledge of cetaceans in both Romanian and Black Sea waters. CeNoBS project and BlackCeTrends are just two vivid examples of cooperation within the basin and outside with partners from ACCOBAMS and ASCOBANS area.

Keywords: *Mare Nostrum, cetaceans, blue growth, sightings, strandings, ACCOBAMS agreement*

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ROLE OF BLACK SEA YOUNG AMBASSADORS IN THE IMPLEMENTATION OF STRATEGIC RESEARCH AND INNOVATION AGENDA

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Abstract. The Black Sea Young Ambassadors are young early career professionals with different ocean-related backgrounds such as marine research, civil society, industry, policy, or either educational program. We started our journey under the umbrella of Horizon 2020 funded Black Sea CONNECT project, our mission being to raise awareness on marine science, playing an important role in advocating for Blue Growth in the Black Sea and promote the goals of the Strategic Research and Innovation Agenda. At the same time, we aim to engage with youth to contribute to build a generation that protect seas and oceans and to create opportunities for further cooperation and collaboration between the Black Sea and other sea basins. We had the opportunity to be actively involved in many events and initiatives such as Virtual Early Career Ocean Professional Day which followed the official launch of the UN Decade, European Maritime Day in My Country, How to engage with the Mission “Restore our Ocean and Waters by 2030” Conference and many others. Recently, we conducted bottom-up and local actions in the Black Sea riparian countries as part of the Awareness-Raising Campaign. The activities consisted of workshops dedicated to improving students’ knowledge on Black Sea biodiversity, invasive alien species, marine cultural heritage and marine litter, beach clean-up events, pollution free rivers-pollution free Black Sea outdoor actions, vlog on the Black Sea’s unique features, photo contests and capacity building activities among general public.

Keywords: *awareness-raising, Black Sea, SRIA, young generation*

Acknowledgements: The financial support was provided by the European Union’s Horizon 2020 Black Sea CONNECT project under grant agreement no. 860055; BRIDGE-BS project under grant agreement no. 101000240 and DOORS project under grant agreement no. 101000518.

WAVE LIVING LAB IN CONSTANTA AND COMMUNITY AWARENESS FOR THE SUSTAINABLE DEVELOPMENT OF COASTAL AREAS

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Abstract. The sustainable development of urban coastal areas aims to achieve equitable and resilient cities through a participatory governance approach. The aim of this paper is to assess the contribution of the Living Lab developed in Constanta under the framework of the WAVE Erasmus+ project to increasing community involvement for a better urban planning for both environmental health and citizens' well-being. The Living Lab approach included a multidisciplinary methodology using spatial, statistical, and qualitative analyses of an urban Natura 2000 lake area under high tourism pressure and impact of chaotic development. Workshops, interviews, and questionnaires with different local actors (students, schools, residents, tourists, and professionals) were at the centre of the participatory analysis approach to frame the main problems and dysfunctionalities of the study area based on the voice of multiple stakeholders. The main findings revealed that the Living Lab strengthened the active public participation of relevant actors for supporting environmental improvement and a better quality of life for both the local community and the tourists of this coastal area city. The study conclusions contribute to the local policy making of urban development within a framework of participatory territorial governance aiming at economic, social, and environmental cohesion.

Keywords: *urban living lab, community participation, coastal areas, sustainable development*

Acknowledgements: Results funded by the Erasmus+ project – WAVE: Water Areas Vision for Europe – Integrated knowledge and visions for sustainable water landscapes in Europe (grant no. 2020-1-RO01-KA203-080122).

MANAGEMENT APPROACHES FOR SUSTAINABLE DEVELOPMENT PROJECTS INTO BLACK SEA

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Abstract. The Black Sea and its resources have become an important pole of geopolitical interest as well as a strategic landmark for the riparian states and the development of the region in recent decades.

At the same time, the protection and conservation of marine habitats of community interest have become the main object of regulation both at the European Union and national level, being also the subject of programs and projects, initiated and developed by various entities with concerns in the field of research marines, wildlife organisations, environmental assessment authorities and experts.

It is well known that, considering the dynamics of marine biodiversity, it is obvious that marine habitats of community importance happen to exceed the conventional limits of the natural protected areas established in the Black Sea.

As such, the anthropogenic pressures manifested at the level of marine ecological systems are evident, because of the cumulation of some effects generated from multiple sources.

In this situation, the following questions arise: (i) How important is the prevention of an anthropogenic impact on a marine habitat of community importance identified outside the conventional limits of a protected natural area? (ii) Can the vulnerability of a marine habitat of community interest, located outside the natural marine protected areas, be protected based on an environmental impact assessment carried out according to the current procedure for issuing the environmental agreement?

The authors discuss the usefulness of management tools in substantiating measures for the protection of marine ecosystems and the effects that the use of these tools can produce in concrete terms.

Thus, a series of arguments are made in favour of the usefulness and effectiveness of management tools for environmental protection, from the perspective of protecting the natural environment and existing spatial relationships between vulnerable habitats, using as a case study the Marine Ecosystem Monitoring Program during the Rehabilitation Project coastal – Mamaia Area, Constanta (2020-2021).

Keywords: *impact assessment, management, marine habitats*

BLUE DEVELOPMENT OF URBAN AREAS OF BLACK SEA AND COASTAL HAZARDS – CASE OF BATUMI LIVING LAB – PILOT SITE 6, GEORGIA

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Abstract. The presentation deals with coastal urban areas of Georgia, with emphasis on the core area of the Living Lab – Pilot site 6 – the City of Batumi (designated within EU “Horizon 2020” project “BRIDGE”), the leading development hub in the Eastern Black Sea area and major centre of tourism attraction and entertainment. The rapid development of the area stems from repeated attempts by successive Georgian administrations to open windows of opportunities for local businesses and foreign investments. The developments continued unabated even during Covid-19 restrictions, spillover affecting entire country. Batumi, a leading sea port, maintaining its role as an important logistic centre, pursues rapid growth and urban expansion, which calls for urgent introduction of sustainable blue economy and green urban growth principles. And all that is proceeding under the anticipated climate change hazards, such as the accelerated sea level rise, coastal floods, urban heat and humidity. Some approaches towards sustainable urban development have been formulated, although the process is still at its inception, while genuine adaptation planning is lagging.

Keywords: *urban development, Living Lab, blue economy, coastal zone management, climate change, coastal hazards*

Acknowledgements: Horizon 2020 BRIDGE-BS¹ and DOORS-BS² acknowledged by respective authors.

SEA OF COASTAL PLAN FOR GRIGOLETI, GEORGIA – EXPERIENCE WITH APPLICATION OF EO AND NBS TOOLS

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Abstract. Georgia's Environmental Assessment Code, enacted recently in harmonisation with European SEA and EIA Directives, in furtherance of EU-Georgia Association Agreement, subjects all strategic documents, such as spatial development plans, to mandatory application of Strategic Environmental Assessment (SEA). Experience is being acquired how to tackle the task, which is even more complicated for dynamic coastal areas. Some of the constraints are the lack of data to inform the SEA process, as well as the need for employing SEA best practices and methodologies. In this communication, experience is shared with the application of various tools and methods on an example of undertaking SEA for Grigoleti-Kvavilnari Coastal Zone Spatial Plan. Earth Observation (EO) datasets derived from various sources, such as the Copernicus Marine Service, Georgian Data Cube coastal pilot, and some other sources, were tapped to tackle coastal issues, providing evidence base and visualisations e.g. for algal bloom incident, or coastal dynamics, so that unique sandy beach with magnetite material, thoroughly investigated recently, is kept intact to maintain providing its socio-economic and environmental services. As for the methodology, Impact Assessment Framework for Nature-Based Solutions (NBS), elaborated within European Horizon 2020 project, was applied to integrate NBS into SEA and thus into coastal plan.

Keywords: *Strategic Environmental Assessment (SEA), Earth Observations (EO), Coastal Planning, Nature-Based Solutions (NBS)*

Acknowledgements: Support of H2020 Connecting Nature and Doors-BS acknowledged by author¹.

**Session V: Marine Spatial Planning
(MSP), Coastal Management and
Ocean Literacy – Posters**

BLUE ECONOMY AND BIODIVERSITY – ROMANIAN BLACK SEA COAST AREA

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Abstract. The blue economy is based, among others, on the principles of sustainable development, and an important pillar in this sense is represented by the conservation of biodiversity. In the particular case of the Romanian coast of the Black Sea, the existence of marine protected areas and a biosphere reserve that also includes a marine part implies a series of aspects that must be taken into account in any type of development of coastal areas. The presence of Natura 2000 protected areas imposes restrictions on certain types of economic or social activities, and these are not always understood or respected by decision-makers in coastal areas. The examples are diverse, from the disorganized tourism carried out on the wild beaches of the northern part of the littoral area to the location of industrial-type objectives in the immediate vicinity or inside protected areas. A coastal development based on Blue Growth principles must include and take into account the biodiversity aspects of coastal areas and these areas must be included in the different types of development in a way that does not affect the integrity of protected species or habitats.

Keywords: *biodiversity, sustainability, blue economy*

USING OF SPATIAL ANALYSIS TOOLS TO ASSESS THE HUMAN INDUCED PRESSURES AND VULNERABILITIES OF COASTAL AND MARINE ENVIROMENT IN THE CONTEXT OF MARITIME SPATIAL PLANNING AND COASTAL MANAGEMENT

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Abstract. The „vulnerability” is a concept that spatially identifies the ecosystem and socio-economic components that are susceptible to disturbances associated with natural and anthropogenic risks. By overlaying spatial information representing biotic characteristics (habitats or species) and socio-economic uses, we can identify the spatial distribution of marine ecosystem vulnerabilities.

Knowing the vulnerability of ecosystem components to human pressures is essential for the spatial planning of the maritime and coastal space. Assessing the condition of any ecosystem component in relation to a stressor includes sizing the impact in terms of spatial extent.

For the present paper, 2 spatial analysis tools were used:

- "Coastal Vulnerability Index” for assessing the vulnerability of the coastal zone to natural risks (erosion/sea level rise/flooding) (Gornitz et al., 1991).
- "Human impact index" which evaluates where human stressors overlap spatially with ecosystem types or important species that are sensitive to these stressors.

Both models represent useful tools for the decision-making process in the planning and management of the marine and coastal zone.

Keywords: *vulnerability, human pressures, coastal vulnerability, spatial analysis*

WIND ENERGY TECHNOLOGIES FOR SUSTAINABILITY WITHIN EUROPEAN UNION GREEN POLICY: THE CASE OF GREECE

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Abstract. Lately, Renewable Energy Resources (RES) are used in the strategy for sustainability, and environmental protection, as in the roadmap for a Green Europe by the year 2050, various green technologies with focus on RES are incorporated. Green policy in EU aims to long- and short-term goals in energy sustainability strategy, since EU imports a high percentage of energy sources, approximately the 53,2% of the energy consumed. Renewable energy sources are commonly used in SDGs application and in green policies since Europe 2020 project, aiming to support electricity production especially within the current crisis. Wind energy, constitutes a popular type of RES, conducted by technologies to achieve maximum efficiency and energy sustainability. In 2021, 236 GW of wind power capacity are currently installed in Europe and 12% of this figure is offshore. It is important that 64% of all wind power capacity in Europe is spread across five countries: Germany (64 GW), Spain (28 GW), the UK (27 GW), France (19 GW), and Sweden (12 GW). In 2021, new wind installations in Europe amounted to just 17.4 GW, from which 14 GW onshore and 3.4 GW offshore. It is expected for EU to install 116 GW of new wind farms over the period 2022-2026.

Especially in Greece, despite the potential for wind energy applications that is high in many locations, the share of wind in the percentage of the average annual electricity demand covered by wind in 2021 was 18% while EU's average is 14%. Greece has 4.5 GW of wind energy installed today, all onshore. There are already many projects in Greece in wind energy industry although there are also problems being recognized.

Keywords: *wind energy, RES, energy sustainability, wind technologies, green policy, european policy*

MANAGING COASTAL PROTECTION THROUGH MULTI-SCALE GOVERNANCE STRUCTURES IN ROMANIA

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Abstract. The last half century, human interventions on the Romanian Black Sea coast have abruptly changed the natural trends of coastal evolution, increasing erosion rates on many coastal sectors and transforming the natural landscape with major impact on coastal ecosystems. This required decision makers to develop effective coastal and marine conservation regulations and programs. This paper uses Evolutionary Governance Theory (EGT) as a conceptual framework to examine the currently emerging governance issues, due to the growing pressure from increasingly diverse human activities coupled with climate change impacts that threaten the functional integrity of the coastal ecosystems. A proper evaluation and understanding of the policy framework helped us to identify the prerequisites for participative management. Results indicate that the legislation is sectorial, the competences are overlapping and the responsibilities are scattered. The analysis shows that policies related to governance of coastal and marine resources are not well synchronized and they signal an important gap in policy. Input from stakeholders helps us to understand some of the failures that are not present in the literature, since most of them occur at the local level. This work was funded by the Romanian National Authority for Scientific Research and Innovation, CNCS-UEFISCDI [PN-II-RU-TE-2014-4-2479, 2015 and PNIII- P1-1.1-TE-2016-2491, 2018] and supported by Era.Net Rus-Plus BS STEMA [42, 2016]. NV was also supported by the Scoping Mission on Feasibility of a Project on Integrated Maritime Policy in the Black Sea [C15047/AV/NV/2014-358/COM 2011 Lot 01/Black Sea, 2015]. AS was supported by two grants of the Ministry of Research and Innovation [PN 16450103 and 18160103].

Keywords: *Integrated Coastal Zone Management, Actors, Regulations, Land-sea interactions, Black Sea*

SUSTAINABILITY OF THE SURVEYING & MARITIME INTERNET OF THINGS EDUCATION (SMARTSEA) PROJECT

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Abstract. The Internet of Things (IoT) technology has advanced rapidly over the past five years, finding applications in several sectors. Large shipping industries are already investing in IoT techniques to optimize transparency, safety and reduce costs. However, there is a global shortage of trained engineers and technicians to handle this new technology safely.

As a unique European pilot-project funded by the European Union’s Erasmus+ Programme Knowledge Alliances, SMARTSEA (2019-2022) aimed to develop an advanced interactive certified MSc course related to Maritime & Surveyor IoT applications that will train individuals with the necessary skills & knowledge to work in the rising “Smart Maritime & Surveying” industry.

The SMARTSEA curriculum is innovative also in the fact that it comprises interactive teaching methods & partnerships with expert academic & maritime organizations to provide to the students a solid background for starting a fruitful career in the industry. The course duration is eight months, plus three mobility periods; two of them to participate in large-scale laboratories, and a 1-month industrial placement.

A key factor for success is to ensure that the results and achievements of the project are made widely available to its target audience comprised of students, industrial partners, academic & market business role and scientific community. In order to reach its target audiences according to its expected impacts, an effective communication strategy it was developed, based on project-specific dissemination and communication activities.

This approach will provide an overview of the resources needed to accomplish the exploitation and dissemination objectives throughout the project lifecycle, while creating guidelines for future development and exploitation.

Keywords: *MSc course, Smart Maritime & Surveying, project lifecycle, exploitation*

Acknowledgement: The project has received funding from the European Union’s Erasmus+ Programme: Knowledge Alliances call under grant agreement No 612198-EPP-1- 2019-1- ES-EPPKA2-KA.

BEACH MARINE LITTER QUANTIFICATION AND DISTRIBUTION AT THE ROMANIAN BLACK SEA COAST

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Abstract. Marine litter is one of the biggest pollution problems that our seas are facing these days and the Black Sea is no exception. A long-term beach litter monitoring has been conducted between 2016 and 2021, by Mare Nostrum NGO, on 8 beaches from South (Vama Veche) to North (Corbu). These sampled beaches are monitored at least two times per year, using the methodology available in the “Guidelines on Monitoring of Marine Litter in European Sea”, periodically updated by the Marine Strategy Framework Directive (MSFD) Technical Group (TG) Litter. The total number of marine litter items recorded is 193952 and 80% is represented by the plastic or synthetic polymers, the major category of marine litter by material on the Romanian Black Sea coast. Cigarette butts are the most common form of litter, accounting for 87839 items. This represents a significant cause for concern. The coastal landscape is impacted by marine litter, by losing touristic value, but also causes serious threats to marine environment and has economic implications to different sectors. A combination of measures in a regional context is required, focusing on prevention and reducing the rate at which waste is produced.

Keywords: *Mare Nostrum, marine litter, Black Sea, Common Maritime Agenda, coastal pollution, monitoring*

INSIGHTS ON HOW TO INCORPORATE SOCIO-CULTURAL ALUES INTO MARITIME SPATIAL PLANNING PROCESS IN THE BLACK SEA

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Abstract. Maritime Spatial Planning (MSP) capacity to support integrative and sustainable management seems to be globally driven primarily by economic interests and evident concerns emerging about stakeholder exclusion and blue growth prioritization. In this paper, we present a review of the MSP process implementation in the Black Sea region and discuss how integrating the socio-cultural layers into MSP can help to increase consolidation at the executive level, to promote adaptability, support environmental justice and improve MSP acceptance taking into account the current geopolitical instability. Furthermore, we focus on identifying the disparities between the conceptualization and operationalization of MSP and possible points of connection between MSP and frameworks based on social-ecological system theory. Therefore, it is crucial to continue examining the reality of MSP in the area and to bridge the gap between the dominant economic rhetoric and sociocultural-ecological system approach. N.V. acknowledges support from the European MSP Platform and MSP Assistance Mechanism implemented by CINEA on behalf of DG MARE (European Commission).

Keywords: *stakeholder engagement, human dimension, inclusive process, socio-ecological system approach*

PUBLIC PARTICIPATION TO REDUCE MARINE LITTER POLLUTION IN THE BLACK SEA

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Abstract. Marine litter is one of the main challenges of the world. Despite of numerous scientific surveys, visible indications, advices from international conventions rated by member countries, litter pollution is still one of the main threats for all living organisms and their environment.

Decision makers are not successful to interpret the outputs of research surveys, so, there are no effective national plans and strategies to mitigate litter pollution. Moreover, litters are transboundary, therefore regional concerted actions are needed to reduce. Implementation of efficient waste collection and treatment services, recycling procedures are urgently needed. Some of the developed countries are successful on these field, however, they are also affected from pollution due to transportation by rivers, waves and currents.

One of the main solutions is to produce less waste and separate on source to recycle/or reuse them. In that case individual behaviours become more important to control/reduce litter pollution. From this point of view, international organisations, fund raisers, national agencies and governments are very keen to support projects which aims awareness raising studies for the society for different ages, settlement areas and different functioners in the society.

LitOUTer project has been implemented to reach this target with the financial support of ENI, Black Sea Cross Border Program for 2020-2022 with 6 partners from 4 countries, In the project, bottom-up approach was accepted for the training and various awareness activities for the stakeholders. housewives, different level of students, fishermen, mukhtars, NGOs, local authorities, and decision-makers are the main

Keywords: *LitOUTer, marine litter, awareness, training, Black Sea*

Acknowledgements: This project has been supported by the financial assistance of the European Union and was funded by the ENI CBC Black Sea Basin Programme 2014-2020 (Project Number BSB785).

STATE OF MARINE LITTER POLLUTION IN THE BENTHIC HABITAT OF SOUTHEASTERN BLACK SEA COASTS

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Abstract. Marine litter is a major concern worldwide and poses an environmental, health, economic, and aesthetic threats. Knowledge on the status of distribution and abundance of marine litter on the sea bottom is necessary for the implementation of both national and international policy frameworks, and public awareness.

The Black Sea is a semi-closed basin, connected to the Mediterranean through the narrow Turkish straits system (Istanbul Strait, Sea of Marmara, and Dardenelles) with a limited water exchange.

Wide range of river systems carry diverse pollutants to the sea of which some settle down and accumulates intensively by destructing bottom habitats and some others float coasts of riparian countries by the existing wind and current systems. In this presentation litters on the bottom habitat were analysed based on field samplings with R/V Denar I of KTU. During the surveys, 671 litter items weighing 83.93 kg were collected from the sampling stations. The average density by number and weight were calculated as 460.70 ± 99.71 n/km² and 80.68 ± 48.06 kg/km². The litter density was found significantly higher at 10–20 m (646.09 ± 165.63 n/km²) compared to 20–30 m (165.53 ± 81.02 n/km²) and >30 m (413.87 ± 146.59 n/km²) depth ranges. Plastics (69.03%) are the most abundant litters by number, followed by textile (20.94%) and metal (5.68%). The litter composition varies between the trawl and no-trawl zones. Results indicate that more detailed research is needed to understand the interaction of various factors affecting transportation and accumulation of marine litter in the Black Sea.

Keywords: *marine environment, litter, benthic habitat, plastics, Southern Black Sea*

Acknowledgements: This study was supported by the Scientific and Technological Research Council of Turkey, Marmara Research Center (TUBITAK-MRC). The authors would like to thank the crew of the R/V KTU Denar1.

MONITORING OF MARINE LITTER (ML) IN BEACH SEDIMENTS AND MARINE BIOTA OF THE ROMANIAN BLACK SEA

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Abstract. Marine litter (ML) pollution is globally recognized as a widespread problem nowadays. In marine environments, ML has affected all parts of the world's seas and oceans, being present in all marine habitats. The Black Sea does not constitute an exception from marine plastic global tendency; the ML pollution has been identified as a major issue affecting the environmental state of the Black Sea too. The assessments for monitoring purposes on ML occurrence in the sand of the Romanian Black Sea beaches started in 2018 by NIMRD and is ongoing. Diverse microplastic types are present in the top 5 cm of the marine sandy beaches of Romania, with high densities values of polystyrene (EPS). The most dominant microplastic types found in our samples are polystyrene (foam), plastic fragments and films. Microplastics also have been detected in marine biota from the Black Sea area. The analysis of the stomach contents of two species of seabirds present in the Romanian coastal area in 2021, respectively the seagull (*Larus sp.*) and the great cormorant (*Phalacrocorax carbo*) highlighted the presence in a proportion of 29.41% of plastic materials of different sizes (micro-, meso-, macro- and megaplastics) from the total number of tested birds and three colour categories (white, transparent and brown).

Our results support the need to continue in the national program for monitoring the state of the Black Sea ecosystem.

Keywords: *Marine litter, beach sediments, marine biota, monitoring, Black Sea.*

Acknowledgements: This research has been carried out with the financial support from Nucleu Programme SIMAR (PN 18340201) and H2020 EUROqCHARM Project.

**Special Session: European Marine
Research Infrastructures: supporting
Blue Growth in the Black Sea -
Lectures**

EURO-ARGO: THE EUROPEAN CONTRIBUTION TO THE GLOBAL ARGO OCEAN OBSERVATIONS NETWORK

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Abstract. The European contribution to the International Argo Programme for *in situ* ocean observations is coordinated by Euro Argo ERIC, a distributed Research Infrastructure that organizes and federates national Argo contributions at the European level. The Euro Argo Programme provides enhanced coverage in the European regional seas by deploying and operating an array of around 800 floats corresponding to ¼ of the global Argo fleet of profiling floats. It delivers data both in real-time and delayed mode for ocean health and climate change research and monitoring as well as for operational services such as those of the Copernicus Marine Service.

Euro Argo was established as a European Research Infrastructure Consortium (ERIC) in 2014. Since then, Euro Argo ERIC has allowed increased sampling in areas of specific European interest e.g., marginal seas (Baltic Sea, Mediterranean Sea and the Black Sea), and high latitudes (regions seasonally covered by sea ice e.g., Nordic Seas, the Arctic and Southern Oceans). It has contributed to the development of sensor and float technology e.g., deep Argo floats that profile down to abyssal depths and floats that measure biogeochemical parameters (e.g., oxygen, pH, nitrate, chlorophyll-a, suspended particles, and downwelling irradiance). The ERIC Office has also developed and implemented a web-based at-sea monitoring system capable of monitoring the entire European fleet and individual floats. These activities are performed in collaboration with both the Argo Information Centre (AIC) and the Coriolis Data Centre.

Keywords: *EURO-ARGO ERIC, float, in situ ocean observing system*

LIFEWATCH ERIC: THE E-SCIENCE INFRASTRUCTURE FOR BIODIVERSITY AND ECOSYSTEM RESEARCH

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Abstract. LifeWatch ERIC is the eScience European Infrastructure for Biodiversity and Ecosystem Research, representing a Europe's main line of response to biodiversity loss and ecosystem degradation.

While still under construction, LifeWatch ERIC is fast developing and already operational in facilitating the targeting and modelling of biodiversity and ecosystems burning issues, such as IAS early detection, impact evaluation and mitigation strategies. Ecology, computer engineering, data, analytics and other resources are the main components of this e-Infrastructure, whose the web-based facilities are available as FAIR digital objects, including data resources, services, workflows, training and communication materials, virtual research environments.

LifeWatch ERIC: i. Provides access to data collected at a global level, ICT services, tools, storage capacity and computational power; ii. Connects physical observatories, research centres and scientific communities; iii. Offers researchers and stakeholders the resources to explore their own innovative scientific approach; iv. Empowers citizens to engage with science and contribute to their own well-being.

Digital objects on the Black Sea ecosystems are already accessible on the LifeWatch ERIC catalogues, including to date 129 different resources spanning more than 80 years of observations. Recently, the participation to the DOORS project increased the direct involvement of the scientific community in applying the resources available in LifeWatch ERIC to the Black Sea. The main objectives of this contribution are: 1. Equipping scientists working on the Black Sea with the already operational distributed web-based tools for data integration and analyses; 2. Acting a co-constructing process of new tools, services, including training and communication, workflows, and virtual research environments, matching specific research needs of this specific scientific community.

LifeWatch ERIC aims at offering its research facilities to support the scientific community to address the crucial issues of Black Sea biodiversity, ecosystem organization, conservation, management and recovery, in the context of anthropogenic and natural pressures, including climate change.

Keywords: *ESFRI, European Research Infrastructure Consortium, big data, global change, invasive alien species*

EMSO-EUXINUS, ROMANIAN CONTRIBUTION TO EMSO ERIC

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Abstract. European Multidisciplinary Seafloor and water column Observatory (EMSO) European Research Infrastructure Consortium (ERIC) is a distributed Research Infrastructure currently comprising twelve optical cable and stand-alone Regional Facilities (RFs) and three shallow water test sites, from nine countries members engaging twenty-eight research organizations strategically located all the way from the southern entrance of the Arctic Ocean across to the North Atlantic through the Mediterranean to the Black Sea. Since 2021 EMSO ERIC extending the geographical coverage to the Nordic Seas and the Arctic region. EMSO's extension will benefit from an experienced team managing moored observatories, ocean gliders and the Mohn Ridge Seafloor and Water Column Observatory. EMSO distributed facilities providing a variety of EOVs that address major scientific and technical challenges such as natural hazards, climate change and marine ecosystems. EMSO provides data and services to a large and diverse group of users, from scientists and industry to institutions and policy makers. It is a unique infrastructure to monitor relevant information from the seafloor, source of important processes that affect climate change and biodiversity and geohazards, to the surface and that helps both the definition of environmental policies based on scientific data, as well as environmental societal demands across European seas. EMSO participates in the European Ocean Observing System.

EMSO - EUXINUS is the only observation system enabling real time monitoring of the Black Sea marine environment. It provides real time and a continuous data flow regarding the water quality and dynamics in the Western part of the Black Sea. It is for the first time when the scientific community dealing with the marine environment in the Western part of the Black Sea has such direct and continuous access to information.

The main objective of this system is to provide high quality information data for detection, estimation, forecasting and fast notification of the natural marine hazards in conjunction with the other equipment installed offshore in order to protect the two countries (Bulgaria and Romania) against such phenomenon. The second main objective of the network is to provide long time series of physical and bio-chemical data regarding the properties of air and water masses.

Keywords: *European Research Infrastructure, ocean observation systems, interdisciplinarity, deep seafloor and water column*

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DANUBIUS-RI: AN EUROPEAN RESEARCH INFRASTRUCTURE INITIATIVE TO PROMOTE INTERDISCIPLINARY SCIENCE IN RIVER-SEA SYSTEMS

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Abstract. Surface waters are key for global biogeochemical cycles, food and energy production, and societal wellbeing. Biodiversity hotspots at the interface between land and water provide essential ecosystem services. However, pressures from natural and manmade environmental perturbations at local and global scales exert a significant and growing threat to functionality.

DANUBIUS-RI, or the International Centre for Advanced Studies on River-Sea Systems is planned to become a pan-European Research Infrastructure to fill the gap and facilitate research on large river-sea systems in Europe and worldwide. It will provide access to a range of European river-sea systems, facilities and expertise.

DANUBIUS-RI, as a distributed Research Infrastructure, will have a Hub and Data Centre in Romania, Supersites and Nodes across Europe and an e-learning office in Spain. The Hub, which will be located in the Danube Delta, will provide leadership, coordination, and key scientific, educational and analytical capabilities. Supersites will be designated natural sites providing the focus for observation, research and modelling at locations of high scientific importance and utilizing a range of opportunities to study river-sea systems from source to

sea. These Supersites will cover critical areas in Europe, such as the Guadalquivir Estuary and the Ebro-Llobregat Deltaic System in Spain, The Elbe Estuary – North Sea system and Middle Rhine – in Germany, the Rhine – Maas Delta System in the Netherlands, the Thames Estuary and the Forth river catchment in the United Kingdom, the Nestos river-delta-sea system in Greece, the Po Delta – North Adriatic lagoons in Italy and the Danube Delta, in Romania.

Nodes will be centres of expertise providing facilities and services, data storage and provision, experimental and *in situ* measurements facilities, state-of-the-art analytical capabilities and implementation of standardised procedures and quality control.

The key elements of DANUBIUS-RI regard interdisciplinarity, as these will bring together the environmental, social and economic sciences, in freshwater – transitional and marine domains. It will enhance the impact of European research while maximising the return on investment. The quality standards will be ensured by DANUBIUS-RI through its DANUBIUS Commons (common standards for all activities).

DANUBIUS-RI is the process of becoming an ERIC, with Step 2 of the process currently in preparation.

Keywords: *DANUBIUS-RI, River-Sea Systems, distributed research infrastructure*

INFRASTRUCTURE NETWORKS IN THE EUROPEAN GLOBAL OCEAN OBSERVING SYSTEM AND THE DOORS APPROACH

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Abstract. Marine Research Infrastructures (MRI) play a key role in delivering oceanographic services and information to answer societal and policy questions. Existing for various types of technologies, sensors, and automation capabilities, Europe's MRIs jointly contribute to a system of ocean observations, with a potential to feed data into European and global marine data services (EMODnet, Copernicus Marine Service, SeaDataNet, OceanOPS, etc). In the last years, development of MRI networks has been a paramount enabler to the sharing of data, methods and procedures, establishment of best practices for data management and interoperability, and the increase of sustainability of observations. The European Commission has been promoting MRI network collaboration through such instruments as European Research Infrastructure Consortium (ERIC) as well as numerous research and development projects. ERIC represents a mature level of an MRI network having achieved funding commitments for several years ahead from several European nations as well as from the European Commission. However, not all MRIs aim to be an ERIC – there are other ways to achieve network maturity and sustainability. The European Global Ocean Observing System (EuroGOOS) and the framework for the European Ocean Observing System (EOOS) are helping MRI networks collaborate and collectively address joint priorities, research questions, and sustainability plans. EuroGOOS and EOOS promote the MRI networks through various EU-funded projects to strengthen the impact of this work. Among those are EuroSea (EU Innovation Action fostering European coordination for ocean observing and forecasting) and DOORS (EU project delivering science and knowledge base for Blue Growth in the Black Sea). These activities bring together established and mature ERIC organizations as well as developing MRI networks (such as, for example, EuroGOOS Task Teams on tide gauges, argo floats, gliders, high-frequency radars, ferryboxes, and fixed platforms). The DOORS project showcases the existing European MRI collaborations, brings together all marine ERICs to share practice and expand their capabilities, and showcases the opportunities of MRI collaboration at the European and regional levels. The DOORS observations mapping tool delivers state of play visualization of the MRI and data capabilities for the Black Sea.

Keywords: *Marine Research Infrastructures, oceanographic services, European research collaboration, ocean observing*

ENVRI-FAIR: ENVIRONMENTAL RESEARCH INFRASTRUCTURES BUILDING FAIR SERVICES ACCESSIBLE FOR SOCIETY, INNOVATION AND RESEARCH

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Abstract. European Environmental Research Infrastructures (ENVRIs) on the ESFRI level are core facilities for providing data, research products and services from the four subdomains of Earth system science – Atmosphere, Marine, Solid Earth, and Biodiversity/Terrestrial Ecosystems. The ENVRI Cluster represents the core component of the European environmental research infrastructure landscape, with the ENVRI community as their common forum for collaboration and co-creation. The topics covered by the ENVRIs span the entire range of scientific objectives relevant for Earth system monitoring.

ENVRI-FAIR is the cluster project of the ESFRI Environment (ENV) Domain, aiming towards the provision of services compliant with FAIR principles. The overarching goal of ENVRI-FAIR is to advance the findability, accessibility, interoperability, and reusability (FAIRness) of digital assets, in particular research data, products, and services, provided by the ENVRI Cluster, and to connect them to the emerging service ecosystem of the European Open Science Cloud (EOSC).

ENVRI-FAIR targets the development and implementation of both technical frameworks and policy solutions that make subdomain boundaries permeable for environmental scientists and prepare Earth system science for the new Open Science paradigm. Cross-discipline harmonisation and standardisation activities, together with the implementation of joint data management and access structures at RI level, facilitate the strategic coordination of observation systems required for interdisciplinary science. In addition, common policies, open standards, interoperability solutions, operational services, and stewardship of data based on the FAIR principles will essentially help maturing RIs to solve those common problems. On the ENV Domain level, ENVRI-FAIR creates the open-access platform ENVRI-Hub for collaboration and co-creation of the ENVRI community and for delivering environmental data and services through EOSC.

Keywords: *European Environmental Research Infrastructures, data FAIRness, EOSC, Cross-disciplinary harmonisation and standardisation*

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